BioHealth Link:
Questions of Cancer

Summer Institute

A Professional Development Opportunity
for
Science and Health Teachers
at the Middle & High School Level

July 24 through 27, 2000

Johns Hopkins Medical Center
Baltimore, Maryland

Sponsored by
Maryland Public Television
and
Johns Hopkins/National Institute for Environmental Health Sciences Center in Urban Environmental Health and the Johns Hopkins Oncology Center

Funded by
The Howard Hughes Medical Institute
&
The Seraph Foundation

2000 BioHealth Link: Questions of Cancer
Summer Institute Lesson Plan Binder*
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*NOTE: All lesson plans are also available on the Internet at http://www.mpt.org/learningworks/teachers/ehl/

INTRODUCTION

ACKNOWLEDGMENTS

We would like to thank the following for their support in making the 2000 BioHealth Link: Questions of Cancer Summer Institute a successful experience for teachers:

Presenters & Supporters

Funders:
Howard Hughes Medical Institute
The Seraph Foundation, Inc.

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National Institutes of Health, Office of Science Education
Science Kit & Boreal Laboratories
U. S. Environmental Protection Agency

BIOHEALTH LINK: QUESTIONS OF CANCER

We are all connected to our environment through an intricate and delicate web of complexity. Exploring that complexity has engaged top scientists around the world for quite some time as they look at questions such as: What is the link between cancer and our surroundings? Why is our food supply being compromised by cancer-causing chemicals and how can we eat and cook our foods to prevent cancer? Why are so many people detecting skin cancers?

As educators, we know that our students are asking these questions as well, with equal concern. How can we best encourage them to investigate these issues scientifically to form knowledgeable answers about the link between our environment and our health?

BioHealth Link: Questions of Cancer was developed specifically to address this educational concern. It was conceived as a professional development opportunity for health and science teachers at the middle and high school levels to give them the resources they need to promote scientific and health literacy in their classes using today's technology.

BioHealth Link: Questions of Cancer Summer Institute and the ***EnviroHealth Link*** Web site at http://www.mpt.org/learningworks/teachers/ehl/ are designed to support a community of learners involved in environmental health issues relating to the causes, prevention, and treatment of cancer. The Institute is sponsored by Maryland Public Television and the Johns Hopkins University School of Hygiene and Public Health and the Center in Urban Environmental Health, with funding from the Howard Hughes Medical Institute and the Seraph Foundation.

Summer Institute

During this four-day seminar, teachers become learners again as Mentor Teachers present classroom lessons on topics such as features of cancer cells, genetic testing, dangers of radon, meat in our diet, childhood cancers, nutrition and cancer prevention, artificial sweeteners, and ultraviolet radiation – completely integrated with a wealth of Internet resources, computer software, educational videos, and videotape and multimedia presentations – to demonstrate how effective these technologies can be as a way of enhancing their middle and high school students' work with environmental health issues, and as a personal resource to enhance their individual health and science curricula.

As they work through these lessons, participants will also meet with Johns Hopkins research scientists involved in environmental health/cancer research. These professionals provide an enriched view of some of the issues raised in these lessons, such as current findings in the early detection of skin, breast, and prostate cancers.

EnviroHealth Link Web site

The dialogue established at the Summer Institute continues throughout the school year, as participants link electronically to an array of resources at the ***EnviroHealth*** Web site. There, teachers can receive important news updates from the environmental health field and receive timely feedback and additional classroom activities and projects from their fellow participants, access environmental health/cancer lesson plans, engage their students in two interactive Web-based projects, and quickly access hundreds of environmental health/cancer Web sites.

ABOUT THE JOHNS HOPKINS UNIVERSITY SCHOOL OF HYGIENE AND PUBLIC HEALTH

The School of Hygiene and Public Health at the Johns Hopkins University has been designated as an Environmental Health Sciences Research Center by NIEHS and offers multidisciplinary and interdisciplinary education and training in the basic and applied professional sciences in environmental health. It operates an innovative interdisciplinary professional education program to train practicing professional in the broad environmental issues of risk analysis, assessment, and management in relationship to national policy questions of importance to government, industry, and the general public in environmental health. It has a long tradition of institutional involvement with the health needs of the community, including twelve current prevention and training initiatives in area schools and health centers.

The School's Department of Environmental Health Sciences is one of the oldest and largest such departments in the world. It focuses on a variety of issues including the hygiene of water, air, and soil; food and drug adulteration; and the causation, spread, and prevention of transmittable diseases. The Department investigates these issues through mechanism-based research and the application of this research to explore the impact of toxic molecules from the environment on organs, tissues, cells, and DNA, as well as through studies to examine the risks to health in specific populations. These investigations lead to methods that identify susceptible individuals and the rational development of prevention strategies.

The School also encompasses a number of Centers engaged in multidisciplinary research. These Centers include the Environmental Health Sciences Center, the Research and Training Center in Environmental Health Sciences, the Educational Resource Center, and the Center for Occupational and Environmental Health. Researchers here are currently engaged in a number of projects including:

- the identification of the genes responsible for airway inflammation in subjects exposed to ozone
- the effect of electromagnetic fields on workers
- investigations of the impact of lead poisoning on the brain receptors
- assessment of ultraviolet light and its role in skin cancer
- early detection of lung cancer
- chemoprevention of liver cancer in human populations

BIOGRAPHIES

2000 BIOHEALTH LINK: QUESTIONS OF CANCER JOHNS HOPKINS STAFF

Martin D. Abeloff, M.D.
Dr. Abeloff is the Eli Kennerly Marshall, Jr. Professor of Oncology and Director of the Johns Hopkins Oncology Center and Oncologist-in-Chief of the Johns Hopkins Hospital and Health Systems in Baltimore, Maryland. Dr. Abeloff is a medical oncologist whose major research focus has been the management of solid tumors, particularly breast and lung cancer.

Dr. Abeloff received his M.D. degree from the Johns Hopkins University School of Medicine in 1966. He subsequently completed his residency training in internal medicine at the University of Chicago and the Beth Israel Hospital in Boston. In addition, he received research training in hematology at the New England Medical Center and in oncology at the NCI-Baltimore Cancer Research Center. In 1972, Dr. Abeloff joined the faculty at the Johns Hopkins University School of Medicine where he subsequently served as Director of Medical Oncology, Clinical Director, and Head of the Medical Oncology Training Program. He currently holds academic appointments in the Departments of Oncology and Medicine in the School of Medicine and the Department of Environmental Health Sciences in the School of Hygiene and Public Health.

Stephen Baylin, M.D.
Dr. Baylin is a Ludwig Professor in Cancer Research and is also Associate Director for Basic Research at the Hopkins Oncology Center. As leader of the Tumor Biology Program, Dr. Baylin's major current research goal involves highly collaborative efforts in the program to understand the derivation and consequences of aberrant DNA hypermethylation in human cancer. A second goal in the same program is to determine the molecular determinants of endocrine differentiation in human tumors and how these are altered in the derivation of lung and other carcinomas. Understanding DNA methylation could provide an important insight for the biology of human cancer development and offers a potential molecular target for new cancer therapy approaches.

Thomas A. Burke, Ph.D.

Thomas A. Burke is an Associate Professor at The Johns Hopkins University, School of Hygiene and Public Health, Department of Health Policy and Management, with joint appointments in the Department of Environmental Health Sciences and the School of Medicine Department of Oncology. He is also Co-Director of the Johns Hopkins Risk Sciences and Public Policy Institute. His research interests include environmental epidemiology, the evaluation of community exposures to environmental pollutants, the assessment and communication of environmental risks, and the application of epidemiology and health risk assessment to public policy. He is a Principal Investigator for the Pew Environmental Health Commission aimed at revitalizing the national infrastructure for environmental health. He is particularly interested in health and environment in the cities.

Prior to his appointment at Johns Hopkins, Dr. Burke was Deputy Commissioner of Health for the State of New Jersey. He has also served as Assistant Commissioner for Occupational and Environmental Health at the New Jersey Department of Health, and as Director of the Office of Science and Research in the New Jersey Department of Environmental Protection. He served as the scientific coordinator for many of the State's major investigations, including investigations of toxic contaminants in drinking water, the evaluation of dioxin contamination from industrial sources, and the investigation of chromium exposure in urban areas from industrial waste used as landfill.

Dr. Burke is the Chair of the Advisory Committee to the National Center for Environmental Health of the Centers for Disease Control. He also serves as a member of the Executive Committee of the EPA Board of Scientific Counselors. An editor of the book, ***Regulating Risk: The Science and Politics of Risk***, he served on the National Academy of Sciences Committee on Risk Characterization. He has been a member of the Council of the Society for Risk Analysis and has served on Office of Technology Assessment Advisory Panels on Research on Risk Assessment of Chemical Carcinogens, and Managing Nuclear Materials from Warheads. He was also a member of National Academy of Sciences Committee on Risk Characterization, Panel on Separations Technology and Transmutation Systems, and Committee on Remediation of Buried and Tank Wastes, evaluating nuclear waste management options. He has served on EPA Science Advisory Board subcom-

mittees, including reviews of the Clean Air Act Residual Risk Report to Congress and the Superfund Hazard Ranking System. He was also a member of the General Accounting Office expert panel to review the Superfund public health assessment process.

Dr. Burke received his Ph.D. in epidemiology from the University of Pennsylvania, his M.P.H. from the University of Texas, and his B.S. from Saint Peter's College.

Donald S. Coffey, Ph.D.

Donald S. Coffey is a Professor of Urology, Oncology, Pathology and Pharmacology and Molecular Sciences at the Johns Hopkins University School of Medicine where he is also Director of the Research Laboratories of the Department of Urology. A prominent urological scientist, Dr. Coffey was appointed as The Catherine Iola and J. Smith Michael Distinguished Professor of Urology at The Johns Hopkins University School of Medicine. Dr. Coffey is also a member of the Principal Professional Staff at The Johns Hopkins University Applied Physics Laboratory.

Dr. Coffey received his Ph.D. in Biochemistry from the Johns Hopkins University School of Medicine in 1964. Dr. Coffey is currently President-Elect of the National Coalition for Cancer Research. He is Past-President of The Society for Basic Urologic Research and the American Association for Cancer Research. For 19 years Dr. Coffey served as a member of the National Prostatic Cancer Program of the National Cancer Institute and served as National Chairperson from 1984-1988. He has received the Robert Edwards Award from The Tenovus Institute, the Fuller Award from the American Urological Association, and the First Society of International Urology - Yamanouchi Research Award. Dr. Coffey is also the recipient of two Merit Awards from the National Institutes of Health. He is an author on more than 250 research publications.

David S. Ettinger, M.D.

Dr. Ettinger is Professor of Oncology and Medicine at the Johns Hopkins University School of Medicine. He is Associate Director for Clinical Research at the Johns Hopkins Oncology Center. A graduate of the University of Louisville School of Medicine in 1967, Dr. Ettinger completed his medical internship and residency at the Albany Medical Center and Mayo Clinic, respectively. Dr. Ettinger completed his training in medical oncology at Johns Hopkins in

1975, and since then, has been on the faculty of the School of Medicine. He has been a chairman of the Thoracic Committee of the Eastern Cooperative Oncology Group (1980 – 1982) and since 1990 he has been chairman of the Medical Oncology Lung Subcommittee of the Radiation Therapy Oncology Group.

Dr. Ettinger is clinical director of Hopkins SPRE grant for lung cancer. He is a member of the National Comprehensive Cancer Network (NCCN) Board of Directors as well as a member of the NCCN Guidelines Steering Committee, and has been chairman of its non-small cell lung cancer practice guidelines panel, antiemetic practice guidelines panel, occult primary tumor practice guidelines panel and the neuroendocrine cancer guidelines panel. He is a member of the Oncology Center's Phase I Studies working group and from 1982-1990 was principal investigator of the phase I studies of new anticancer agents contract from the NCI.

Dr. Ettinger is a past President of the Maryland Division of the American Cancer Society. His interest is in new drug development and innovative multi-disciplinary treatment strategies in lung cancer and sarcomas. In addition, he has had a long interest in improving supportive care measures associated with cancer and its treatment. He has authored or co-authored over 175 papers.

John D. Groopman, Ph.D.
Dr. Groopman is chair of the Department of Environmental Health Sciences and is Professor of Oncology and Associate Director of the Oncology Center for Cancer Prevention and Control. He received his academic training at MIT and NIH's National Cancer Institute's Laboratory of Human Carcinogenesis, where he was the recipient of the Institute's Career Development Award.

In addition to his work at Johns Hopkins, he is chairman of both the Maryland State Legislative Committee of the American Association for Cancer Research, and a member of the Advisory Council of the National Institute of Environmental Health Sciences.

Michael C. Hibler
Mr. Hibler is the Programs Manager for The Department of Patient & Family Services at The Johns Hopkins Oncology Center. He is also Co-Director of The Cancer Counseling Center. Additionally, Mr. Hibler

currently serves pharmaceutical and biotechnology corporations on developing educational interventions for patients and families taking novel therapeutics.

Thomas W. Kensler, Ph.D.
Dr. Kensler received an A.B. in biology from Hamilton College in Clinton, NY and spent his junior year at the University of Alaska in Fairbanks studying arctic ecology. He was awarded the Ph.D. degree in toxicology from the Massachusetts Institute of Technology in 1976 where his doctorial dissertation focused on mechanisms of aflatoxin hepatocarcinogenesis. He subsequently completed a postdoctoral fellowship at the McArdle Laboratory for Cancer Research at the University of Wisconsin where he investigated the actions of retinoids as inhibitors of multistage carcinogenesis. After two years as a Staff Fellow in the Laboratory of Toxicology at the National Cancer Institute in Bethesda, MD, Dr. Kensler joined the faculty in the Department of Environmental Health Sciences, Johns Hopkins School of Hygiene and Public Health in 1980. He was promoted to professor of Environmental Health Sciences in 1992 and currently holds joint appointments in the Departments of Pharmacology and Molecular Sciences, Oncology, and Biochemistry. Research interests in his laboratory focus on the biochemical and molecular mechanisms involved in the induction of cancer by chemicals to serve as a basis for the prevention, interruption or reversal of these processes in man. One of the major mechanisms of chemical protection against carcinogenesis, mutagenesis and other forms of toxicity mediated by carcinogens, is the induction of enzymes involved in their metabolism, particularly phase 2 enzymes. A major research goal in his laboratory has been to develop the tools to test the hypothesis that enzyme induction is a useful strategy for chemoprevention in humans. Current efforts focus on understanding the molecular mechanisms underlying phase 2 enzyme induction, the development and validation of intermediate biomarkers to assess enzyme induction in man, and their application to chemoprevention studies. He has led several clinical chemoprevention trials of enzyme inducers in a region of the People's Republic of China, where exposures to aflatoxins and risk of developing liver cancer are high.

Susan D. Laman, M.D.
Dr. Laman is an Assistant Professor in the Department of Dermatology at the Johns Hopkins School of Medicine. She trained in both Internal Medicine

and Dermatology at the University of Iowa and Clinics. Currently, she is the co-director of the Pigmented Lesion Clinic at Johns Hopkins.

Barbara Lubejko, R.N., M.S., O.C.N.
Ms. Lubejko began her nursing career at the Johns Hopkins Oncology Center in 1982. She has held a variety of positions at the Oncology Center, including caring for adult patients in an inpatient setting, coordinating the care of patients on research studies, and in her present role as Nurse Educator. Barbara received her BSN from the University of Virginia and her MS from the University of Maryland. In her present position, Barbara is responsible for the orientation and continuing education of the nursing staff in the Oncology Center. She is also co-chairing the committee responsible for orienting the staff that will be working in the Harry and Jeanette Weinberg Building.

William G. Nelson, M.D., Ph.D.,
William G. Nelson, M.D., Ph.D., is a trained medical oncologist who focuses his research efforts on the prevention and treatment of prostate cancer. Dr. Nelson is an expert in the areas of the molecular pathogenesis of human prostate cancer, the molecular epidemiology of prostate cancer, prostate cancer diagnosis and staging, and translational clinical trials in prostate cancer prevention and treatment. His laboratory has identified the most common somatic genome alteration associated with human prostate cancer, inactivation of the *GSTP1* gene encoding a carcinogen-detoxification enzyme, and has collected recent data supporting the hypothesis that focal inflammatory lesions in the prostate may constitute prostate cancer precursor lesions.
Current studies ongoing amongst Dr. Nelson's laboratory and several other collaborators include case-control epidemiological studies of prostate cancer risks associated with serum selenium levels and with *GSTP1* gene polymorphisms.

Drew M. Pardoll, M.D., Ph.D.
Dr. Pardoll. is currently Director of the Division of Immunology and Hematopoiesis in the Johns Hopkins Cancer Center, and Seraph Professor of Oncology. He completed his M.D./Ph.D. training at the Johns Hopkins University School of Medicine and his medical residency at the Johns Hopkins Hospital.

Dr. Pardoll serves on a number of National Advisory Boards including the

NCI-BRB Oversight Committee as chairman, the AACR Public Affairs Committee and the Cancer Research Institute. He has been involved in the development of genetically engineered cancer vaccines and other immunotherapy strategies. His vaccine approaches are currently being evaluated in a variety of human cancers including prostate cancer, multiple myeloma and cervical cancer.

Elizabeth A. Platz, Sc.D., M.P.H.
Dr. Platz is an Assistant Professor of Epidemiology at the Johns Hopkins School of Hygiene and Public Health and at the Johns Hopkins Oncology Center. Dr. Platz trained as a cancer epidemiologist at the Harvard School of Public Health.

Her research focuses on the etiology and prevention of prostate cancer and colorectal cancer and precursor adenomatous polyps. Using the prospective cohort and case-control study designs, she has examined a wide array of factors encompassing nutrition, lifestyle, reproduction, and genetics that may influence the development and progression of these cancers. With her colleagues, Dr. Platz recently evaluated whether differences in levels of exposure to purported modifiable prostate cancer risk factors may account for the elevated risk of prostate cancer in African-American men compared to white men in the U.S. She also estimated the proportion of colon cancers and adenomas that potentially could be prevented in Americans for simultaneous reductions in a constellation of modifiable risk factors, including obesity, physical inactivity, and cigarette smoking.

Kathleen Rohrer, RN, MS
Kathleen Rohrer is a Nurse Educator in the Department of Surgery at the Johns Hopkins Hospital. She received her diploma in Nursing from Arnot-Ogden Memorial Hospital, Elmira, NY in 1972, her BSN in Nursing from the University of North Carolina at Chapel Hill in 1980; and her MS in Nursing from the University of Maryland at Baltimore in 1987. In her role as Nurse Educator, she has been responsible for development, implementation, and evaluation in the following areas: Preceptor, Surgical Intensive Care Unit; Lead Medical- Surgical Instructor, Advanced Medical – Surgical Instructor, Wake Technical College, Raleigh, NC (1980-1982); Staff Development Instructor, Maryland General Hospital, Baltimore (1982-1985); clinical Nurse Specialist, Homewood Hospital, Baltimore (1985-1990); and Nurse Educator, Johns Hopkins Hospital (1990-present).

Michael A. Trush, Ph.D.
Since 1991, Dr. Trush has served as Deputy Director of the Johns Hopkins Center in Urban Environmental Health. His current areas of research include chemical carcinogenesis, biochemical and molecular toxicity, bone marrow toxicity and leukemia, biochemical risk analysis, and inflammatory cell biology and toxicity. In addition to his scientific research, Dr. Trush is also interested in enhancing the educational process. To that end, he has served on numerous local and national committees designed to upgrade science education.

Dr. Trush began his career in science education as a high school biology teacher.

James R. Zabora, Sc.D.
James R. Zabora, Sc.D., is Associate Director for Community Research at The Johns Hopkins Oncology Center in Baltimore, MD. In addition, Dr. Zabora is Assistant Professor on the faculty of The Johns Hopkins University School of Hygiene and Public Health and an Instructor in the Department of Environmental Health Sciences at The Johns Hopkins School of Hygiene and Public Health. He is the co-editor of the ***Journal of Psychosocial Oncology*** and is a former president of the Association of Oncology Social Work. In 1994, Dr. Zabora received the Association's National Leadership Award.

Dr. Zabora is the author of numerous chapters and articles related to the psychosocial care of cancer survivors and their families. In 1995, Dr. Zabora was the only staff member from Johns Hopkins to be honored by the Clergy United for Renewal in East Baltimore for his contributions to the local community in cancer prevention and control. Within the Oncology Center, Dr. Zabora administers a breast cancer screening program for low income and high risk women from a number of minority populations. Based upon his success with this program such as the highest annual follow-up rate in the State of Maryland, he was appointed as Co-Director of Community Outreach and Education of The Johns Hopkins Center in Urban Environmental Health. He has also delivered numerous educational presentations on oncology-related issues including issues of minority health in the United States, Asia and Europe.

2000 BIOHEALTH LINK: QUESTIONS OF CANCER MENTOR TEACHERS

Lesli Adler
Lesli is the Director of the DNA Resource Center for Montgomery County Public Schools. The DRC is one of the largest biotechnology equipment loan and teacher training and support programs in the country. The core program modifies existing labs and activities and develops unique ones for the 10,000 student, teacher, and community members who participate annually.

Lesli teaches Advanced Placement Biology, Molecular Biology and supervises science interns at Thomas S. Wootton High School in Rockville, Maryland. She teaches "Biotech Bootcamp" to prepare participants for the rigors of biomedical research for the Howard Hughes Medical Institute/National Institutes of Health/ Montgomery County Public Schools Student and Teacher Internship Program. She has consulted and written curriculum for the Howard Hughes Medical Institute, the American Physiological Society, Summer Productions (the Discovery Channel), and has served as the community member for the Animal Care and Use Committee for a local research lab.

Lesli received her degree from the University of Maryland at College Park, and has continued her education with an eclectic assortment of courses. She has taught all levels of life sciences in inner city, rural and suburban schools in Maryland and New York. Lesli returned to teaching after a ten-year hiatus in the "real world." At one job for a non-profit educational organization, she managed a network of math and science teacher summer training institutes. Her duties included visiting teacher training programs throughout the U.S. and monitoring the exciting activities teachers were involved in. She quickly returned to teaching because "there are so many opportunities for varied and interesting experiences."

John Bois
John Bois has been teaching at Northwestern High school in Prince George's County, Maryland for nine years. He teaches AP Biology and

Microbiology/Physiology. He is also the Science Teacher Coordinator. John originally came to the U.S. from Australia in a rock and roll band called the Dingoes. Although they were managed by the Rolling Stones' manager, they failed to crack the big time.

At 35, John went to Harvard University Extension and straight on for a Masters at The Harvard School of Education. During this time he developed an interest in dinosaurs, particularly their nesting behavior. He recently contributed to the BBC Production, ***Walking With Dinosaurs.***

Among other activities, John has been selected to appear in an ASCD training film demonstrating teaching techniques. He is also currently developing a Web site activity for "Bridging the Watershed', an organization which brings students into National Park Service parks for environmental studies. He has been an MPT mentor teacher on two previous occasions.

Angelique Bosse

Angelique teaches Genetic Analysis, Cell Physiology, and Biology at the Math/Science Computer Science Magnet Program at Montgomery Blair High School in Montgomery County, Maryland. She obtained a Master's Degree in Education from the University of Maryland, a Mater's Degree in Cell and Molecular Physiology from Penn State's College of Medicine, and a Bachelor's Degree in Biology from Boston College.

Angelique has presented a variety of workshops at the country, state, and national levels. Many of her ideas for workshops have come from her experience as a Howard Hughes Medical Institute research intern at the National Institutes of Health. For two summers, Angelique worked in an immunology laboratory at the National Institute of Arthritic and Musculo-skeletal Diseases. The laboratory focused on signal transduction in T-cells. Angelique assisted in the identification and sequencing of a gene for a protein that is mutated in some patients who have Severe Combined Immune Deficiency (SCID). For her work, Angelique was included as a co-author on the paper, "Localization and characterization of human JAK3 protein", published in Genomics in November 1996.

By presenting at BioHealth Link, Angelique hopes to share some of the activities she uses in her cancer unit which serves as a transition between her Genetic Analysis and Cell Physiology classes. By studying cancer, students can relate damage in genetic material to cytological changes.

Edward R. Dieterle, II
After completing his undergraduate studies in chemistry and education at Virginia Polytechnic and State University in Blacksburg, Virginia Ed began teaching at Northwestern High School in Hyattsville, Maryland. Currently he is preparing for his sixth year as a chemistry teacher. Besides maintaining Northwestern's Website at http://www.pgcps.org/~nwest and his classroom site at http://www.pgcps.org/~nwest/nhsced01.html, Ed works with technology staff development throughout Prince George's County. Last spring he began teaching Multimedia Design for Instruction at Johns Hopkins University's Center for Technology in Education through the Department of Continuing Education. In addition to teaching and technology Ed enjoys golf and other outdoor sports.

Kevin Feeney
Kevin received his Bachelor's degree in science education from Bloomsburg University in Pennsylvania. After graduation, he moved to the Baltimore area and taught for the Baltimore City school system for six years. During his tenure in the city, he taught seventh and eighth grade students. He also served as team leader for five of the six years.

Kevin has recently received his Masters degree in education with a concentration in gifted and talented learners from Johns Hopkins University. For the past three years he has been working for the Baltimore County Public School system at Ridgely Middle School where he is currently the science content leader.

Doug Fireside
Doug Fireside has been teaching for eight years, starting in New Orleans and moving to Baltimore in 1994. He currently teaches science at Robert Poole Middle School in an advanced academic program "The Ingenuity Project". Doug has been very fortunate to work with Felicity Ross who was a state finalist for the President's Excellence in Math and Science Teaching in 2000. Doug teaches science at the 6^{th}, 7^{th} & 8^{th} grade levels, along with 8^{th} grade computer science. He requires his students to fully integrate technology into every unit of study.

Doug has been a presenter at many different conferences including regional Teach for America conferences in Baltimore and Washington, D.C. He has also twice been a Master Teacher at Maryland Public Television's National Teacher Training Institute for Math, Science & Technology and at the spring 2000 NTTI presented a workshop on designing Web pages. This past year Doug served as a Master Teacher at the MPT & Johns Hopkins School of Hygiene and Public Health's

EnviroHealth Link Summer Institute and on the ***EnviroHealth*** Link Web site. Doug designed and presented a workshop on video utilization at the Maryland Tech Consortium Fall Institute.

Doug enjoys working with teachers, "There is no better way to grow professsionally than to sit with other educators and share ideas. I get more from presenting at conferences then I ever think I could give."

Jennifer Petering

Jennifer is a 9th year teacher in the Howard County Public School System who has taught AP Biology, Environmental Science and Biology at all high school grade levels. She currently teaches 8th grade science to all levels from inclusion to gifted and talented at Glenwood Middle School. She is the Content Team Leader who displays continual advancement professionally. Jennifer has a genuine interest in helping her students achieve the highest standards through use of technology and other resources. As a science facilitator, she is committed to training students to make a positive difference in all aspects of life.

Jennifer holds an undergraduate degree from the University of Mississippi and earned her Master's of Education from Towson State University.

Jennifer has been a presenter at the National Education Research Association in San Francisco, defending her master's thesis on in-school suspension. She has also presented at numerous conferences including the National Science Teacher's Association, Maryland Association for Science Teachers, Maryland Middle School Association, and Howard County Public School conferences. She is an active participant in the Chesapeake Bay Foundation in which she is an advocate for many environmental causes. Her students participate in active research involving "Bay Grasses in Classes" and "Nitrate Net Programs" sponsored by the Living Classrooms Foundation and Chesapeake Bay Trust.

Jennifer has been an active participant in task development of one 2001 MSPAP 8th grade assessment. In past years, Jennifer was a participant in a summer biotechnology program sponsored by Battelle, located in Research Triangle Park, NC where she was placed at the Education, Research, Development, and Engineering Center in Aberdeen Proving Ground. She has developed new technologies that are still being used by the Army.

Felicity Messner Ross

Felicity is a sixth, seventh and eighth grade mathematics teacher for "The Ingenuity Project" at Robert Poole

Middle School in Baltimore City. "The Ingenuity Project" is a rigorous mathematics, science and technology program located in three Baltimore City middle schools and one Baltimore City high school.

Felicity is particularly interested in gender equity in mathematics education. In 1997, Felicity Ross was awarded an Eleanor Roosevelt Teacher Fellowship from the American Association of University Women. This fellowship was awarded to her based on the math, science and technology program she designed for a group of at-risk African-American girls. This spring, Felicity was selected as a state finalist for the Presidential Award for Excellence in Mathematics and Science Teaching.

Felicity completed her undergraduate studies at the University of Michigan earning a Bachelor of Science degree in mathematics and psychology. She is currently working on her Masters Degree at Loyola College in Baltimore. Felicity was a master teacher for MPT's EnviroHealth Link Institute last summer and a master teacher for the National Teacher Training Institute for Math, Science & Technology this past spring.

GWYNETH ANNE JONES

"Get into CyberShape!
A Web Resource for Environmental Health,
& Science Educators"

Gwyneth Anne Jones left a career in advertising, public relations and marketing nearly eight years ago to pursue a career in education and in her words, "I've never looked back!" After working in advertising, first with ***Columbia Magazine*** and then ***Baltimore Magazine***, she was later hired as the Assistant Director of Marketing and Special Events for Sinai Hospital of Baltimore. She feels that the business world taught her the building blocks of effective communication. She now uses those skills to communicate her love a research and information-gathering, reading, and technology with her students as a Library Media Specialist at Murray Hill Middle School in Howard County Public Schools, Maryland. With an undergraduate degree in English Literature (1987) and a Masters of Instructional Technology (1992), both from Towson University, she believes that the pursuit of knowledge is both rewarding and exciting. Trying to instill the view that research is a challenge and not a chore, Ms. Jones uses all the latest technologies with her students to further that tenet. A proponent of the Internet since 1993, Ms. Jones incorporates both WebQuests and Web Site Building with her students and staff in a variety of subject areas.

Gwyneth was one of 14 MICCA (Maryland Instructional Computer Coordinators Association <http://www.howard.k12.md.us/micca/> Grant Winners for 1998-99 for
her innovative computer-based proposal entitled: "Studying the Effect of Weather and Erosion on the Environment" and presented "Netscape Navigator: A Template for Success In and Out of the Classroom" at the spring MICCA '99: "Technology, the Classroom, and You" conference.

Also in 1998-99 Gwyneth was recruited to become one of that year's Maryland Public Television National Teacher Training Institute for Math, Science, and Technology Master Teachers. In 1999-2000 Gwyneth served as Internet Workshop presenter at MPT's National Teacher Training Institute.

AMADO "SONNY" NARVAEZ

Multimedia Workshop Presenter
The Hyper-Powered Curriculum: Using HyperStudio & PowerPoint in the Classroom

Sonny Narvaez is currently employed by Montgomery County Public Schools as an elementary school media specialist. As an adjunct instructor for the College of Library and Information Services (CLIS) at the University of Maryland, he designed and teaches a series of four workshops in educational technology for CLIS's School Library Media Program. He has received numerous awards from Montgomery County for his contributions to public education in general as well as for his work in educational technology. Sonny is a frequent contributor to the ***HyperStudio*** and HyperLogo listservs on the Internet, and three of his ***HyperStudio*** stacks were published professionally in ***HyperStudio Journal***.

Prior to becoming a media specialist, Sonny taught high school and junior high school German for the Virginia Beach City Schools. Sonny is also an accomplished professional magician, and as an artist has illustrated several magic books for publishers in the U.S. and Canada.

LESSON PLANS

Good Cells Gone Bad, Part I: Features of Cancer Cells

Time Commitment: Three 90-Minute Periods
Grade Levels: 11 & 12

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Overview

A normal cell may sustain genetic damage as the result of exposure to radiation, viruses, chemicals, or a natural cellular "mistake," called a mutation. If the genetic damage interrupts the normal mechanisms of growth and proliferation, the cell will grow and divide uncontrollably. The resulting cancer cells differ from the normal cells in structure and function.

In this series of activities, students will investigate the differences between normal cells and cancer cells. Students will examine electron micrographs of cells and organelles, observe an actual tumor cell over a twenty-four hour period, stain and observe normal and transformed cells, and investigate the cellular physiology of a

particular cancer.

Cooperative structure of the lesson:
Students will be working in pairs to complete the laboratory activities and computer activities. Students will also be sharing information on the various types of cancers with classmates and the school community.

Expected products from lesson:
Students will follow the progression of a cancer cell throughout a twenty-four hour period, be able to identify cellular structures on electron micrographs, identify differences between normal and transformed cells, and learn about the physiology of various human cancers.

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Instructional Technology Resources

Internet Sites:

BioHealth Link Web Site
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html
This site, created for BioHealth Link and maintained by Maryland Public Television, contains links to useful cancer resources.

Internet Project Resources
http://www.mpt.org/learningworks/teachers/present/tech/home.html#WebQuests & Internet
This site, maintained by Maryland Public Television, has links to Internet project web resources.

Cells Alive http://www.cellsalive.com
Educational site containing the "Cancer Cell Cam." The cancer cell cam documents the changes in a cancer cell over a twenty-four hour period. At 12:00 midnight an image of a cell is displayed and is updated every ten minutes for twenty-four hours. Students can monitor the cell throughout the day or go back in time to make observations.

ABCDs of Melanoma Detection
http://www.aad.org/SkinCancerNews/WhatIsSkinCancer/ABCDMel.html
The American Academy of Dermatology patient information site on melanoma provides images and information about early warning signs of melanoma.

Oncolink http://cancer.med.upenn.edu/
University of Pennsylvania's cancer resource site includes disease oriented menus

with information about specific types of cancer, a section on cancer causes, screening, and prevention, and information about clinical trials.

4cancer.com http://www.4cancer.com/
4anything.com search service provides consumer information site and links for specific types of cancer.

Dr. Koop.com Cancer Center http://www.drkoop.com/conditions/cancer/
The former U.S. Surgeon General's consumer healthcare information site has sections about causes of cancer, a cancer library, latest cancer news, cancer research, treatments, and links for information about cancer. The interactive Web site allows for searching information about a specific cancer.

Cancernet http://cancernet.nci.nih.gov/
The National Cancer Institute's site contains information about specific types of cancer, treatment options, clinical trials, genetics, causes, risk factors, prevention, and other resources.

American Cancer Society http://www.cancer.org/
The American Cancer Society's site provides information on various types of cancer, prevention, treatment options, alternative methods, and current cancer news items.

Cancer Research Roundup
http://www.ngnews.com/news/1999/10/102099/geobytes_6522.asp
The National Geographic Society and Environmental News Network Partnership site contains the latest news in cancer research from a variety of print media.

Educational Software:
***HIP Biology* 1 and 2**
CD-ROM package- $199.00
Or $129.00 each
Published by the Center for Image Processing in Education
P.O. Box 13750
Tucson, Arizona 85732-3750
800-322-9884

Videos:
Oncogenes
$149.00
Films for the Humanities & Sciences
P.O. Box 2053
Princeton, NJ 08543-2053
800-257-5126
http://www.films.com

Cancer and Metastasis
$149.00
Films for the Humanities & Sciences
P.O. Box 2053
Princeton, NJ 08543-2053
800-257-5126
http://www.films.com

Other Technology:
Compound Microscopes
***CellServ* Kit # 1**
$65.00
CellServ
One Cloister Court
Bethesda, Maryland 20814-1460
301-496-8290
http://www.cellservkits.com

OTHER INSTRUCTIONAL RESOURCES
Books:

- Freshney, Ian. Culture of Animal Cells. New York: Alan R. Liss, Inc., 1987. (first two chapters)

- Head, J. Student's Collection of Electron Micrographs. Gladstone: Carolina Biological Supply Company, 1985.

- Lewis, Ricki. Human Genetics. Dubuque: W. C. Brown publishers, 1994.

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Teacher/Student Background Information

The structure and function of cancer cells differs from that of normal cells. Cancer cells are not contact-inhibited and therefore may grow uncontrollably. Unlike the normal tissue in which a tumor is growing, the cancer cells are dedifferentiated and do not function like the normal cells. The cancer cells produce an enzyme, telomerase, which enables the cells to protect their chromosomes from shrinking with each cell division.

Also, cancer cells may produce proteins that attract blood vessels to them through a process called angiogenesis. The blood vessel formation provides the tumor with nutrients, and a means of escape. Special enzymes produced by the cancer cells

enable them to dissolve their way out of the tissue and into the blood supply. In the process of metastasis, cancer cells that enter the blood stream can be transported to other parts of the body. If the cancer cell is able to settle in another tissue and grow, it forms a secondary tumor.

Normal cells grown in culture usually grow and divide an average of 50 times before dying. This is called the *Hayflick Limit*.

Occasionally cells in a strain will become "transformed" and acquire the ability to grow and divide indefinitely. These immortal cells exhibit many different characteristics than normal cells. Transformed cells have a rounded shape, chromosomal abnormalities, less cytoplasm, less growth factor requirements, are not contact-inhibited, inappropriately express telomerase enzyme, and are less adherent to the surfaces of the culture dish.

In these activities, students will be investigating the differences between normal cells and cancer cells by examining electron micrographs of cells and organelles, observing a cancer cell over a twenty four-hour period, staining and observing normal and transformed cells, and by investigating the physiology of a particular cancer.

To complete these activities, students must be able to use the Internet as a resource and also be familiar with using compound microscopes.

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Vocabulary

Anchorage Dependent- cells, or cultures derived from them, which will grow, survive or maintain function only when attached to a substratum such as glass or plastic
Angiogenesis- development of blood vessels
Cell Culture- this term is used to denote the growing of cells in vitro including the culture of single cells
Cell Line- culture of cells with an indefinite life span, considered immortal
Cell Strain- cells originating from a single cell culture
Contact Inhibition- the cessation of cellular division when the cells have covered the entire surface of the growing vessel
Dedifferentiated- a term implying irreversible loss of the specialized properties that a cell would have expressed in vivo
Fibroblasts- a type of cell commonly found in the extracellular matrix surrounding tissues, such as the connective tissue of the dermis. Fibroblasts have a characteristic shape that will appear pointed or elongated when viewed under the light microscope and grow in sheets wherein the cells are rather loosely in contact with one another.

Hayflick Limit- a cell's internal "clock" controlling the number of cell divisions
In vitro- growth of cells in an artificial environment, most often glass or specially treated plastics
In vivo- cells growing in the living body or organism
Metastasis- movement of cancer cells from one part of the body to another
Telomerase- an enzyme which stabilizes tips of chromosomes
Telomere- the tip of a chromosome
Transformation- a permanent alteration of the cell phenotype presumed to occur via an irreversible genetic change

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Learning Objectives

Content:
The students will:

- **recognize** growth patterns of normal cells.
- **identify** characteristics of transformed cells.
- **describe** changes in a cancer cell over a twenty-four hour period.
- **understand** the process of metastasis.
- **investigate** and report on a type of human cancer.

Science Core Learning Goals:
I1.5.8 The student will describe similarities and differences when explaining the concepts and/or principles(cell transformation).
I3.2.1 The student will explain the function of structures (cytoskeleton) found in cellular and multicellular organisms.
I3.5.3 The student will investigate how natural and man-made changes in environmental conditions (carcinogens) will affect individual organisms and the dynamics of populations.
I1.5.2 The student will explain scientific concepts and processes (cancer development) through drawing, writing, and/or oral communication.

Technology:
The students will:
- **utilize** the Internet to observe cancer cells and to research particular cancers.
- **use** NIH image technique to observe electron micrographs of cells and cell organelles.
- **stain** and affix normal and transformed cells to microscope slides.
- **use** microscopes to observe cells and chromosomes.

Science Core Learning Goals:
I1.3.1 The student will develop an demonstrate skills in using lab and field equipment (microscopes) to perform investigative techniques.
I1.3.3 The student will demonstrate the safe handling of the chemicals (stains) and materials of science.
I3.3.4 The student will describe the effect of a gene alteration on an organism and/or population (cancer).

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Lesson Assessment

Content:

- Lesson Assessment Worksheet #4- "ABCD Melanoma Check Homework Assignment"
- Lesson Assessment Worksheet #5- "Human Cancer Investigation"

Technology:
- Lesson Assessment Worksheet #1- "Cancer Cell Cam"
- Lesson Assessment Worksheet #2- "***Oncogenes*** and ***Cancer and Metastasis*** Videos"
- Lesson Assessment Worksheet #3- "Observing Normal and Transformed Cells"
- "Cell Factory" lesson worksheet (from ***HIP Biology***)

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Materials Needed

(Per student)

- Lesson Assessment Worksheet #1- "Cancer Cell Cam"
- Lesson Assessment Worksheet #2- "***Oncogenes*** and ***Cancer and Metastasis*** Videos"
- Lesson Assessment Worksheet #3- "Observing Normal and Transformed Cells"
- Lesson Assessment Worksheet #4- "ABCD Melanoma Check Homework Assignment"
- Lesson Assessment Worksheet #5- "Human Cancer Investigation"

(Per student team/group of 2)

- compound microscope
- 1 copy of ***CellServ*** Kit #1, "Visualization of Normal and Tumor Cells" student procedures
- 1 copy of lesson "The Cell Factory" lesson from ***HIP Biology***, or, alternatively electron micrographs of cell organelles

(Per class)
- Computer with Internet access
- VCR and monitor
- ***Cancer and Metastasis*** video
- ***Oncogenes*** video
- ***HIP BIOLOGY/ NIH Image*** software
- Forceps
- Beakers
- Microscope slides
- Cover slips
- Toothpicks
- Lens paper
- Water
- Lab coats
- Paper towels
- ***CellServ*** Kit #1
- Access to library or media center
- Butcher paper or poster paper
- Colored markers
- Scissors
- Tape or glue

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Procedures

This series of activities requires students to work individually for some activities and with a partner for the lab activities, computer activities, and cancer research activities. Students need to have access to the Internet, media center or library, and need compound microscopes for the laboratory activities.

No special accommodations are required as students will be working in pairs to complete the lab activities and computer activities.

Day 1: Comparison of Normal Cells To Cancer Cells

Set-up Directions:
To prepare for the NIH Image activity, each pair of students will need copies of the ***HIP Biology*** lesson "The Cell Factory" and access to computers with the ***HIP Biology*** lesson images. Alternatively, obtain electron micrographs of cell organelles to show the students.

The second activity is to be done outside of class. Students should be given about a week to complete this activity. The only requirements are access to the Internet at the Web site http://www.cellsalive.com, and copies of Lesson Assessment Worksheet #1- "Cancer Cell Cam" for each student.

Teacher Presentation & Motivation:
Before the "Cancer Cell Cam" activity, students should review the appearance of normal animal cells. Tell students they will use images of electron micrographs of cell parts to create an animal cell.

Introduce the "Cancer Cell Cam" to students as an opportunity for them to witness the behavior of an actual cancer cell. Tell students that the Cells Alive Web site is an educational site that contains the "Cancer Cell Cam" at http://www.cellsalive.com. Starting at 12:00 midnight every day an image of a cancer cell is put on the Web site. The image is updated every ten minutes for twenty-four hours. Encourage the students to view the cancer cell at various times throughout the day.

Activities:
Have the students review cell structure and organelles by completing the ***HIP Biology*** Lesson "The Cell Factory". They should follow the directions on the "Cell Factory" lesson worksheet to create a model animal cell. Alternatively, have students examine hard copy photos of electron micrographs. After students have reviewed the structure of normal animal cells, they will be ready to observe a cancer cell.

Students can access the "Cancer Cell Cam" at http://www.cellsalive.com at various times during a twenty-four hour period. Have students record their observations by making a drawing and writing a description of what they observe about once every three hours. Students should record their observations on Lesson Assessment Worksheet #1- "Cancer Cell Cam." It is reasonable to require students to make six observations, about three hours apart, during the twenty-four hour period. It is possible for students to go back in time by clicking the back arrows.

Day 2: Features of Normal and Transformed Cells

Set-up Directions:

To prepare for viewing the videos ***Oncogenes*** and ***Cancer and Metastasis***, the teacher will need to set up a TV and VCR and make copies of Lesson Assessment Worksheet #2- "***Oncogenes*** and ***Cancer and Metastasis*** Videos." The ***Oncogenes*** video should be rewound to the start of the tape. Set the ***Cancer and Metastasis*** tape at about 14 minutes and 30 seconds into the video program at the section entitled "Uncontrolled Growth."

To prepare for the laboratory activity, the teacher will need ***CellServ*** Kit #1, "Visualization of Normal and Tumor Cells", and copies of Lesson Assessment Worksheet #3- "Observing Normal and Transformed Cells."
To prepare the homework assignment, make copies of Lesson Assessment Worksheet #4- "ABCD Melanoma Check Homework Assignment."

Before students arrive, set up at least two staining stations. Set stain #1, stain #2, and a beaker of water, in that order on a mat of paper towels. Have microscope slides, forceps, toothpicks, permount, lens paper and compound microscopes available.

Teacher Presentation & Motivation:
Before viewing the videos, ask students what they know about the development of cancer from one aberrant cell to metastasis. Discuss with students the formation of tumors and the differences between benign and malignant tumors. A tumor is derived from one aberrant cell. The clump of cells that form the tumor may be benign or malignant. Benign tumor cells are slow growing and do not adversely affect the tissue that they are growing in.

Malignant tumor cells are harmful to the host. These cells become dedifferentiated and do not perform the functions of the normal cells of that tissue. The size of the tumor may physically impair the tissue. The cancer cells produce telomerase enzyme, which protects the tips of the chromosomes, and prevents degradation of the chromosomes. The cancer cells may also produce chemicals that attract blood vessels through a process called angiogenesis. Growth of blood vessels enables the tumor to get nutrients and also provides an avenue of escape. The cells may metastasize by producing enzymes that allow them to dissolve their way out of the tissue and into the blood vessels. If the cancer cell is able to settle in another tissue and grow, the new tumor is called a secondary tumor.

A pre-lab lecture is necessary to orient the students to the purpose of the laboratory exercise. Students should understand the difference between growing cells in-vitro and in-vivo and the advantages and disadvantages of studying both types of cells.

Walk students through the normal progression of a cell culture from inoculum, lag phase, exponential growth phase, stationary phase, and death phase. Introduce students to the concept of programmed cell death and the Hayflick limit. Explain the

role of shrinking telomeres in the cell's death.

Introduce the concept of cellular transformation. Explain the possibility that cells in culture may become transformed. Transformed cells grow and divide indefinitely. The immortal cell line exhibits characteristics that distinguish them from normal cells. Unlike normal cells, transformed cells are not contact-inhibited, are not anchorage-dependent, may grow on top of each other, are rounded in shape because of cytoskeletal abnormalities, have less growth factor requirements and have chromosomal abnormalities.

Also, describe the origin of the fibroblast cells that will be observed in this lab. Explain that the normal fibroblasts have elongated shape and grow in an organized pattern.

Activities:
Before completing the lab activity, students should watch portions of the videos, ***Oncogenes*** and ***Cancer and Metastasis***.The focus for viewing is a specific responsibility or task students are responsible for during or after watching the video, to focus and engage students' viewing attention. In this lesson students will visualize the development of cancer from tumor formation to the spread of cancer through the process of metastasis.

As the students view the following portions of the videos, they should answer the questions on Lesson Assessment Worksheet #2- "***Oncogenes*** and ***Cancer and Metastasis*** Videos."

BEGIN the ***Oncogenes*** video and **STOP** after the narrator has listed the characteristics of cancer cells that distinguish them from normal cells. Allow time for students to record characteristics that distinguish cancer cells from normal cells. Remove the ***Oncogenes*** video from the VCR.

Put the ***Cancer and Metastasis*** video in the VCR. **BEGIN** the video at about 14 minutes and 30 seconds at the section "Uncontrolled Growth". **PAUSE** the video at the end of the section and allow students time to list the differences between benign and malignant tumors. **RESUME** the video at about 17 minutes and 15 seconds at the section "Invasion". **PAUSE** the video at the end of the section and allow students time to describe the steps of tumor invasion. **RESUME** the video at about 19 minutes and 20 seconds at the section "Cellular Movement". **PAUSE** the video at the end of the section and allow students to list three factors that aid movement of tumor cells within the tissue. **RESUME** the video at about 23 minutes and 45 seconds at the section "Infiltration of Tissue". **PAUSE** the video at the end of the section and allow students to list the first steps of tumor invasion and metastasis. **RESUME** the video at about 30 minutes and 50 seconds at the section "Metastasis". **STOP** the video at the end of the section and allow students time to describe the process of metastasis.

To complete the lab, students should follow the directions on the ***CellServ*** Kit #1, "Visualization of Normal and Transformed Cells" laboratory procedure. After the cover slips are stained and mounted, students should complete Lesson Assessment Worksheet #3- "Observing Normal and Transformed Cells."

To educate other about the differences in normal and transformed cells, enlarge the drawings and enhance them with color. Display the drawings of normal and transformed fibroblast cells next to each other in the classroom or hallways of the school. Near the display, post an explanation of the characteristics that distinguish normal cells from tumor cells.

As a homework assignment, have students institute a monthly ABCD Melanoma check for their family members. According to the American Academy of Dermatology, people should check their skin monthly for early warning signs of skin cancer. By becoming familiar with how your skin looks, it may be easier to spot any irregularities. Have each student set aside a day each month to remind family members to use the ABCD melanoma test. This simple test requires the person to examine any moles and pigmented lesions for four warning signs. Give students a copy of Lesson Assessment Worksheet #4- "ABCD Melanoma Check Homework Assignment" to take home and share with their families. They also may access the ABCDs of Melanoma Detection Web site for more information at http://www.aad.org/SkinCancerNews/WhatIsSkinCancer/ABCDMel.html.

Day 3: Cancer Cell Changes

Set-up Directions:
To prepare for this activity, the teacher should reserve class time in the computer lab and class time in the media center or library. Make copies of Lesson Assessment Worksheet #5- "Human Cancer Investigation" for each student. Students may work individually or in pairs.

Teacher Presentation & Motivation
After having completed the previous activities, students should be knowledgeable about the characteristics of transformed cells, the behavior of tumors and the process of metastasis. Now that the students have background knowledge about cancer development, they will be investigating a particular cancer to try to put together the cellular and physiological processes.

Activity:
Have each student or pair of students select a type of cancer they would like to research. Starting with the Web sites listed at the beginning of this lesson packet; ask students to gather information about their selected cancer topic. They need to find information about the function of the normal cells in that tissue, the symptoms

of cancer, risk factors, features of transformed cells, treatment options, and current research into the cancer.

After filling in all the information on Lesson Assessment Worksheet #5- "Human Cancer Investigation," students need to plan a poster to display the information. Encourage students to make colorful posters with diagrams to educate others about the cancer. When the posters are complete, have each student or pair present their information to the rest of the class.

Also, display the student posters on the various types of cancers in the hallways or classroom for others to see. Hang the displays in areas of high exposure so passersby will be encouraged to view them and learn from them.

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Enrichment Options

Community Connection:
Create a link on the school web site to a web page that includes information about tumor growth and metastasis. Include photographs of drawings of tumor cells and posters from class presentations.

Guest Speaker:
NIH Speakers Bureau at the National Institutes of Health Office of Science Education http://science-education.nih.gov/homepage.nsf/for+teachers?OpenForm. This site allows a teacher to request speakers electronically.

Interdisciplinary Extensions:

- **Language Arts**

Have each student or pair of students write a paragraph summarizing current research into their cancer topic. Create a booklet each year containing the blurbs students write. Share the research booklets with the following years' classes.

- **Mathematics**

Use the microscopes to calculate sizes of normal cells and transformed cells. Develop a method for measuring the nucleus:cytoplasm ratio to determine if the ratio differs between normal and transformed cells.

- **Fine Arts**

Have students do a creative reaction project using the theme of cell transformation. Students can create paintings, sculptures, or another visual representations of transformed.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Angelique Bosse & Lesli Adler

Name _____ Class _____ Date _____

LESSON ASSESSMENT WORKSHEET #1- Cancer Cell Cam

Log on to the "Cancer Cell Cam" at http://www.cellsalive.com.

At 12:00 midnight each day, an image of a cancer cell is posted at this site. You may observe the changes in the cell over a twenty-four hour period. It is possible to go back in time by clicking the back arrows.

Record your observations of a cancer cell at about three hour intervals. Draw what you see and describe what you see in words. At least six observations are required.

Observation #1 Time _____

Observation #2 Time _____

Observation #3 Time _____

Observation #4 Time _____

Observation #5 Time _____

Observation #6 Time _____

Observation #7 Time _____

Observation #8 Time _____

Name _____ Class _____ Date _____

Lesson Assessment Worksheet # 2- *Oncogenes* and *Cancer and Metastasis* Videos

1. What characteristics of cancer cells distinguishes them from normal cells?

2. List the conditions under which a cell displays controlled and appropriate growth behavior.

3. Compare and contrast benign and malignant tumors.

4. Describe the steps of tumor invasion.

5. List three factors that aid movement of tumor cells within the tissue?

6. What are the first steps of tumor invasion and metastasis?

7. Describe the process of metastasis.

Name _____ Class _____ Date _____

LESSON ASSESSMENT WORKSHEET #3- Observing Normal and Transformed Cells

1. Examine both the normal and transformed cells under the microscope on low power. Draw what you see in the viewing field.

Normal Lung Fibroblast Cells
(low power)
_____ X

Transformed Fibroblast Cells
(low power)
_____ X

2. Examine both the normal and transformed cells under the microscope on high power. Draw what you see in the viewing field.

Normal Lung Fibroblast Cells
(high power)
_____ X

Transformed Fibroblast Cells
(high power)
_____ X

3. Record your written observations below. Note the growth patterns, cell shapes, cell sizes, nucleus/cytoplasm ratio, and any other observations about each of the two cell types.

   Normal

   Transformed

4. Compare and contrast the human lung fibroblast cells with the mouse fibroblasts. What similarities and differences did you observe?

5. What are some characteristics of transformed cells that you would not be able to observe in this lab?

6. List and describe biological processes or environmental factors that could result in the formation of transformed cells.

Name _____ Class _____ Date _____

Lesson Assessment Worksheet #4- ABCD Melanoma Check Homework Assignment

According to the American Academy of Dermatology, people should check their skin monthly to spot any changes in moles or pigmented lesions. Set a day each month that you will remind your family members to do this simple ABCD Melanoma Check test.

If you have Internet access available, have your family view the images at
http://www.aad.org/SkinCancerNews/WhatIsSkinCancer/ABCDMel.html
This page shows illustrations for each of the warning signs. Below is a description of the danger signs that the AAD suggests you check for.

A is for "asymmetry"

One half doest not look like the other

B is for "border irregular"

The border is not smooth, but irregular

C is for "color varied"

The color is not consistent- combinations of tan, brown, black, and sometimes white, red, and blue

D is for "diameter"

The diameter should not be larger than 6mm (about the size of a pencil eraser diameter)

If any of your family members recognizes any of the danger signs, they should consult a dermatologist.

Name _____ Class _____ Date _____

LESSON ASSESSMENT WORKSHEET #5- Human Cancer Investigation

Human Cancer _____

Research your cancer topic using Internet sites listed in this lesson plan, or in books and journals. Record information on this worksheet and then plan a poster presentation for your class.

1. **Normal Cell Structure and function**

2. **Symptoms of cancer**

3. **Risk factors**

4. **Changes in the cell (genetic and morphological)**

5. **Treatment options**

6. **Current Research**

7. **Prevention Possibilities**

Good Cells Gone Bad, Part II: Genetic Damage

Time Commitment: Three 90 Minute Periods
Grade Levels: 11 - 12

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Overview

The DNA of a cell is vulnerable to radiation, chemicals, viruses, and natural cellular mistakes. Any of these things may cause genetic damage either by altering chromosome structure or by mutating the cell's DNA. Genetic damage to the chromosomes or to the genes may result in cancer. Certain chromosome aberrations are associated with cancers and some mutations may interfere with the normal progression of the cell cycle. If the cell cycle is disrupted, the cell may be transformed into a cancer cell.

In this series of activities, students will study the cell cycle, prepare human tumor cell chromosome spreads, observe the cytotoxic effects of carcinogens, and search for specific mutations that cause human cancers.

Cooperative structure of the lesson:
Students will work in pairs to complete the laboratory activities and computer activities. Students will also share information on the various types of cancers with classmates and the school community.

Expected products from lesson:
Students will describe the cell cycle, learn how to do a karyotype, describe genetic abnormalities in a human cancer cell line, describe effects of cytotoxins on cells, and learn about the genetics of various human cancers.

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Instructional Technology Resources

Internet Sites:

BioHealth LinkWeb Site
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html
This site, created for BioHealth Link and maintained by Maryland Public Television, contains links to useful cancer resources.

Internet Project Resources
http://www.mpt.org/learningworks/teachers/present/tech/home.html#WebQuests & Internet
This site, maintained by Maryland Public Television, has links to Internet project web resources.

The Biology Project
http://www.biology.arizona.edu/human_bio/activities/karyotyping/karyotyping.html
This site, developed by the University of Arizona, contains many online activities to help students learn about biology.

On-Line Mendelian Inheritance of Man http://www.ncbi.nlm.nih.gov/Omim/
This site is a database of human genes and genetic disorders developed by the National Center for Biotechnology Information. The site contains reference information in the form of pictures, text, and sequences.

Human Gene Mutation Database
http://archive.uwcm.ac.uk/uwcm/mg/hgmd0.html
This database is maintained at the Institute of Medical genetics in Cardiff at the University of Wales College of Medicine. The site provides information about mutations associated with genes, proteins, and diseases.

Educational Software:

***HIP Biology* 1 and 2**
CD-ROM package- $199.00
Or $129.00 each

Published by the Center for Image Processing in Education
P.O. Box 13750
Tucson, Arizona 85732-3750
800-322-9884

Videos:
Oncogenes
$149.00
Films for the Humanities & Sciences
P.O. Box 2053
Princeton, N.J. 08543-2053
800-257-5126
http://www.films.com

Cancer and Metastasis
$149.00
Films for the Humanities & Sciences
P.O. Box 2053
Princeton, N.J. 08543-2053
800-257-5126
http://www.films.com

Other Technology:
Compound Microscopes
***CellServ* Kits (#3 and #4)**
$65.00 per kit
CellServ
One Cloister Court
Bethesda, Maryland 20814-1460
301-496-8290
http://www.cellservkits.com

OTHER INSTRUCTIONAL RESOURCES
Books:

- Freshney, Ian. Culture of Animal Cells. New York: Alan R. Liss, Inc., 1987. (first two chapters)
- Lewis, Ricki. Human Genetics. Dubuque: W. C. Brown publishers, 1994.

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Teacher/Student Background Information

Normal cells grown in culture usually grow and divide an average of 50 times before dying. This is called the *Hayflick Limit*.

Cell division is regulated by several cell division cycle (cdc) genes and proteins. One major regulatory protein is Mitosis Promoting Factor, or MPF. MPF concentration peaks at the end of interphase and the beginning of mitosis. MPF is a kinase enzyme that phosphorylates proteins in the cell that are necessary for mitosis to proceed. MPF targets proteins that play a role in chromosome condensation and mitotic spindle formation.

In addition, many other proteins such as growth factors, growth factor receptors, protein kinases, phoshpatases, and G-proteins contribute to normal growth and proliferation of cells.

If cells sustain genetic damage such as mutation of any of the regulatory proteins, the cell cycle may be disrupted. Radiation, chemicals, or viruses may cause mutations in cdc genes, or other regulatory genes. Unless the damage can be repaired, the cell may become transformed.

Because these transformed cells have the ability to grow and divide indefinitely, they are said to be cancerous and effectively immortal.

A number of genetic differences between normal and transformed cells exist. Cancer cells inappropriately express an enzyme, telomerase, which protects the tips of the chromosomes and prevents chromosome degradation with each cell division. Some cancers result from large chromosome mutations, called aberrations. Also, transformed cells often have more than or less than the proper number of chromosomes.

In these activities, students will be investigating the genetic differences between normal and transformed cells by performing karyotypes, staining and observing chromosomes of a transformed cell line, observing the effects of cytotoxins on cells, and investigating the genetic causes of various human cancers.

To complete these activities, students must be able to use the Internet as a resource and also must be familiar with using compound microscopes.

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Vocabulary

Acrocentric- chromosomes identified as those having a centromere located near the terminal end of the chromosome
Aneuploid- the situation which exists when the nucleus of a cell does not contain an exact multiple of the haploid number of chromosomes; one or more chromosomes being represented more or less times than the rest.
Autosomes- any chromosome other than the sex chromosomes
Carcinogen- a substance that induces cancerous changes in the cell
Cell Culture- this term is used to denote the growing of cells in vitro including the

culture of single cells
Cell Division Cycle (cdc)- refers to genes involved in the regulation of cell division cycle
Cell Line- culture of cells with an indefinite life span, considered immortal
Cell Strain- cells originating from a single cell culture
Centromere- the chromosomal region where the chromatids are held together and to which the mitotic spindle apparatus attaches.
Chromatid- a chromosome at prophase and metaphase consists of two parallel strands held together at the centromere. Each strand is termed a chromatid. The chromatids are separated at anaphase with each chromatid eventually becoming a chromosome in each daughter cell
Contact Inhibition- the cessation of cellular division when the cells have covered the entire surface of the growing vessel
Cytokinesis- the separation of the cytoplasm into two parts which occurs in the latter stages of mitosis or cell division
Diploid- the state of cells in which all chromosomes are two in number and are structurally identical with those of the species from which the culture is derived
Hayflick Limit- a cell's internal "clock" controlling the number of cell divisions
HeLa Cells- a human tumor cell line derived from cervical cancer cells
In vitro- growth of cells in an artificial environment, most often glass or specially treated plastics
In vivo- cells growing in the living body or organism
Karyokinesis- the equal division of nuclear material which occurs in cell division
Metacentric- chromosomes characterized by having a centrally located centromere
Mitosis- the phase of the cell cycle characterized by chromosome condensation, the alignment of the chromosomal pairs along the equatorial plane of the cell and separation of chromatids which leads to two new daughter cells each containing identical sets of chromosomes
Mitosis Promoting Factor (MPF)- a protein which is active at the onset of mitosis and produces changes in the cell that enable the cell to undergo mitosis
Mutagens- chemicals or radiation that induce mutation
Telocentric- chromosomes characterized by a terminally located centromere
Telomerase- an enzyme which stabilizes tips of chromosomes
Telomere- the tip of a chromosome
Transformation- a permanent alteration of the cell phenotype presumed to occur via an irreversible genetic change

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Learning Objectives

Content:
The students will:
- **explain** the mechanisms whereby the cell cycle may be disrupted and lead to cancer
- **observe** effects of cytotoxins on cells

- **identify** genetic differences between normal and transformed cells
- **list** genetic abnormalities associated with cancer
- **describe** characteristics of chromosomes that are used in karyotyping
- **investigate** and report on the genetics of a type of human cancer

Science Core Learning Goals:
I3.1.1 The student will be able to describe the unique characteristics of chemical compounds and macromolecules (nucleic acids) utilized by living systems.
I3.1.2 The student will be able to discuss factors involved in the regulation of chemical activity (cell division cycle) as part of a homeostatic mechanism.
I3.2.1 The student will explain the function of structures (chromosomes) found in cellular and multicellular organisms.
I3.5.3 The student will investigate how natural and man-made changes in environmental conditions (carcinogens) will affect individual organisms and the dynamics of populations.
I1.5.2 The student will explain scientific concepts and processes (cancer development) through drawing, writing, and/or oral communication.

Technology:
The students will:
- **use** the Internet to identify known mutations of genes and find information on related diseases
- **stain** and affix transformed cells to microscope slides
- **prepare** human chromosome spreads
- **use** microscopes to observe cells and chromosomes
- **calculate** the average number of chromosomes per cell in a sample of human cancer cells
- **use** NIH image technique to prepare karyotypes and review the cell cycle

Science Core Learning Goals:
I1.3.1 The student will develop an demonstrate skills in using lab and field equipment (microscopes) to perform investigative techniques
I1.3.3 The student will demonstrate the safe handling of the chemicals (stains) and materials of science.
I3.3.4 The student will describe the effect of a gene alteration on an organism and/or population (cancer)

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Lesson Assessment

Content:
- Lesson Assessment Worksheet #2- "Carcinogen/Mutagen Homework Assignment"

Technology:
- Lesson Assessment Worksheet #1- "Effects of Cytotoxins on Cells"
- Lesson Assessment Worksheet #3- "Human Chromosome Spreads"

- Lesson Assessment Worksheet #4- "***Oncogenes*** and ***Cancer and Metastasis*** Videos"
- Lesson Assessment Worksheet #5- "Human Cancer Mutation Investigation"
- "Karyotype" lesson worksheet (from ***HIP Biology***)
- "Cell Cycle" lesson worksheet (from ***HIP Biology***)
- "Mitosis Movie" lesson (from ***HIP Biology***)

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Materials Needed

(Per student)
- Lesson Assessment Worksheet #1- "Effects of Cytotoxins on Cells"
- Lesson Assessment Worksheet #2- "Carcinogen/Mutagen Homework Assignment"
- Lesson Assessment Worksheet #3- "Human Chromosome Spreads"
- Lesson Assessment Worksheet #4- "***Oncogenes*** and ***Cancer and Metastasis*** Videos"
- Lesson Assessment Worksheet #5- "Human Cancer Mutation Investigation"

(Per student team/group of 2)
- compound microscope
- 1 copy of lesson "The Cell Cycle: How much time is spent in each phase?" from ***HIP Biology*** or, alternatively microscope slides of onion root tips.
- 1 copy of the lesson "The Mitosis Movie" from ***HIP Biology***
- 1 copy of lesson "Karyotypes: Diagnosing chromosome abnormalities" from ***HIP Biology*** or, alternatively a photograph copy of a human chromosome spread.
- 1 copy of ***CellServ*** Kit #3, "Effects of Cytotoxins on Cells" student procedures
- 1 copy of ***CellServ*** Kit #4, "Preparation of Human Chromosome Spreads" student procedures

(Per class)
- Computer with Internet access
- VCR and monitor
- ***Oncogenes*** video
- ***Cancer and Metastasis*** video
- ***HIP Biology NIH Image*** software
- Forceps
- Beakers
- Microscope slides
- Cover slips
- Toothpicks
- Lens paper
- Water
- Lab coats
- Disposable droppers
- Paper towels

- ***CellServ*** Kit #3
- ***CellServ*** Kit #4
- Access to library or media center
- Butcher paper or poster paper
- Colored markers
- Scissors
- Tape or glue

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Procedures

This series of activities requires students to work individually for some activities and with a partner for the lab activities, computer activities, and cancer research activities. Students need to have access to the Internet, media center or library, and need compound microscopes for the laboratory activities.

No special accommodations are required as students will be working in pairs to complete the lab activities and computer activities.

Day 1: How Genetic Damage May Affect the Cell Cycle

Set-up directions:
To prepare for the NIH Image activities, each pair of students will need copies of the two ***HIP Biology*** lessons "Mitosis Movie" and "The Cell Cycle", and access to computers with the ***HIP Biology*** lesson images. If ***HIP Biology*** is unavailable, microscopes and slides of onion root tips can be used instead.

To prepare for the lab activity the teacher will need ***CellServ*** Kit #3, "Effects of Cytotoxins on Cells", student procedures and copies of Lesson Assessment Worksheet #1- "Effects of Cytotoxins on Cells". To prepare for the homework assignment, make copies of Lesson Assessment Worksheet #2- "Carcinogen/Mutagen Homework Assignment" for each student.

Before students arrive, set up at least two staining stations. Set stain #1, stain #2, and a beaker of water, in that order on a mat of paper towels. Have microscope slides, forceps, toothpicks, permount, lens paper, and compound microscopes available.

Teacher Preparation & Motivation:
Review the cell cycle with students. Interphase is divided into G_1, S, and G_2. Mitosis is divided into prophase, metaphase, anaphase, and telophase.

Tell students that chemicals, radiation, or viruses may interrupt the cell cycle by damaging the cell's DNA. If the damage to the cell cannot be repaired, the cell may become transformed.

A pre-lab lecture is necessary to orient the students to the purpose of the laboratory exercise. Students should understand the difference between growing cells in vitro and in vivo and the advantages and disadvantages of both types of cells.

The effect of chemicals, radiation, and viruses may be tested on cells grown in culture. Cells in vitro may be subjected to varying levels of potential carcinogens. The investigator may observe the effects on cells.

Activities:
Before completing the lab activity, have students do the ***HIP Biology*** Lessons "Mitosis Movie" and "The Cell Cycle". They should answer the questions on the ***HIP Biology*** lesson handouts.

Alternatively, have students view onion root tip cells in the compound microscope. Students should be able to identify cells that are in each of the phases of mitosis and describe the cellular processes in each stage after doing either of these activities.

To complete the lab, students should follow the directions on ***CellServ*** Kit#3, "Effects of Cytotoxins on Cells" laboratory procedure.

After the cover slips are stained, and mounted, students should complete Lesson Assessment Worksheet #1- "Effects of Cytotoxins on Cells".

To educate others about the effects of toxins on cells, enlarge the diagrams of abnormal cells and add color. Display the drawings of normal cells and cells exposed to cytotoxins next to each other in the classroom or hallways in the school. Near the display, post an explanation of the characteristics that distinguish normal cells from the aberrant cells.

As a homework assignment, give students a week to interview each person in their family to ascertain what possible environmental carcinogens and mutagens to which they may have been exposed. Students should use Lesson Assessment Worksheet #2- "Carcinogen/Mutagen Homework Assignment" to collect information from family members.

Day 2: Chromosome Aberrations

Set-up Directions
To prepare for this activity, the teacher will need ***CellServ*** Kit #4, "Preparation of Human Chromosome Spreads" student procedures and copies of Lesson Assessment Worksheet #3- "Human Chromosome Spreads" for each student.

To prepare for the NIH Image activity, the teacher will need either an example of a karyotype to show students or copies of the ***HIP Biology*** lesson, "Karyotypes" and

access to computers with ***HIP Biology*** lesson images.

If ***HIP Biology*** is not available, the teacher could have a sample karyotype to show the students. Alternatively, provide access to the Internet so students may use the karyotype activity at "The Biology Project" at the web site http://www.biology.arizona.edu/human_bio/activities/karyotyping/karyotyping.html

Before the students arrive, set up at least two staining stations. Put stain #1, stain #2, and a beaker of water, in that order on a mat of paper towels. Have microscope slides, forceps, toothpicks, permount, lens paper and compound microscopes available.

Teacher Presentation & Motivation:
A pre-lab lecture is necessary to orient the student to the purpose of the laboratory exercise.

Tell students that the cells that are used in this lab, HeLa cells, are a human cell line (cervical cancer) from a woman from the 1950's. These cells are immortal and will grow and divide indefinitely if supplied with nutrients. Normal cells in culture obey the Hayflick Limit and only divide about 50 times before dying. In contrast, transformed cells do not obey the Hayflick Limit.

Part of the reason these cancer cells are able to divide indefinitely is because they produce telomerase enzyme. Whereas normal cells' telomeres shrink with each cell division cycle, cancer cell telomeres are stabilized and protected by telomerase enzyme. This enzyme adds nucleotides to the telomeres prior to replication to prevent telomere shrinking.

Explain that cancerous cells have chromosomal abnormalities. Transformed cells are often aneuploid, which means they have either less than or more than the normal number of chromosomes. Abnormal chromosome number results from the cell's loss of coordination between karyokinesis and cytokinesis.

Cell chromosome constitution can be determined by making a karyotype. Describe the steps involved in karyotyping and show a diagram of a karyotype. Students will be aware of the characteristics of chromosomes that are used to organize them into a karyotype. Scientists use chromosome size, placement of the centromere, and banding patterns to organize the chromosomes into a karyotype. The autosomes are arranged in pairs from largest (#1) to the smallest (#22). Depending on the placement of the centromere, chromosomes may be metacentric, acrocentric, submetacentric, or telocentric. The size of the p and q arms is determined by the placement of the centromere. Different dyes can be used to produce various characteristic banding patterns.

Activities:
To complete the lab activity, students should follow the directions on the ***CellServ*** #4, "Preparation of Human Chromosome Spreads" laboratory procedures. After the chromosome spreads are prepared and stained, students should complete

Worksheet #3- "Human Chromosome Spreads".

After doing the lab activity, students should make a karyotype using ***HIP Biology*** software. Students should follow the directions on the lesson worksheet to create normal and disease karyotypes. Alternatively, students can do an actual cut-and-paste karyotype from a photograph of a chromosome spread.

Another option would be for students to complete an online interactive karyotype activity at
http://www.biology.arizona.edu/human_bio/activities/karyotyping/karyotyping.html

Day 3: Oncogenes and Cancer

Set-up Directions:
To prepare for viewing the videos *Oncogenes* and *Cancer and Metastasis*, the teacher will need to set up a T.V. and VCR. Make copies of Lesson Assessment Worksheet #4- "*Oncogenes* and *Cancer and Metastasis* Videos." Set the *Cancer and Metastasis* video at about 9 minutes and 45 seconds into the video program at the section entitled "The Development of Cancer." Set the *Oncogenes* video to about 3 minutes and 30 seconds into the video program.

To prepare for the cancer/mutation activity, the teacher should reserve class time in the computer lab. Make copies of Lesson Assessment Worksheet #5- "Human Cancer Mutation Investigation" for each student. Students may work individually or in pairs.

Teacher Presentation & Motivation
Before watching the video, briefly review the role of growth factors, growth factor receptors, protein kinases, phosphatases, and G-proteins in the normally functioning cell.

Discuss with students the environmental factors that may lead to cancerous growth. The cell cycle is disrupted when radiation, chemicals, viruses, and inherited genetic defects alter genes.

After having completed the previous activities, students should be knowledgeable about the cell cycle and its regulation, toxic effects of carcinogens, and the genetic causes of cancer. Now that the students have background knowledge about cancer development, they will be investigating a particular cancer to try to put together the genetic and cellular processes.

Activities:
Before students complete the mutation investigation, have them watch portions of the videos, *Oncogenes* and *Cancer and Metastasis*. The focus for viewing is a specific responsibility or task students are responsible for

during or after watching the video, to focus and engage students' viewing attention. In this lesson students will examine the role of proto-oncogenes in healthy cells and the changes that occur to transform them to oncogenes.

As the students view the following portions of the videos, they should answer the questions on Lesson Assessment Worksheet #4- "*Oncogenes* and *Cancer and Metastasis* Videos."

BEGIN the *Oncogenes* video at about 3 minutes and 30 seconds into the video program. PAUSE the video after the narrator has described the difference between proto-oncogenes and oncogenes. Allow time for the students to answer the first question on the worksheet. RESUME the video at about 4 minutes. Following the description of environmental factors that cause cancer, STOP the video and allow time for students to answer the second question on the worksheet. Forward wind the video to about 11 minutes and take the *Oncogenes* video out of the VCR.

Put the *Cancer and Metastasis* video in the VCR and START the tape at about 9 minutes and 45 seconds at the section entitled "The Development of Cancer." PAUSE the video at the end of the section and allow time for students to answer the third question on the worksheet. RESUME the video at about 11 minutes and 15 seconds at the section entitled "Oncogenes." Direct students to the chart under question 4. As they watch the "Oncogenes" section, students should fill in the chart next to c-myc, erb-B2, and p53. At the end of the "Oncogenes" section, STOP the tape and remove it from the VCR.

Put the *Oncogenes* video back in the VCR and RESUME the tape at about 11 minutes and the start of the discussion of leukemia in chickens. Direct students to the last two genes on the chart on the worksheet. As they watch the video, they should take notes on src and ras oncogenes in the chart. When students have completed the chart, STOP the video.

Following the videos, have each student or pair of students select a type of cancer they wish to investigate. Use the On-Line Mendelian Inheritance of Man site at http://www.ncbi.nlm.nih.gov/Omim/

Follow the directions on Lesson Assessment Worksheet #5- "Human Cancer Mutation Investigation". The result is a display of information about the disease such as description, clinical features, inheritance, population genetics, cytogenetics, mapping, references, etc. Fill in the information about the disease on Lesson Assessment Worksheet #5- "Human Cancer Mutation Investigation".

Students can then search for specific information about known mutations in the gene that causes their cancer. Use the Human Gene Mutation Database at http://www.uwcm.ac.uk/uwcm/mg/hgmd0.html

Continue to follow the directions on Lesson Assessment Worksheet #4- "Human Cancer Mutation Investigation". The result is information about mutations in the gene and a table of known mutations. Have students record information about three mutations on Lesson Assessment Worksheet #4- "Human Cancer Mutation Investigation".

Have students work by themselves, or in pairs, to plan a poster to display the information they have found. Encourage students to make colorful posters with diagrams to educate others about the genetics of cancer. When the posters are complete, have each student or pair present their information to the rest of the class.

Also, display the student posters on the various types of cancers in the hallways or classroom for others to see. Hang the displays in areas of high exposure so passersby will be encouraged to view them and learn from them.

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Enrichment Options

Community Connection:
Create a link on the school's Web page to information about the genetics of the cancers that the class investigated. Include addresses for the Web sites used to prepare the information.

Guest Speaker:
NIH Speakers Bureau at the National Institutes of Health Office of Science Education http://science-education.nih.gov/homepage.nsf/for+teachers?OpenForm. This site allows teachers to request speakers electronically.

Interdisciplinary Extensions:

- **Language Arts** Have students write a short story about a person who suffers from the cancer that the student investigated. Relate the mutation of the protein to the symptoms the patient suffers from.

- **Mathematics** Have the class look at cancers that result from a known genetic mutation such as retinoblastoma. Find out the prevalence of these cancers in populations. Have students use the Hardy-Weinberg Equilibrium equation to calculate the gene frequencies in those populations.

- **Social Studies** Investigate relationships between frequencies of cancer genes in various populations. Are people in various parts of the world that are more susceptible to certain cancers? What environmental or genetic factors could explain higher cancer rates in certain populations?

- **Technology** Monitor the updates in known mutations for a particular cancer throughout the school year. As more research in conducted, scientists are discovering new mutations daily. Internet databases reflect the changes and additions to the information.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Angelique Bosse & Lesli Adler

Name _____ Class _____ Date _____

LESSON ASSESSMENT WORKSHEET #1- Effects of Cytotoxins on Cells

1. Examine both the low dose (1ug/mL) and the high dose (10ug/mL) cells under the microscope on high power. Draw what you see in the viewing field.

low dose (1ug/mL) cells
(high power)
_____ X

high dose (10ug/mL) cells
(high power)
_____ X

2. Examine the control cells under the microscope on high power. Draw what you see in the viewing field.

Transformed Fibroblast Cells
(high power)
_____ X

3. Record your written observations below. Note the cell shapes, cell sizes, characteristics of nucleus, cytoplasm irregularities, and any other observations about each of the cell types.
   Control Low DoseHigh Dose

4. The cytotoxin used in this lab was colchicine. Colchicine adversely affects the polymerization of the microtubules. What structures and processes must be affected by the toxin?

5. Calculate an aberration index for each of the cell samples observed in this lab. Examine 100 cells on each of the cell samples. Divide the number of aberrant cells by the total number of cells examined. Multiply this number by 100.

   Control- $\frac{\text{\# aberrant cells}}{\text{\# aberrant cells + \# normal cells}}$ X 100 % aberrant cells

   Low Dose- $\frac{\text{\# aberrant cells}}{\text{\# aberrant cells + \# normal cells}}$ X 100 % aberrant cells

   High Dose- $\frac{\text{\# aberrant cells}}{\text{\# aberrant cells + \# normal cells}}$ X 100 % aberrant cells

6. Is there a pattern to the aberration indexes?

7. Colchicine is used in the process of karytyping. Karyotypes are prepared by photographing the cells in metaphase of mitosis. Research the process of karyotyping and determine what role colchicine plays in the process.

8. What are some known carcinogens? How do they affect the cells?

Name _____ Class _____ Date _____

Lesson Assessment Worksheet #2- Carcinogen/Mutagen Homework Assignment

Directions:

1. Interview each person in your family to ascertain what possible environmental carcinogens and mutagens that they may be exposed to.
2. Start with the suspected mutagens/carcinogens listed below.
3. Ask each of your family members which of the following consumer products they use.
4. Fill in the checklist.
5. Write a paragraph about your findings. Inform your family members how they scored on your questionare.

Suspected Mutagen/Carcinogen	**Consumer Product**
2-amino 5-nitrophenol	hair dye components
caffeine	cola tea coffee
furylfuramide	food additive
nitrosamines	pesticides herbicides cigarette smoke
proflavine	antiseptic in veterinary medicine
sodium nitrite	smoked meats
Tris	flame retardant in children's sleepwear

*information in this table obtained from Lewis, Ricki. Human Genetics. Dubuque: W.C. Brown publishers, 1994. (p. 161)

Family Member's Name	(Check if they do use product)
1.	2-amino 5-nitrophenol Caffeine Furylfuramide Nitrosamines Proflavine Sodium nitrite Tris

2.

2-amino 5-nitrophenol
Caffeine
Furylfuramide
Nitrosamines
Proflavine
Sodium nitrite
Tris

3.

2-amino 5-nitrophenol
Caffeine
Furylfuramide
Nitrosamines
Proflavine
Sodium nitrite
Tris

4.

2-amino 5-nitrophenol
Caffeine
Furylfuramide
Nitrosamines
Proflavine
Sodium nitrite
Tris

5.

2-amino 5-nitrophenol
Caffeine
Furylfuramide
Nitrosamines
Proflavine
Sodium nitrite
Tris

Name _____ Class _____ Date _____

LESSON ASSESSMENT WORKSHEET #3- Human Chromosome Spreads

1. Draw a chromosome spread under a microscope on low and high power. Try to center one well-spread set of chromosomes.

Chromosome spreads
(low power)
_____ X

Chromosome spreads
(high power)
_____ X

2. Count the number of chromosomes in three different chromosome spreads (use high power). What is the average number of chromosomes in the HeLa cells that you observed?

   #chromosomes in spread 1=

   #chromosomes in spread 2=

   #chromosomes in spread 3=

   average #chromosomes in 3 spreads =

3. Why are HeLa cells said to be "aneuploid"? What causes aneuploidy in cancer cells?

4. Explain the change in telomeres as cells age. What role does telomere length play in the mortality of most cells?

5. What is telomerase and how is thought to contribute to the immortality of cancer cells? How does telomerase work?

6. What are characteristics of chromosomes that scientists use to arrange them into a karyotype?

7. Research an example of a chromosome aberration that causes cancer.

Name _____ Class _____ Date _____

LESSON ASSESSMENT WORKSHEET #4- *Oncogenes* and *Cancer and Metastasis* Videos

1. Distinguish between proto-oncogenes and oncogenes.

2. List factors that trigger the transformation of proto-oncogenes to oncogenes.

3. How does mutagenic transformation lead to malignant transformation?

4. For the following list of proto-oncogenes, describe the normal cellular function and the function of the mutated oncogene.

Gene	Normal Proto-Oncogene Function	Mutated Oncogene Function
c-myc		
erb-B2		
p53		
src		
ras		

Name _____ Class _____ Date _____

LESSON ASSESSMENT WORKSHEET #5- Human Cancer Mutation Investigation

Human Cancer _____

Directions for online Mendelian Inheritance in Man:

1. Go to http://www.ncbi.nlm.nih.gov/Omim/
2. Select "Search the OMIM Database"
3. Type in a disease such as "retinoblastoma" in the box next to "Enter one or more search keywords"
4. Click "Submit Search"
5. The result is a protein or proteins that are known to be related to the disease
6. Click the colored number next to your choice (for retinoblastoma it is #180200)
7. Under Table of Contents, select subheadings such as "description of the disease", "clinical features of the disease", "inheritance", "population genetics", "mapping", "pathogenesis", "animal model", "function", etc. List at least 10 interesting facts about your disease below.

Ten facts about (write your human cancer here) _____

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Directions for the Human Gene Mutation Database:

1. Go to the Human Gene Mutation Database at http://www.uwcm.ac.uk/uwcm/mg/hgmd0.html
2. Click on the "Search now!" button
3. In the box next to "Enter keyword(s)" type in a disease such as "retinoblastoma"
4. Click "Search"
5. Under "here is the result…", click on "RB1"

6. The result is journal article references with information about mutations in the gene and a table of mutations
7. Under "mutation type", click on "nucleotide substitutions (missense/nonsense)"
8. The result for retinoblastoma is 42 examples of mutations showing both the nucleotide mutated and the resulting phenotype
9. Choose 3 different mutation types and record the information below.

Mutation Type	Total # Mutations
1.	
2.	
3.	

10. For each of the above mutation types, click on the mutation type and select one particular mutation to describe. Answer the following questions for each mutation you investigate:

    a. How is the normal DNA sequence changed?

    b. How is the protein affected?

11. For one mutation type, select one of the listed mutations to research in a journal. Click on one reference number from the list and click on a study of your choice. Read the study, and summarize the study by filling in the information below (be sure to phrase the information in your own words).

    - Title of the study:
    - Authors:
    - Purpose of the study:
    - Methods:
    - Results:
    - Significance of the study:

Testing 1,2,3, Part I:
Testing for Cancer Causing Gene

Time Commitment: Three 45-Minute Periods
Grade Levels: 9 - 12

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Overview

One of the great personal quandaries to arise in the age of molecular genetics is whether or not to "get the test" for mutant genes that may cause cancer. Although rare, abnormalities in the BRCA1 and BRCA2 genes have been found to "run in families" and be indicators of a tendency for familial breast and associated cancers such as ovarian cancer and prostate cancer. Although very few teenagers will develop breast cancer, many of their lives will be affected because mothers, grandmothers, aunts and other female relatives and friends may be diagnosed with the disease.
In this lesson, students will study inheritance patterns and use the information from a family pedigree to assess the possibility of an

individual having an abnormal gene that may increase her chance of developing breast cancer. The lesson will deal with psychosocial impact issues for those "patients" who test positive.
Students will perform a simulation gel electrophoresis analysis of DNA for evidence of the mutant gene that increases one's risk for breast and associated cancers.

Cooperative structure of the lesson:
The class will role-play as family members to analyze the pedigree of a fictional family to determine if a particular family member might carry the mutant genes for cancer. Although each student will have a sample of DNA to test for the genetic abnormality, the hands-on lab will be performed in groups of four.

Expected products from lesson:
Students will use a model of the genetics of familial breast cancer to understand how a genetic test is done, and what the results might indicate. Students will prepare a ***PowerPoint*** presentation describing their lessons and activities for teachers of other classes to use.

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Instructional Technology Resources

Internet Sites:
BioHealthLink: Questions of Cancer Site
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html

Internet Project Web Resources
http://www.kn.pacbell.com/wired/fil/pages/listinternetcy1.html

National Institutes of Health Office of Science Education http://www.science-education.nih.gov/col This site from the Science Education Office of the National Institutes of Health contains an on-line version of a pedigree analysis and gel electrophoresis testing for gene mutations. The pedigree is simpler, but the genetic analysis is more complicated and includes analyses of haplotypes for BRCA1 and BRCA2. The lesson ("Electrophoresis") can be found in the Health Science

Curriculum Online. Although free, teachers must register to use the site.

Cancer Risk Assessment and Counseling http://www.dnai.com/~ptkelly
Patricia D. Kelley is a medical geneticist. who offers her services to health professionals and individuals. She includes new information weekly about cancer risk and presents it in a non-threatening manner. Please note: some sites have so much information, they can be overwhelming to students.

Breast Cancer Demographics
http://www.people.virginia.edu/~rjh9u/bcancer.html
This is a wonderful site at the University of Virginia, sponsored by professor Huskey, who teaches undergraduate biology. Although many of the lessons are aimed at upper level high school and college undergraduates, he has collected pertinent, excellent resources. This page contains two articles. One from ***Scientific American***, 1995, "Deaths Caused by Breast Cancer, by County" and "Misunderstood Statistics of Breast Cancer" from the ***Washington Post,*** November 8, 1995.

Multimedia Software:

- ***Microsoft PowerPoint***

Video(s):
A Question of Genes: Inherited Risks
http://www.PBS.org/gene/welcome
Teacher guides can be downloaded from
http://www.pbs.org/gene/educator/41_discussion.html
$29.95 + $4.95 shipping & handling
1-800-440-2651

A six part video describing "An intimate look at the social, ethical and emotional consequences of genetic testing for individuals and families.

DNA Science: Techniques for the Teaching Laboratory, DNA Restriction Analysis
Produced by Cold Spring Harbor DNA Learning Center and distributed by Carolina Biological Supply Company.

Catalog # BA-21-2732-V, $33.00
1-800-334-5551

This video is a companion to the text ***DNA Science***, David Micklos. It demonstrates the steps to prepare and perform a restriction digest as used in the Advanced Placement Biology curriculum. Although the video is essentially a teaching program, demonstrating techniques for teachers, it also has excellent footage for students showing the proper way to use micropipettes and load gels.

Other Technology:

- DNA gel electrophoresis
- Digital camera optional

OTHER INSTRUCTIONAL RESOURCES

Books:

Kreuzer, Helen and Adrianne Massey, Recombinant DNA and Biotechnology, American Society for Microbiology Press, 1996 (available through Carolina Biological Supply Company #BA21-2214, $41.00).

Matyas, Marsha Lakes, Women Life Scientists; Past, Present and Future, Connecting Role Models to the Classroom Curriculum, American Physiological Society, 1997.

Micklos, David and Greg Freyer, DNA Science, A First Course in Recombinant DNA Technology, Cold Spring Harbor Laboratory Press, 1990 (available through Carolina Biological Supply Company, #BA 21-2211, $34.00).

Slide-Tape Presentation & Booklet:

"Understanding Gene Testing: A Slide Lecture" and the accompanying booklet (NIH publication number 96-3905) is produced by the National Cancer Institute of the National Institutes of Health. The slide-tape program is free to teachers and class sets of the booklet can be ordered from the National Cancer Institute (1-800-4-CANCER). The package contains fifty 35 mm slides, the accompanying script and a sample booklet. Performing the presentation is easy. The script is well-written and the graphics are colorful and lively. The program takes about 10 minutes.

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Teacher/Student Background Information

Please be aware that this is a very frightening topic for students. Many of them have family members or friends of family who have been impacted by breast cancer. Reassure students that people note the abnormal, that most women will not have breast cancer, and that the statistics must be carefully analyzed to illustrate the true risk.

Mutations are a change in the sequence of nucleotides in a person's DNA. Mutant genes may cause cells to divide uncontrollably and form cancerous tumors. Uncontrollable cell cycling can be caused by abnormalities in either the protein signals that promote cell division or those that inhibit cell division. In simpler terms: either the accelerator is broken and remains "on" or the brakes are broken and remain "off." Either way, you are still moving forward, or the cell continues to reproduce.

The mutations that cause the abnormalities could result from many causes: UV radiation in sunlight, environmental toxins, viruses and other unknown factors, or

spontaneous changes in the base sequences during DNA replication that now get passed to future generations.

Over an average woman's lifetime, she has approximately a 1/8 chance of developing breast cancer, with only approximately 3% of those cases due to inherited forms of breast cancer. In most instances of non-familial cancers, there must be chains of mutation events, often including multiple genes on multiple chromosomes, before the cell cycle is disrupted.

The gene for familial breast cancer (BRCA1) was discovered in 1994. Mutations in BRCA1, chromosome 17q, are associated with approximately half of all hereditary forms of breast cancer – which is only 10% of all breast cancer cases. Almost 90% of women with BRCA1 mutations will develop breast cancer. These women are also at increased risk for ovarian cancer.

The gene and its protein product (1865 amino acids) demonstrate that tumor suppressor genes can act outside the nucleus of the cell to regulate cell division. The protein is expressed in epithelial cells of the mammary gland and passes through the golgi apparatus, packaged into vessicles, and secreted from the cell. The secreted protein binds to receptors on the surface of epithelial cells and generates an intracellular signal cascade that inhibits cell division. It also acts to inhibit the growth of ovarian cells. Loss of the protein by gene mutation contributes to continued cell division and the formation of tumors.

A second breast cancer gene, BRCA2 on chromosome 13q, encodes a protein similar to the BRCA1 product. BRCA2 mutations are responsible for about 1/3 of hereditary breast cancers. Males inheriting this gene have a 1/10 chance of developing breast cancer, and women an 8/10 chance. Inheriting mutations in both tumor supressor genes increases the risk of breast cancer.

Although students realize that a person can be "tested for mutant genes," most don't really know what that phrase means. In some cases, the changes in nucleotide sequences will mean the affected part of the genome has obtained or lost restriction enzyme cleavage sites. These differences in cleavage patterns can be detected and analyzed by gel electrophoresis. Gel electrophoresis is a powerful tool to demonstrate the connection between classical genetics and molecular biology. See "Sample Gel Electrophoresis" for a description of interpretation of DNA bands on the gel. One large size band indicates that the individual has inherited normal genes from each parent. Two smaller bands indicate that the individual has inherited a mutant gene from each parent. A large band and two smaller bands indicate that the individual has inherited a normal gene from one parent and a mutant gene from one parent. The gel demonstrates the pair of (dimorphic) chromosomes inherited from our parents – one from mom and one from dad.

This lesson assumes that students and teachers are familiar with the basic principles of pedigree analysis and the basic principles and techniques of gel electrophoresis. This scenario can be used as an initial exposure to gel electrophoresis, but more time must be allotted to explain the basic biotechnology

processes.

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Vocabulary

Gel Electrophoresis- A method of separating charged molecules in a sugary matrix (agarose) to which is applied an electrical field.
Genome- The array of genes carried by an individual.
Genotype- The specific genetic constitution of an organism; often looking at the allelic composition of one or a limited number of genes under investigation.
Pedigree- A diagram showing the ancestral relationships and transmission of genetic traits over several generations in a family.
Penetrance- The frequency, expressed as a percentage, with which individuals of a given genotype manifest some degree of a specific mutant phenotype.
Phenotype- The observable traits of an organism that are genetically controlled.
Restriction Enzyme (endonuclease)- An enzyme that recognizes specific nucleotide sequences of DNA and cleaves the DNA at that site.

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Learning Objectives

Content:
***The student(s) will**:*
- **Demonstrate** that the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring.
- **Illustrate and explain** how expressed traits are passed from parent to offspring.
- **Interpret** how the effect of gene alteration through natural or technological advances may have beneficial or harmful effects on the individual, society and/or the environment.
- **Explain** how new traits may result from new combinations of existing genes or from mutations of genes in reproductive cells.
- **Analyze** pedigrees demonstrating inheritance of breast cancer.
- **Predict** the outcome of a genetic test.
- **Decide** whether an individual should be tested for a genetic disease.
- **Explain** how the ability to test for a person's genetics has brought new risks as well as improvements to human existence.

Technology:
The student(s) will:
- **Demonstrate** that data analysis is a vital aspect of the process of scientific inquiry and communication.
- **Use analyzed data** to evaluate an hypothesis.

- **Use models** and computer simulations to represent systems.
- **Demonstrate** the use of gel electrophoresis technology as a **model** to test for genotypes.
- Use technology to **locate**, **evaluate** and **collect** information from a variety of on-line sources.
- Use technology to **prepare** a ***PowerPoint*** program to **present** information to teachers and students.

1.12.10: design, construct, and use models (e.g., math, computer, physical) to make predictions about actual events.
1.12.11: demonstrate and explain how using existing tools extend knowledge and identify the limitations, which drive the need for new technologies (e.g., create improvements in observing, estimating, measuring, computing, collecting, and communicating scientific data and information). 1.12.14: explain that science and technology have strongly influenced the course ofhistory and cite how human inventiveness has brought new risks as well as improvements to human existence.

Core Learning Goals:
1.0 Skills and Processes - Students will explain how the nature of science has affected scientific inquiry, technology, and the history of science.
1.12.1: access and process information in order to formulate questions that lead to a testable hypothesis, which demonstrates the logical connections between the scientific concepts and the design of an investigation.
1.12.2: design and safely implement experimental approaches, which answer scientific questions.
1.12.3: select and correctly use appropriate instrumentation including computers and
their accessories and demonstrate safety when conducting investigations
1.12.4: using appropriate instruments, including calculators, spreadsheets, and databases and graphing programs, formulate and support an explanation or model (physical, conceptual, or mathematical).
1.12.5: analyze appropriate data in forming conclusions and apply what has been learned to evaluate the hypothesis.
1.12.6: interpret and communicate findings through speaking, writing, and drawing using developmentally appropriate methods including technology tools and telecommunications.
1.12.7: defend a position on a scientific issue and take into account the different types of risks and benefits in formulating a plan of action.
3.0 Life Science - Students will use scientific skills and processes to explain the dynamic nature of living things, their interactions, and the results from the interactions that occur over time.
3.12.4: explain how traits are inherited and passed from one generation to the next (i.e. from parental DNA, RNA to gross anatomical traits of offspring).

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Lesson Assessment

Content:
Use "Pedigree Analysis" found in appendix

Technology:
Use "Pedigree Analysis" and "Assessment #1, Just the Facts"

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Materials Needed

(Per student)
- Pencils
- 3 x 5 cards, numbered 1-25 with family biographies
- DNA samples numbered 1-25 and correlated with the cards/pedigree members. Pre-digested samples can be purchased from EDVOTEK (1-800-EDVOTEK, 115C, samples for 24 wells, $114 or Neo-Sci 1-800-526-6689, 10-21-1993)
- tape
- "Family Pedigree" with outline of pedigree, including symbols for male, female, afflicted, non-afflicted
- "Sample Gene Map" with restriction sites noted
- "Sample Gel Electrophoresis" with DNA bands indicated
- "Assessment #1, Just the Facts"
- "Pedigree Analysis"
- Biography card from "Biographies- Family Background"

(Per student team/group of 4 students)
- Gel box and power supply
- TBE buffer (available at all major biological supply companies)
- Micropipette
- Tips for micropipette
- Rack for sample tubes
- Microfuge tubes w/ samples
- 0.8% Agarose gel (0.8 grams agarose, 100 ml distilled water, in 250 ml ehrlenmyer, covered w/ plastic wrap, boiled until melted and clear, poured when tolerable to touch container without hot pads)
- Transparent film (to cover agarose during melting)
- Microcentrifuge
- Visualization medium (ethidium bromide or methylene blue) I recommend EDVOTEK Insta Stain (1-800-EDVOTEK)
- Appropriate transilluminator (uv if using ethidium bromide or white light if using methylene blue. An overhead projector will also work for gels stained with methylene blue)
- Balance

- Trays for staining
- Camera and film for photographing gels (not necessary if using blue stain, since students can handle the gels)
- Small plastic zip-lock sandwich bags
- Insta-Blue Stain (EDVOTEK)
- Distilled water
- Size marker for gel (available at any major biological supply house)

(Per class)
- microwave (to melt agarose)
- Computer with Internet access
- VCR and monitor

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Procedures

Students will use Internet sites listed above to obtain background information about breast cancer and its occurrence. The information in these sites is easy to access and presented in a non-threatening format. They will answer the questions in "Assessment #1, Just the Facts." }

Members of the class will assume the roles of members of the family whose pedigree will be analyzed. The family members will be tested for mutant genes. The teacher will moderate the discussion leading to identification of the family relationships and the penetrance of the cancer genes.

Groups of four students will test the samples for evidence of the mutated genes.

This can be done in a normal biology classroom.

The actual testing for the BRCA genes involves multiple analysis sites. An on-line extension activity for honors or advanced level students can be found at http://www.science-education.nih.gov/

No special accommodations are required as students will be working in teams and a team member can load the gels if necessary.

Please note: The timeline is variable. The initial fact-finding activity can be done as a homework assignment if students have access to computers at home, in school or public libraries. It is assumed that students have been instructed in the basic principles of gel-electrophoresis and use of Internet resources.

Day 1: Pedigree Analysis

Set-up Directions:
The teacher will need to prepare the biography cards for the students, and print the

pedigree on the board. Electrophoresis materials should be assembled for review.

Activities:
The teacher should open the discussion by asking how many students have been impacted by cancer, and specifically by breast cancer. The teacher should then introduce the activity by highlighting that the class will be acting in a scenario based on an actual family dilemma about whether or not family members should be genetically tested.

The teacher will distribute the booklets and present the slide-tape program, "Understanding Gene Testing" to the class. This program describes basic information and essential concepts about genetic testing. It answers some of the most frequently answered questions about the science, the risks and benefits of genetic testing.

The students will prepare a ***PowerPoint*** presentation of the class lessons similar to the "Understanding Genetic Testing" slide program. The teacher will arrange for photographs to be taken during the lessons to be incorporated into the program. A script will be prepared to accompany the photographs describing the lessons and activities. Teachers from other classes might use the program to introduce the basic concepts and techniques of genetic testing to instruct other students in this sensitive issue.
The teacher will moderate the discussion/ role-play about pedigrees and genes that "run in families." The students are members of the extended family who have assembled here to determine whether Mary (#16) should be tested for the mutant gene. Remind the family members that Mary asked for them to come because she is worried about whom may be afflicted.

The teacher should ask whether or not everyone present in the room is comfortable with sharing this information. Not everyone will answer "yes" to that question. Encourage discussion about personal reasons for yes and no answers.

Each student receives a card with a brief biography and health status of the family member s/he is representing. The students may meet in small groups and discuss some "family" memory to personalize the role they are playing.

Students introduce themselves to the class and post the name, sex information on the pedigree. Some family members have already died due to natural causes, disease, or accident. This information is included in the biographies on the cards.

The common pedigree symbols will be demonstrated: a circle represents a female, a square represents a male. Shading the person's designation, indicates that the person has been diagnosed with cancer, and is still living. Deaths are noted on the pedigree by drawing a diagonal slash through the person's circle or square. There is no special designation for breast cancer as opposed to other forms of cancer.

The teacher will indicate penetrance of the disease by asking the following

questions: How many people have been affected by cancer (diagnosed, cured, died)? Did everyone affected have the same cancer? Did the cancers seem to cluster? Some members of the family will have cancers, but will have married into the family. The teacher will point out these individuals and ask if their cancers should be included in the analysis. Students will identify the cluster of cancers that might indicate familial breast cancer "genes."

Teacher will then ask, "How is someone tested for cancer genes?" Student answers will probably include a response indicating that blood is taken…." The teacher then needs to probe further. The DNA must be extracted from the cells and analyzed. What does "analysis" mean? How would it be done? And what would the results "look like."

Teacher will lead students to a discussion of mutations in genes leading to alteration (addition or loss) of a restriction site. Using a the "Sample Gene Map," indicate where the mutant genes are located and how the resulting mutation results in different bands on the gel. Teacher will show how the resulting gel will appear if the gene is normal, and if the gene is mutated.

Day 2: Gel Electrophoresis

Set-up Directions:

Gel electrophoresis materials will be distributed to groups of four students. 0.8% agarose can be melted ahead of time and held in a hot water bath until needed. An alternative, and time saving method, is to cast the gels in advance and store them in the refrigerator in a small amount of buffer and wrapped in plastic wrap or a sandwich bag. The DNA samples must be correlated with members of the pedigree.

Activities:
Teacher will review methods of gel electrophoresis. The Cold Spring Harbor video ,"***Restriction Digest***" has an excellent demonstration of gel loading procedures lasting about 5 minutes.

Each student will receive a sample to be loaded and "run" on the gel. Students must "pulse" the samples in the centrifuge before loading them onto the gel. Check that the gels are oriented correctly in the box and the samples will run to the positive electrode. Remind students to keep notes indicating the identity of the samples in each lane.

The gels are then covered with buffer, the boxes closed, hooked to the power supplies (generally running @ 100v). Minigels will take approximately 30 minutes to run.

While the gels are running, students will complete a "fact-finding" worksheet about the causes and occurrence of breast cancer. Students complete "Assessment 1, Just the Facts" as they acquire background information about breast cancer from

http://www.dnai.com/~ptkelly and http://www.people.virginia.edu/~rjh9u/bcancer.html If this has already been done as homework, the teacher will review the information with the class.

When the gels have run to the appropriate spot on the gel, the teacher will remove the gels for staining. I recommend Blue Insta-Stain from EDVOTEK. Gels are placed in a plastic bag and students can handle them for analysis.

Day 3: Analyzing the Test Results

Set-up Directions:

Teacher will give the students the stained gels to analyze. Students will fill in the appropriate genotypes on the pedigree.

Activities:
Students will analyze their gels, determining if he/she had the mutated gene. The genetic information will be added to the pedigree from day 1. The teacher will point out that the information is not always complete. Not everyone will know with certainty his/her genotype. This will lead to questions about ambiguities in testing, the need for confidentiality, etc. The teacher also needs to emphasize that an individual having 2 mutated genes increases the risk of cancer, but does NOT guarantee it. Likewise, an individual with no mutations may still get cancer. Risk formulas do NOT necessarily translate to any individual's risk of getting the disease.

Students will view the video, "***A Question of Genes,Part 6***" about a real family faced with the genetic testing dilemma.

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Enrichment Options

Community Connection:
Students can participate in "Race for the Cure," and annual "marathon" for survivors of breast cancer and anyone with an interest in supporting research leading to cures for the disease.
Students will sponsor a fund-raiser such as a car wash with proceeds going to "Cancer Care," an organization dedicated to personally supporting cancer patients.

Guest Speaker:
Johns Hopkins University, the National Institutes of Health and almost any major hospital and health care provider such as Kaiser Permanente maintain speaker's bureaus with lists of speakers interested in presenting information to students. These are free and the speakers have usually received instruction about presenting to schools.

Interdisciplinary Extensions:

- **Language Arts/ Social Studies**

Write a letter to your congressman explaining why funds are needed to study the basic biology that may lead to understanding the causes and finding cures for breast cancer.

Read Refuge: An Unnatural History of Family and Place by Terry Tempest Williams (Random House, 1991). Terry Tempest Williams is a naturalist from Salt Lake City, Utah. Ten women in Ms. Williams' family have been diagnosed with cancer. Her narrative follows her five-year struggle with cancer and her comparison of her medical condition with changes in the ecosystem of the Great Salt Lake wetlands. Quoting Felice Aull's review at the Medical Humanities Internet site, (http://www.endeavor.med.nyu/lit-me) "The interplay of the uncontrollable elements of nature and the inevitability of life and death make this book an elegant study of "renewal and spiritual grace…" This is an emotionally powerful book describing a daughter's grieving for her mother. There is a surprise ending. Ask female family members to read the book also. Discuss it with them.

- **Mathematics**

Stephen J. Gould was diagnosed with mesothelioma. Because of this, he has written several essays explaining the mathematics of cancer statistics. I recommend "Case One, A Personal Story" from Full House, Harmony Books, 1996 or "The Median Isn't The Message" from Bully for Brontosaurus, Norton 1991. These books are easily available in paperback and in libraries. Students find his essays insightful and interesting.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

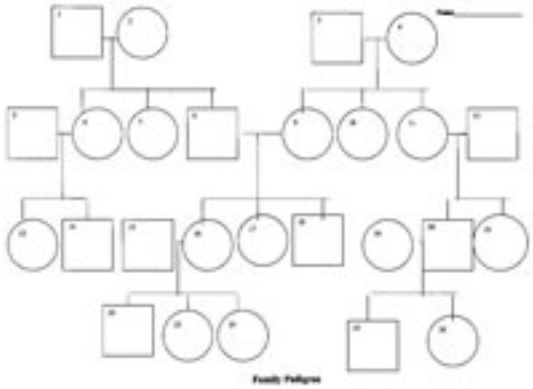
2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Lesli Adler and Angelique Bosse

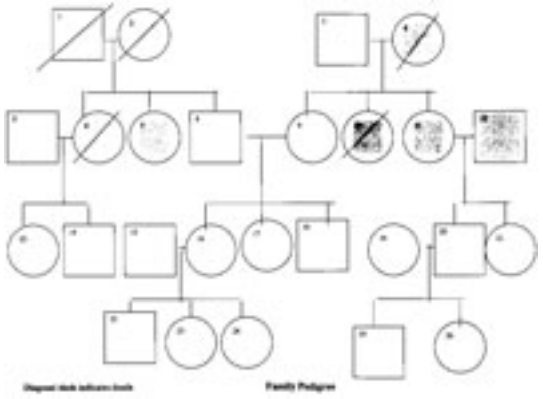
Name _____ Class _____ Date _____

Family Pedigree & Gene Distribution

Click on an image below to begin printing a "portrait" view of the page.



Pedigree Worksheet 1



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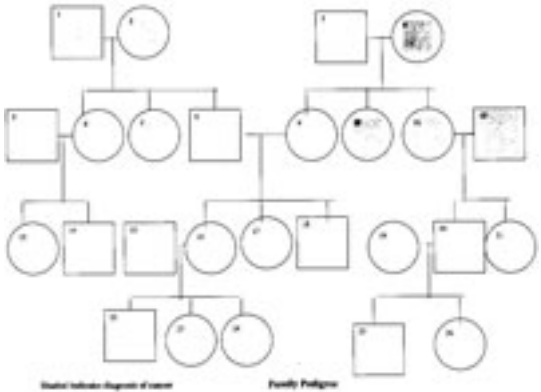
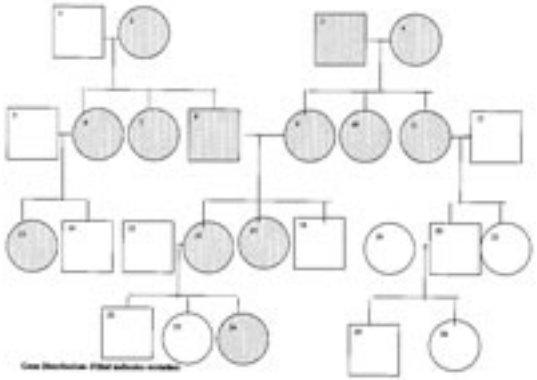


Pedigree Worksheet 3



Pedigree Worksheet 4

Name _____ Class _____ Date _____

Sample Gene Map

Fragment of a Normal Gene Showing No Mutation and No Restriction Site

ATTCCGGAATTCGCGTAATCATTCCGGCCTATTCGCCCT

Fragment of Gene Showing Mutation Resulting in a Restriction Site

ATTCCGGAATTCGC*GAATTC*ATTCCGGCCTATTCGCCCT

Size Marker	Inherited 2 Normal Genes (1 from each parent) Normal Gene	Inherited 2 Genes w/ Cancer mutations (1 from each parent) Cancer Mutation	Inherited one of each type from each parent Dimorphism
60			
50			
	40		40
35		24	24
20		16	16

Name _____ Class _____ Date _____

Just the Facts Assessment #1

1. What percentage of breast cancers are thought to be due to hereditary factors?
2. What are some of the risk factors for breast cancer?
3. One popular theory states that consumption of dietary fat promotes breast cancer. Do the statistics bear this out?
4. Where are the highest rates of breast cancer? The lowest?
5. Is breast cancer the only hereditary cancer?
6. What other hereditary cancers are associated with breast cancer?
7. What is the difference between "genetic" and "hereditary?"
8. How is cancer caused?
9. Can I inherit breast cancer mutations from my father's side of the family?
10. Are hereditary breast cancers only found in younger women?
11. If my mother and father both were diagnosed with cancer, am I at very high risk?
12. If the average woman's risk of having breast cancer is 1 in 9, does that mean of 9 women at a meeting, one will have breast cancer?
13. How important is the size of the breast cancer when it is found?
14. Is there really an "epidemic" of breast cancer?

Just the Facts Assessment #1
Answer Sheet

1. What percentage of breast cancers are thought to be due to hereditary factors? (5%)

2. What are some of the risk factors for breast cancer? (regions of low fertility, high proportion of unmarried women over age 35, college graduates and professionals) (Fat in the diet, alcohol consumption, environmental toxins) (No one really knows)

3. One popular theory states that consumption of dietary fat promotes breast cancer. Do the statistics bear this out? (The Northeast has one of the highest breast cancer rates, yet has one of the lowest fat consumption rates)

4. Where are the highest rates of breast cancer? (northeast- NYC area) The lowest? (Hawaii)

5. Is breast cancer the only hereditary cancer? (no, colon cancer is also hereditary)

6. What other hereditary cancers are associated with breast cancer? (ovarian, prostate)

7. What is the difference between "genetic" and "hereditary?" They are related terms. Differentiation needs to be made between mutations that occur before conception and are then passed to new offspring versus mutation after conception and are not passed in the genes.

8. How is cancer caused? The mutations change the cellular "brakes" or "accelerators" of the cell cycle. Either way, the cell continues to divide.

9. Can I inherit breast cancer mutations from my father's side of the family? (yes)

10. Are hereditary breast cancers only found in younger women with breast cancer? (no, some older women diagnosed for the first time with cancer have the hereditary forms of the disease)

11. If my mother and father both were diagnosed with cancer, am I at very high risk? (Actual risks are dependent on the type of cancer and its hereditary influence. The risks are not necessarily additive. Patterns, side of the family, types of cancer, age at onset are all factors to be analyzed.)

12. If the average woman's risk of having breast cancer is 1 in 9 does that mean of 9 women at a meeting, one will have breast cancer? (No That statistic is often quoted and leaves out a very important factor. That is the risk to age 85. Younger women have much lower risks. There is an 11% lifetime risk, but that needs to be age adjusted. 2% before age 50, 5% age 50 –70, 4% age 70-85. However, death rates within the higher age brackets also occur with much greater frequency due to heart disease, etc.)

13. How important is the size of the breast cancer when it is found? (The smaller the tumor, the better the survival rate – up to 95% for small cancers, easily detected by mammograms.)

14. Is there really an "epidemic" of breast cancer? (answers will vary)

Name _____ Class _____ Date _____

Pedigree Analysis

1. Which family members:

   a. died of cancer? _____

   b. were diagnosed with cancer, but are still living? _____

   c. were diagnosed with cancer, but died of other causes? _____

   d. cannot have their genetic information determined from the pedigree chart?
   _____

   e. can have their genetic information determined from the gel electrophoresis test?
   _____

2. Suppose some family members decide not to participate.

   a. Can their genotype be inferred from the pedigree? _____

   b. How certain would you be of this prediction? _____

3. Mary discovered that she is at very high risk of developing breast cancer. What are the implications of this information?

4. Why might some people choose not to know their genotype?

5. Should Mary's non-adult children be tested? _____

6. Why is it necessary to use a "size marker" when running the gel electrophoresis?
_____

7. What are some of the limitations with this type of test? _____

8. Fill in the pedigree with the genotypes.

Pedigree Analysis

Answer Key

1. Which family members

   a. died of cancer (1,2,4,6,10)
   b. were diagnosed with cancer, but are still living (5,7,11,12,13,17)
   c. were diagnosed with cancer, but died of cancers other than breast cancer, or of other causes (1, possibly 2, possibly 6)
   d. cannot have their genetic information determined from the pedigree chart (all)
   e. can have their genetic information determined from the gel electrophoresis test (all who take the test)

2. Suppose some family members decide not to participate.
   a. their genotype be inferred from the pedigree? (to some degree, depending on where they are in the family, and how they are related to the family members)
   b. How certain would you be of this prediction? (that would depend on their placement within the pedigree)

3. Mary discovered that she is at very high risk of developing breast cancer. What are the implications of this information? (frequent monitoring for breast lumps by self-exams and mammograms)

4. Why might some people choose not to know their genotype? (generally, fear.)

5. Should Mary's non-adult children be tested? (answers will vary, but students need to express questions and concerns)

6. Why is it necessary to use a "size marker" when running the gel electrophoresis? (it is reference size for the proper bands)

7. What are some of the limitations with this type of test? (lab procedure; availability of samples; an accurate test for mutations, since not all mutations lead to loss or gain of restriction sites)

8. Completed pedigree.

Name _____ Class _____ Date _____

Biographies- Family Background

1. Bob- died of lung cancer
at age 60

2. Samantha-
died of unknown cancer at age 55

3. Harold- still living, age 92
PSAs (prostate antigens) elevated

4. Wilma- died age 44
breast cancer

5. Brett- 4 melanomas removed
still living,
age 71 plays golf everyday

6. Susan died of cancer age 36

7. Angela- age 66.
Lumpectomy last year
Lymph nodes apparently not affected

8. Anthony- age 66 Angela's twin brother

9. Lisa- age 62
normal

10. Rose-
died of breast cancer at age 40

11. Bertha- 62
mastectomy last year

12. Will- 64
testicular cancer removed

13. Harriet – 40
mastectomy last month

14. Jason- 45

15. John- 38

16. Mary- 36
Should she take the test?

17. Barbara-35
2 small cysts found on ovaries

18. Curt- 38

19. Debbie-33

20. Edgar- 34

21. Francine- 33

22. Geoff-16

23. Georgia-21
Inez's twin sister

24. Inez-21
Georgia's twin sister

25. Kyle- 20

26. Melanie- 15

Testing 1,2,3, Part II: Researching for the Debate about Ethics & Genetic Testing

Time Commitment: Three to Five 45-Minute Periods
Grade Levels: 9 - 12

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Overview

The personal and societal effects of having the ability to test for genes that may cause cancer will be far-reaching and profound. Political, financial, religious and family decisions will need to take into account many questions that have not yet been identified. Few of our institutions are equipped to guide our students as they face substantial ethical, moral, legal issues because of new (bio)technologies. The purpose of this lesson is to highlight some of the bioethical issues and perspectives that may be expected in a typical medical/genetic procedure.

This lesson includes a sample debate about the issues brought forward as a family decides whether to be tested for the mutant forms of the BRCA1 and BRCA2 genes

that are implicated in familial (hereditary) breast cancer. The lesson will also include production of "Cancer-Lit BINGO", a method for students to obtain both the broad and the specific background knowledge necessary to perform their assigned roles in the debate.

Cooperative structure of the lesson:
Students will be assigned roles for the ethical debate. Students may be assigned as teams if their roles overlap.

Expected products from lesson:
The students will produce a "Cancer-Lit BINGO" as evidence that they have acquired both broad and specific background knowledge necessary to participate in a debate about some of the issues raised surrounding the decision to be tested for mutant genes that are implicated in cancer.

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Instructional Technology Resources

Internet Sites:

BioHealthLink Web Site:
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html

Internet Project Web Resources
http://www.kn.pacbell.com/wired/fil/pages/listinternetcy1.html

Task Force on Genetic Testing www.med.jhu.edu/tfgtelsi/
This site from Johns Hopkins University describes the work of the Task Force on Genetic Testing sponsored by the National Human Genome Research Institute. It contains a comprehensive outline of the ethical, legal and social issues surrounding genetic testing.

Access Excellence http://www.accessexcellence.com
Use ***Access Excellence*** as a gateway. This site is sponsored by Genentech, Inc. as a resource for teachers, and should not be cited for students. This site contains an extensive compilation of biotechnology information and lessons produced by teachers. There is a large, comprehensive bioethics section with extensive links to other, related sites. ***Access Excellence*** also provides users the ability to interact with colleagues. If students need information from articles listed within the site, they can obtain it from the primary source. The following links are suggested:

- **The Gene Connection Second Annual Bioethics Symposium and Workshop** presented by the San Mateo County Biotechnology Education Partnership. This discussion on ethical and social issues arising from new genetic technologies is an excellent primer on the basics principles of

bioethics.

- **National Cancer Institute** produced an excellent booklet, and slide presentation, "Understanding Gene Testing: Basic information about gene testing and key concepts" (also available from 1-800-4-CANCER). The program answers many questions and highlights some of the potential risks of gene testing.
- **National Human Genome Research Institute** (at the NIH) which was established to increase the working knowledge of human genetics and genetic technologies. The site contains a "Talking Glossary of Genetic Terms", "Research Fact Sheets" and a graphics gallery.
- **The Woodrow Wilson Biology Collection** is a compilation of lessons produced by the Woodrow Wilson Fellows. One of the topics is Bioethics. Within this extensive listing of background information are a few particularly pertinent items: "Presenting Ethical Dilemmas to the Classroom", "The Genetic Diagnosis of Cancer", "A Process: Framework for Teaching Bioethics".

Ethical, Legal, Societal Implications of Human Genome Project
http://www.kumc.edu
This is a listing of professional (as opposed to educational) resources (further links) on ethical, legal and policy issues relating to the Human Genome Project. Genetic counseling sites are included. These will provide background information for the teacher as well as information for the student to complete the Cancer-Lit BINGO.

Human Genome Project http://www.ornl.gov
The Human Genome Project is sponsored by the Department of Energy and the National Institutes of Health. This is a compilation of their resources. Almost all are free, and many can be downloaded.

Genetic Privacy Article http://library.thinkquest.org/28599/links_testing.htm
This site should be assigned to students. There is an excellent article about genetic privacy as well as resources about the latest research on breast cancer and genetics.

Decisions, Decisions Online
http://www.teachtsp2.com/ddonline/teachers/instruct.htm
This site is produced by Tom Snyder Productions. Each month students explore a current events issue and role play through a five step critical thinking project. One of the issues presented was "Cloning".

Video:
A Question of Genes: Inherited Risks
http://www.PBS.org/gene/welcome and teacher guides can be downloaded from http://www.PBS.org/gene/educator/41_discussion.html $29.95 + $4.95 shipping and handling.
1-800-440-2651.

This is a six-part video describing "An intimate look at the social, ethical and emotional consequences of genetic testing for individuals and families"

Articles:

"BRCA1/2 Testing, Task Force Report", Sanford Program in Genomics, Ethics and Society (PGES), Journal of Women's Health, June 1998, published by Mary Ann Liebert, Inc.

Casey, Denise, "What Can the New Gene Tests Tell Us", The Judges' Journal, American Bar Association , Summer 1997, Vol. 36, No. 3, This article is written from a legal perspective and discusses the tests for BRCA1 and BRCA2 genes.

"Genetic Testing for Cancer Susceptibility, Statement of the American Society of Clinical Oncology", Journal of Clinical Oncology, (May), 1996, Vol. 14, no 5, pp. 1730-1736

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Teacher/Student Background Information

It is widely recognized that the Manhattan Project (building the atomic bomb) completely altered our world view of science and its impact on society. Scientists believe that the Human Genome Project will have a more profound effect on our lives than atomic power ever had. Celera Genomics in Rockville, Maryland recently announced that they have mapped the entire human genome- several years ahead of schedule. The genomes of several species of animals, plants and microbes have already been sequenced, and their genes identified, and compared to one another. The biotech companies of "Genomic Junction" (Newsweek, April 10, 2000) and around the world are rushing to use this information to develop new genetic tests and therapies. All of our institutions - political, legal, financial, health, industrial, educational – are scrambling to meet unforeseen challenges due to these new (bio) technologies. Obviously, our students will confront very different world issues than we faced at their age.

The repository of this information is collectively known as ELSI – Ethical, Legal and Social Issues derived from the Human Genome Project. Entering ELSI in a web search engine will bring thousands of entries. Making sense of all this information is a daunting task. Fortunately, programs from the Department of Energy http://www.ornl.gov, the National Institutes of Health http://www.nih.gov

"Access Excellence" http://www.accessexcellence.com and the Kansas University Genome Center http://www.kumc.edu have culled the most pertinent information for their targeted users.

Science education standards around the country include lessons designed to help students deal with these new realities. Although most teachers do not have experience from a fully developed course in (bio) ethical decision making, they do have access to lessons developed through cooperative programs between educators and ELSI professionals. Most of these lessons follow a standard format, and usually include some variety of role-play, or decision-making scenario. In all cases, it is imperative that students and teachers have a firm background in the basic principles of genetics.

An excellent framework for teaching social and ethical issues in science has been developed by the Stanford Human Genome Education Project. A complete lesson in making decisions about genetic testing includes the following:

1. Identifying the social or ethical problems confronted by the participants
2. Assessing the factual information available
3. Providing additional information needed to solve the problem
4. Identifying the "stakeholders" in the decision
5. Identifying and considering the values associated with the decision
6. Identifying the options available to the decision makers
7. Determining the criteria for evaluating the options
8. Evaluating the options using the criteria
9. Selecting the best option and considering its consequences
10. Justifying and defending the chosen option
11. Considering the process of decision making and applying it to new cases

Obviously, this list is well beyond the scope of a single lesson. Most teachers and students are relatively familiar with lessons that focus on the main points: Identifying the problem, the stakeholders, their options and possible consequences of their decisions.

A method for acquiring the information necessary to make informed decisions is often the most problematic portion of the lesson. Many teachers assign WebQuests or readings. Unfortunately, students have similar background information. If everyone has been prepared identically, there is no basis for role-play and discussion. To address this, Bio-Lit BINGO© (Adler, 1986), a current events survey, was modified to Cancer-Lit BINGO to be used as a method for students to obtain background information and for teachers to assess their preparation.

This lesson is technically a continuation of the BioHealthLink Lesson, "Testing 1,2,3…Testing for Cancer Causing Genes" "Testing 1,2,3…Testing for Cancer Causing Genes" describes a scenario of a family undergoing genetic tests for mutant BRCA1/2 genes for breast cancer. That lesson explores what is meant by genetic testing and how genetic tests are performed. The story line and pedigrees are used as the basis for this lesson about decision making, and assumes that students are familiar with the basic principles of heredity, genetics and gene testing. It also assumes that students are familiar with basic use of the internet search engines.

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Vocabulary

Ethics - a set of moral values, concepts of what is good and bad, which guides people's behavior

Learning Objectives

Content: *The student(s) will:*

- **Collect** and **organize background data** relating to gene testing and breast cancer and **Create** a "Cancer-Lit BINGO"
- **Identify** individuals and their roles in a mock gene testing scenario and **partcipate** in a debate about gene testing, c**ommunicating** the individual's perspective.

Technology: *The student(s) will:*

- **Understand** the ethical, cultural and societal issues related to technology
- **Use** technology to locate, evaluate, and collect information from a variety of sources
- **Evaluate and select** new information resources

Core Learning Goals:

1.0 Skills and Processes: Students will explain how the nature of science has affected scientific inquiry, technology and the history of science.

1.12.5 Students will analyze appropriate data and form conclusions to apply what has been learned to evaluate a hypothesis.

1.12.6 Students will interpret and communicate findings through speaking, writing and drawing using developmentally appropriate methods including technology tools and telecommunications.

1.12.7 Students will defend a position on a scientific issue and take into account the different types of risks and benefits in formulating a course of action.

1.12.14 Students will explain that science and technology have strongly influenced the course of history and cite how human inventiveness has brought new risks as well as improvements to human existence.

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Lesson Assessment

Content:
"Cancer-Lit BINGO" scoring paradigm
"Video Activity, A Question of Genes"
"Assessment: Whose Right, Who's Right"
"Final Asssessment, From My Perspective…"

Technology:
"Cancer-Lit BINGO" scoring paradigm

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Materials Needed

(Per student)

- "Cancer-Lit BINGO" directions and grid
- "Video Activity, A Question of Genes" worksheet
- "Assessment: "Whose Right, Who's Right?"
- "Final Assessment: From My Perspective…"
- 5" x 8" cards
- writing instrument
- Lesson: "Testing 1,2,3…." "Pedigree Analysis", "Assessment #1", "Family Pedigree".

(Per class)
- Computers with Internet access
- VCR and monitor

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Procedures

This lesson uses role-playing and discussion. Students may work in small groups if their roles would overlap.

Prior to the actual role playing session, students will need access to the Internet. The acquisition of background information could be done as a class assignment in a computer lab or media center or as homework if students have access to computers.

No special accommodations are required.

Although the lesson describes 5 days of activities, by scheduling the "Cancer-Lit BINGO" as homework, the time could be compressed.

Day 1: Set the Stage

The lesson is designed to be a continuation of the lesson, "Testing 1,2,3….Testing for Cancer Causing Genes". The same scenario will be used and the lesson will build upon data obtained from the prior lesson. However, the "Cancer-Lit BINGO" can be used for any lesson that requires students to have background information. The scenarios can be changed to meet the particular needs of the class.

Students will watch the video, "A Question of Genes-Inherited Risks" part 6. The video segment is approximately 15 minutes. The segment should be viewed in its entirety because of the intense personal nature of the story.

PRE-VIEWING ACTIVITIES: Teacher will describe the video. In this episode, two sisters from a family with a tragic history of death from breast cancer and associated cancers decide to take part in an NIH study for the BRCA 1 gene marker. Women who test positive for the mutant gene have a 55 to 85% chance of developing breast cancer by age 70. The video highlights some of the personal issues the women faced when deciding to be tested and when they discovered their results.

FOCUS FOR VIEWING*:* The focus for viewing is a specific responsibility or task(s) students are responsible for during or after watching the video, to focus and engage the students' viewing attention. As students watch the video, they will complete "Video Activity: A Question of Genes which will guide them to identify individuals who will be impacted by the decision to be genetically tested and pose questions and concerns they or others may have about the process.

After viewing the video, the teacher should "think-pair-share" the students' information. Each student should take a minute to think of the most important question/concern and the individual s/he most relates to. Pair with another classmate and compare notes. Share with the class. In this way, roles and concerns/questions are aired before the entire class.

Stakeholder roles will be identified. As homework between day 1 and 2, assign students to study the pedigree from "Testing 1,2,3…Testing for Cancer Causing Genes" Identify those members of the pedigree who have a legitimate stake in gene testing. As a minimum, should be #15, 16, 17, 18, 22, 23, 24. #16 (Mary) is deciding whether to take the test. Also to be decided is whether # 22, 23, 24. Each individual adds another dimension and concern about genetic testing. In addition to

the roles identified in the family scenario, some additional roles might be: family physician, psychiatrist, genetic counselor, research scientists, businessman making test reagents, lab technician, family clergy, close friend, insurance company (Who pays for the tests?), employers (Who pays for health benefits?), etc. until every student or pair of students has a role. Students will be assigned roles as members of the scenario.

As part of this assignment, each student will write a brief paragraph describing the particular interest in genetic testing and the position toward genetic testing of the individual s/he represents.

Day 2&3: Acquiring Background with Cancer-Lit BINGO

These two days could be eliminated by assigning the BINGO as homework.

Assign "Cancer-Lit BINGO". "Cancer-Lit BINGO" is designed for students to acquire both broad and specific background information on a topic. Students survey sources of information about topics relating to breast cancer. As students locate sources of information they write a ten-sentence summary report on a 5"x8" card, and mark the appropriate box on the BINGO grid. The grid is designed with topics relating to breast cancer along the horizontal axis, and sources of information about breast cancer down the vertical axis Like the BINGO game, the goal is to block-out a horizontal row, a vertical column and/or a diagonal. Students acquire broad knowledge of a subject by completing a horizontal BINGO and deep knowledge of a particular aspect of the subject when they complete a vertical BINGO

All students will do a diagonal or horizontal row and students will be assigned a particular vertical column based on their role-play assignment. For example, the student role-playing the physician would need to complete the vertical column titled, "Symptoms of Breast Cancer" and any horizontal or diagonal.

The procedures for completing the BINGO are deceptively simple. It is very easy to find sources of information, but not to make the BINGO grid. I have included a scoring paradigm for the cards. If there is time, students can score each others' cards and gain more background information.

Day 4:

Students will role-play the decisions to take the test and what to do with the information gained.

I have listed some of the questions the teacher should ask to open the discussion and move it along. The questions are also listed in the worksheet, "Assessment: Whose Right, Who's Right?" This might be assigned as an additional exercise.

Why would someone want to take the test? Very often the answer is basically "to have control over my life". Is this a valid reason? What are the consequences of the knowledge to oneself and others? Can negative test results guarantee a cancer-free future? (no) Does a positive test guarantee cancer? (no). Can a negative result give a false sense of security? (yes) What feelings might someone have once they discovered their genetic state? (isolation). How would someone feel if they were spared the mutation but a close relative (#23,24) was not? What should a young woman who tested positive (#24) do as prophylaxis? What should an older woman (#16) do? Should a minor child (#22) be tested? In this family's situation, which is the worse diagnosis, a positive or negative test?

At the end of the debate, as a homework assignment students will complete the "Final Assessment, From My Perspective".

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Enrichment Options

Community Connection:
The Ladies Home Journal supports an excellent web site at http://www.lhj.com/health/cancer/knowbrst.htm describing breast self examination for lumps and abnormalities that may indicate cancer. Students will assemble a selection of web sites describing breast self-examination and mammography and prepare a flier with this information for the female members of their families.

Teachers may contact the professional society for genetic counselors. Prepare a brochure for students in your class about the career.

Guest Speaker:
Almost every hospital or health care facility can provide speakers to present about breast cancer, self-examination, regular mammograms, and current therapies.

One of the first indications that a woman may have cancer is by finding a lump during a personal breast exam. Most community health departments support outreach programs to teach women how to perform these self examinations. Regular mammograms are the second line of defense in diagnosing breast cancer at an early stage. Many women do not know how mammograms are done and what they show.

Contact the local health department and set up a program to teach women self-examination and to inform about regularly scheduled mammograms.

Interdisciplinary Extensions:
- **Language Arts**

Working with cancer patients is a difficult and rewarding task. Many health care professionals were drawn to their profession because of an early, personal exposure to cancer. Interview health care professionals to discover why they chose the career they did.

New York University supports an Internet site called "Medical Humanities". At http://www.endeavor.med.nyu.edu/lit-me, a list of films and literature about cancer can be found. One particularly powerful item is a book, containing a selection of poems written by women about breast cancer. Lifshitz, Leatrice, Her Soul Beneath the Bone: Women's Poetry on Breast Cancer, University of Illinois Press, 1988. Students can write their own poems about their feelings about breast cancer.

- **Fine Arts**

Prepare a storyboard showing the biochemical pathways to cancer and the changes in cells as they become cancerous.

Many cancer patients are advised to express their emotions in art or music. The Internet site, "Confronting Cancer Through Art", http://www.upenn.edu/ARG/CCTA has an on-line gallery. Assemble a gallery showing some of the artwork produced by cancer patients. Your local hospital can also help you find items.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Lesli Adler & Angelique Bosse

Name _____ Class _____ Date _____

Cancer-Lit BINGO

GOAL: To utilize sources of scientific information in researching a topic and to provide a structured approach to researching a topic

VALUE: Worth 1 quiz grade

GRADING: Accuracy of review, Editing, Proper gridding, Following directions

DUE DATES:.

PROCEDURE:

1. Scan sources of information; **FEATURE ARTICLES or ITEMS** only
2. Select sources and topics to complete two 5 line "BINGOs" (one vertical and one horizontal or diagonal)
3. Write summary of each item on a 5" x 8" card; **printed or typed**
4. Copy of the article (item) must accompany the review; Articles & reviews will be submitted in 2 pocket folder

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Name:

title of article

author

source

date of source

source / topic designation (i.e. B,5)

summary and analysis (approx 10 sentences)

_____

****

Groups

-1-	-2-	-3-	-4-	-5-Organizations/Support
Demographics (family members)	Causes/Risks (Lay community)	Symptoms/ Treatment/Therapy (medical professions)	Biological Damage (research professionals)	

********** -A- CANCER WEB SITES SITES: http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html

**********-B- NEWSPAPER (Washington Post, N.Y. Times, Wall Street Journal, - including weekly health sections, etc)

********** -C-WEEKLY NEWS MAGAZINE (Newsweek, Time, U.S. News and World Report, N.Y. Times Sunday Magazine section, etc)

********** -D- SCIENCE MAGAZINE (Scientific American, Science News, Discover, etc)

********** -E- TV-RADIO-LECTURE (PBS, Discovery Channel, Science Friday on National Public Radio, etc)

********** -F- BUSINESS MAGAZINE (Forbes, Business Week, etc)

********** -G- GENERAL INTEREST MAGAZINE (any general publication)

********** -H- EDITORIAL (Television or radio commentary, newspaper or magazine)

**********-I- ON LINE DIALOG ("Ask a scientist", etc)

****

The term "magazine" or "newspaper" also refers to on-line versions as well as print copy. Almost all major publications have free access on-line. Most students are very capable of finding these items.

Cancer-Lit BINGO Scoring Paradigm

Score each item (5" x 8"card) up to 9 points from the following categories: Proper gridding: (3 points)

- the correct number of articles
- the appropriate categories (proper source/topic designation)
- copy of article submitted with the review

2. Proper identifying information for the article: (3 points)

- author & title of the article
- from an appropriate source
- appropriate length and difficulty of articles

3. Proper editing and good writing practices: (3 points)

- readability (legibility)
- editing
- original writing

Name _____ Class _____ Date _____

Video Activity

Purpose: to help students identify individuals who have a stake in genetic testing and identify their questions and concerns about genetic testing.

Directions: Fold this page in half lengthwise. As you watch the video, in the left column identify individuals who have a stake in the decision to be tested for mutant genes. In the right column pose the questions and concerns any individual may have. You may be able to connect individuals to questions & concerns by drawing lines from the individual to the question/concern. Individuals may have multiple lines to questions/concerns, and questions/concerns may have multiple lines to individuals.

Name _____ Class _____ Date _____

Whose Right? Who's Right?

Purpose: to prepare students to participate in the role-play activity by posing questions an individual may need to consider and identifying information so one may make informed decisions about gene testing.

Directions: As you prepare to participate in the role-play activity, briefly list some points to support your views about the following questions:

1. Why would someone want to take the test?
2. Is taking the test "to have control over my life" a valid reason for taking the test?
3. What are the consequences of the knowledge to oneself and others?
4. Can negative test results guarantee a cancer-free future?
5. Does a positive test guarantee cancer?
6. Can a negative result give a false sense of security?
7. What feelings might someone have once they discovered their genetic state?
8. How would someone feel if they were spared the mutation but a close relative (#23,24) was not?
9. What should a young woman who tested positive (#24) do as prophylaxis?
10. What should an older woman (#16) do?
11. Should a minor child (#22) be tested?
12. In this family's situation, which is the worse diagnosis, a positive or negative test?

Name _____ Class _____ Date _____

Final Assessment - From My Perspective

Now that you have participated in the debate, you are ready to make your own decision about whether or not a family member should have the test for the mutant breast cancer gene.

1. Select one of the primary individuals who might have been tests (#15, 16, 22, 23, 24) and explain if you would advise them to be tested, and justify your answer.

2. Several other individuals in the extended pedigree might have legitimate interests in genetic testing. Select one of these individuals and explain that person's position.

Could There Be Cancer In My Classroom?
Part I:
Types, Causes, and Treatments of Childhood Cancers

Time Commitment: Three to Five 55-minute Class Periods
Grade Levels: 6-9

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Overview

This unit is designed to introduce the different types of cancers that affect young people, their causes, and treatments currently available for some of those cancers.

The first lesson in this unit is designed to give students an introduction to cancer. In this lesson students use video and the Internet to gather some background information about cells and cancer. Students will be making a model of the cell and learning about how cancer cells are different from normal cells. In the second part of the unit students work in research

teams as they review a case study of a fictional young person who exhibits symptoms that the students will try and identify. Through the use of online and paper resources, students will try and discover the type of cancer the fictional person has, the possible causes and the possible treatments.

Teaming in this activity can be done in a couple of different ways. You may want each member of the team to take on a different role (that of researcher on causes, researcher on treatments and researcher on types of cancers) or you may want all researchers to work with other researchers of their kind and then go back to solve the original question, as in a jigsaw technique.

Expected products from this lesson:
At the end of this unit your students will have learned a great deal about the types, causes and treatments of common childhood cancers. Students will gain a basic understanding of the cell, the building block of life. Students will be making models of a cell and learning what a healthy cell looks like and how healthy cells differ from cancerous cells. Students also use the Internet to research the different types of cancers.

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Instructional Technology Resources

Internet Sites:

BioHealth Link http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html
This is a search engine designed especially for young people. It is a "kids" version of the Yahoo search engine.

Ask Jeeves for Kids http://www.ajkids.com
This is another search engine designed for use by young people. This search engine allows students to type in questions and receive answers. This site is a little easier to use for Web beginners and has a lot of good content.

Brain Pop http://www.brainpop.com
This site uses flash technology to show people short animated movies on a variety of different topics. Students will be using this site to watch two animated videos, one on cells and one on cancer.

Your Cancer Health Risks http://www.yourcancerrisk.harvard.edu/index.htm
This site was created by the Harvard Center for Cancer Prevention. It provides strong background information for both students and teachers. You can take a "risk assessment" if you want. This assessment is really geared towards adults.

Cells Are Us http://www.icnet.uk/kids/cellsrus/cellsrus.html
Produced by the Imperial Cancer Research Fund, this site offers some really good, easy to understand information about cancer and about cell growth.

About Cancer http://cyberdiet.com/modules/ca/outline.html About Cancer - Includes information concerning protective food practices and supportive diets

Educational Software:

- ***Inspiration***

Inspiration Software, Inc.
7412 SW Beaverton Hillsdale Hwy, Suite 102,
Portland, OR 97225-2167
http://www.inspiration.com

- ***The Ultimate Human Body***

DK Multimedia
95 Madison Ave.
New York City, NY 10016
(800) 356-6575
http://www.dk.com

- Microsoft ***PowerPoint***

http://www.microsoft.com/office/powerpoint/default.htm

Video:
A Journey Through the Cell Series
Channel One Video from March 8, 2000.
http://www.teachone.com

Other Technology:
- Overhead Projector

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Teacher/Student Background Information

Cancer is one of the leading causes of death for young people. In the general media, students are exposed to information on lung cancer and breast cancer,

neither of which affects young people in great numbers. Less heard about are those cancers that might affect young people.

Abnormal growth and reproduction of cells cause Cancer. Cancer cells grow and divide too quickly. The process usually starts when something damages the genetic structure (DNA) inside the cells. Instead of dying in an orderly way, cancer cells keep growing, lump together and form an extra mass of tissue. This mass is called a malignant tumor. Malignant tumors are those that spread cancer cells from the original organs to other organs in the body. As a malignant tumor grows, it damages nearby tissue.

There are three main types of cancers that affect young people. They are lukemia, lymphoma and brain cancer.
There are both genetic and environmental causes for cancer.

Treatment for cancers has changed drastically in the past 20 years. Currently there are different levels of treatment for different types of cancer.

The different types of cancers affect different body systems.

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Vocabulary

Carcinogen--A substance or agent that encourages the growth of cancer cells.
Carcinoma--A cancer which is a malignant growth of epithelial tissue or the tissue that forms the skin or blood vessels in an organism (e.g., the surface cells of the skin and the inside of the blood vessels).
Sarcoma--A cancer which is the malignant growth of connective tissue.
Leukemia--Cancer of the blood-forming tissues.
Malignant--Describes an abnormal growth which can often spread to other areas and may eventually cause death, e.g. a cancer.
Tumor--A lump in the body, without inflammation, it is caused by an abnormal growth of cells. It may be due to the presence of an infectious organism or it may occur spontaneously. In the latter case it can be benign or malignant.
Benign--Describes an abnormal growth which does not spread.
Cancer--The growth of abnormal cells in epithelial , or in connective tissue. The growth increases with time and eventually may cause death.
Biopsy The removal of bits of tissue from the body for diagnostic examination.
Bone marrow -- The inner, spongy tissue of bones where red blood cells and white blood cells are produced.
Chemotherapy -- The use of drugs to treat cancer.
Chromosomes -- Threadlike bodies found in the nucleus, or center part, of a cell that carry the information of heredity.

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Learning Objectives

- **Describe** the structure of the cell.
- **List** steps in cell division.
- **Differentiate** between normal cell division and cancer cell division.
- **Gather information** about cells, cell structure and cancer from the Internet.
- **Construct** a model of a cell.
- **Collect** information on the different types of cancers most likely to affect young people.
- **Identify** body systems affected by different types of cancers.
- **Identify** general causes for different types of cancers.
- **Identify** and compare different treatments available for childhood cancers.

Technology:
The student(s) will:

- **Navigate** the Web to a variety of Web sites related to cancer and human health.
- Use the Internet to **gather** information.
- Use a variety of different search tools to **locate** information.
- **Create** a ***PowerPoint*** presentation on cancer causes, treatment and effects on the human body.

MSPAP OUTCOMES:
Concepts of Science
Students will demonstrate their acquisition and integration of major concepts and unifying themes from the life, physical, and earth/space sciences.

The human body is a complex organism composed of interrelated tissues, organs, and systems.

Attitudes
Students will demonstrate positive attitudes toward science and its relevance to the individual, society, and the environment and demonstrate confidence in their ability to practice science.

Processes of Science
Students will demonstrate the ability to employ the language, instruments, methods, and materials of science for collecting, organizing, interpreting, and communicating information.

Applications of Science
Students will demonstrate the ability to apply science in solving problems and making personal decisions about issues affecting the individual, society and the environment

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Lesson Assessment

For the first section of this lesson, students are asked to complete two Internet searches. Teachers should grade these both for content and effort. There are questions that require students to synthesize information presented on a Web site. Students should be reminded that they are to cite specific information and data from the Web sites. As for assessing the model, students will construct, a scoring rubric is provided at the end of this lesson. The worksheet entitled "Cell Parts" can either be used as a review tool or as a quiz after students complete the first activity.

For the second lesson, each student researcher will need to complete an information worksheet as they complete their research. Each team will need to complete a **recommendation** worksheet. At the end of the activity, student teams will need to construct a ***PowerPoint*** presentation, which should be graded. A scoring rubric for this activity has been included at the end of the second lesson. It is suggested that students view the scoring rubric before beginning the activity.

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Materials Needed

(Per Student)
- Zip lock sandwich sized bags
- 2 cups of corn syrup
- Small amounts of the following:
- colored sprinkles
- spiral noodles
- tic-tac mints
- scotch or masking tape
- Drinking straw cut in to 2 – 3 inch pieces
- Gummy Bears
- Malted Milk Balls
- Colored construction paper
- "Pre-assessment" sheet
- "Cell Parts Review" Worksheet
- "A Question Of Cancer – Cells On The Web" Worksheet
- "Cancer in My Classroom – From Cells to Cancer" Worksheet

(Per Team)
- Internet connected computer

(Per Class)
- Internet ready computer
- VCR/TV
- Overhead of "Cancer in My Classroom General Information" Worksheet

- Overhead Projector/Overhead Pens

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Procedures

Students will gather information from the Internet and will build models in an effort to introduce them to the concepts of cell structure and cancer growth. This general information allows students to prepare as a whole class for the second part of this unit.

Depending on your Internet set up and the experience your students have using and finding information on the Web, you will need to modify the Internet activities accordingly. Management with the model building activity will need to be closely monitored. You may want students to work in small (no more then three) teams to reduce the amount of clean up required.

Day 1

Set-up Directions:
Provide copies of the pre-assessment. These have been created two to a sheet for less duplication, but if you have students with special vision needs or who need more room to write responses, you might want to enlarge the sheets.

Also provide copies of the first Internet worksheet. It is recommended that you preview the Web sites before you send your students on their way. The Web is constantly changing and although every effort has been made to use "permanent" sites, the Internet is never permanent. If you do not have a computer lab that can accommodate students individually or in small groups, you may want to video tape the Web sites and lead students through the Web activities as a whole class. Also since the ***BrainPop*** Web site uses in-line video you will need to make sure that all computers have the necessary plug-ins preloaded, on each machine.

Teacher Presentation & Motivation:
Ask students if they know anyone with cancer. Allow students a chance to share their experiences. Discuss with students what they know about how people get cancer and what they think of when they hear the word cancer. Students will most likely describe older people and may mention cigarettes. Use the overhead "Cancer in My Classroom" as a way to brainstorm information about cancer. Have student's copy some of the information into their notebooks.

Tell students that you are beginning a close look at cancer and before you begin to learn you want them to take a pre-assessment. Pass out the pre-assessment worksheet and give students time to complete it. Students should take no longer then 10 minutes to do this. Ask students to pass their sheet to a partner, then review answers with students. This pre-assessment is designed to get students

thinking about what they know and don't know about cancer.

Tell students that cancer is a general term used to describe a group of cells that are dividing in a way that is not "normal." Tell them that they are going to be using the Internet to gather some general information on cells and cell structures. Because cancer grows at the cell level, it is important to get an understanding of cells, before we discuss cancer.

Pass out "Cells On The Web" Worksheet.. Depending on your students' Internet skills, you may need to guide them through this activity. As you know, Web addresses change frequently so it is strongly suggested you check each link to make sure they are all still active. Also, since one of the Web sites students will visit uses ShockWave technology, you may need to get the plug-in and install it on your computers.

Once students have completed the Web search, review the information with them. Students do not need to memorize each of the organelles, but they should be able to describe the basic function of each cell part. The final question on the search is designed to get students thinking about the function of each part AND it is designed to get students ready for the next activity.

Day 2

Set-up Directions:
Setup for this activity is a must. Students will be building models of cells using a number of different food materials. Making sure that you have enough materials for each student and that the materials are easily accessible is a must. If you use small bowls and place the materials in the bowls before the class starts, the activity will run more smoothly. Depending on the type of students you have, you may want to wait to set out the edible materials until after students have sat down and are ready. Basic instructions have been provided. If you feel it necessary, you might want to reproduce these for your students and have a set of instructions for each person.

Additional set up you might want to consider is the covering of tables in your class with Newspaper (this makes for easier cleanup).

Teacher Presentation & Motivation:
Begin by reviewing the basic cell structure students learned about in day 1 of the activity. You might want to have an over head sheet up so you can list specific organelles and their functions as students review them.

Tell students that they are going to be constructing models of cells and will use common items to represent the different parts. Ask students to review the function of the different cell parts and to look at the different items you have provided. Students should discuss which items should represent each of the parts and why. Orally review this information with students.

Remind students NOT to eat the items (You may motivate them to comply with this by bringing in extra material to eat after students are done with the model building).

Activity:
Have students open their Zip-lock bags and measure and pour in the corn syrup. This represents the **cytoplasm**.
Have students take a single malted milk ball and place it in the corn syrup (this represents the **nucleus**).
Have students place three or four tic-tacs in the corn syrup to represent the **Mitochondria.**
Have students place the short segments of drinking straws in the syrup to represent the **endoplasmic reticulum**.
Have students place a few of the gummy bears in the syrup to represent the **vacuoles.**
Have students place the wagon wheels in the syrup to represent the **lysosomes.**
Have students completely close and seal the bags (You might want to go around and double check this step).
Ask students to roll down the top of the bag and tape it to the main part of the bag.
Have students mount the bags (using tape) to the pieces of construction paper.
Have them write descriptions of the different cell parts on the cardboard.

Day 3: Cells to Cancer Cells

Set-up Directions:
This activity uses the Web site ***BrainPop.com*** and the videos found on the Web site about cancer. You can either have students sitting at computers and have them control the Web, or you can do this on a display for the whole classroom depending on your technology resources. You should read through the provided script when you are actually at the Web site so you can set your pacing. Note: When you pause the ***BrainPop*** video and then hit play, the video rewinds itself a few seconds. This can be helpful for students who might not have caught all of the information the first time. You should also preview the quiz on the ***BrainPop*** site.

Teacher Presentation & Motivation:
In this activity students get a basic understanding of what cancer is and how cancer cells are formed.

Tell students that they have learned about healthy cells and cell structure. Tell them that cancer forms when cells begin to reproduce to rapidly and then do not die off as they are supposed to. Review with students the information about cells and cell structure and function.

Ask students to take out a sheet of paper and a pen or pencil. Tell them that you are going to be watching a video and that you will be pausing the video to make sure they have recorded the information they will need. Bring the Web site up and begin.

Activity:
SCRIPT:
Say, "We have already done a Web search to find out information on cells and cell structure. Who can describe one thing they remember from the Web search?"

Allow students a chance to answer.

Say, "Today we are going to go back to the Web and use the ***BrainPop*** Web site to learn how cancer grows. During this lesson, I will be pausing the ***BrainPop*** video and asking you to record specific information. Make sure that you are paying close attention as we go through this activity."

Get students viewing the ***BrainPop*** Web site and click on the movie about Cancer.

Say, "Before we begin to watch the movie, I want to tell you that you are going to see Tim and Moby explain some basic information about cancer. How many of you know someone who has cancer?"

Allow students a chance to answer.

Say, "As we watch this first segment of video I want you to record what happens to cells to make them cancerous."

PLAY VIDEO

PAUSE when Tim says, "To change its reproductive speed."

Say, "Who was able to record what cancer is?"

Allow students a chance to answer. Review with them the steps in mitosis from the previous Web search. Also review with students the information about how one cell divides to become two and so on. Tell students, "Cells, just like all living things have a life cycle. Cells are born, do a job and die. What part of the cell do you think is responsible for making sure that the cell carries out its functions?"

Allow students a chance to answer.

Say, "Right, the nucleus is responsible for telling the cell what to do and when to do it."

Say, "If you were to write a definition of a carcinogen, what might you say?"

Allow students a chance to answer.

Say, "In the next section of the video we are going to see what happens to all of the cells that are reproducing too fast. You are responsible for recording what happens to those cells. You are also responsible for recording a definition for the term TUMOR."

PLAY VIDEO

PAUSE after Tim gives the definition for **tumor.**

Say, "So, when cells grow too fast and have nowhere to go we call that what?"

Allow students a chance to answer.

Say, "We are going to hear two different terms that doctors use to describe tumors: Benign and malignant. You are responsible for recording the definitions for both of these terms."

PLAY VIDEO

PAUSE when Tim says, "This spreading is called Metastasis."

Say, "Who can describe the difference between benign and malignant tumors?"

Allow students a chance to answer.

Say, "We heard about why malignant tumors are so troublesome. Who can describe that for the class?"

Allow students a chance to answer.

Say, "Normally when your body gets invaded by a germ, what keeps you from getting sick?"

Allow students a chance to answer.

Say, "Your white blood cells are the infection fighters your body relies on to keep you from getting sick. We are going to hear why cancer is so hard to beat. You are responsible for recording what makes cancer different from other diseases."

PLAY VIDEO

PAUSE when Tim says, "Hey, don't give up. Doctors do have ways for detecting and treating cancers."

Review information with students.

Say, "What happens when you get the flu?"

Allow students a chance to share symptoms. Accept all correct answers.

Say, "Those symptoms are signs that your body is fighting off the infection. A fever for example is your body's way of trying to heat itself up to kill the germs that are making you sick. Since some cancers don't trigger your body's immune system, how can you tell if you have cancer? Tim is about to explain this. You are

responsible for recording how doctors find and treat cancer."

PLAY

STOP when Tim says, "New and more effective treatments."

Review information with students.

Say, "With the information you recorded I would like you to take the quiz." ***BrainPop*** offers a quiz you can take. To access the quiz, click the refresh button (or reload) on your Web browser. This will reload the video, and also allow you to click on BACK TO THE QUIZ. Choose this option and run through the quiz with your students. Have them

record their answers and poll the class before making a choice, or you can reproduce the questions from the quiz and use it as one of the assessments.

Day 4

Set-up Directions:
Make sure that you have enough copies of the Worksheet "Cancer In My Classroom – From Cells To Cancer" (one for each student) and that the Web sites listed are still active. You should also provide colored pencils for students. At the end of the Web search students are asked to make drawings of normal and cancerous cells. Providing colored pencils allows students to add detail to their drawings.

Teacher Presentation & Motivation:
For a drill or warm up question ask students, "What are two things you remember from the video we viewed and what is one thing you learned?"

Allow students a chance to answer. You might want to allow students to interview each other and report back the information they recorded. You should make a list of the information they learned on the overhead or chalk board.

Tell students that they received general information about cancer from Tim and Moby, and today they are going to go back to the Internet to get more in-depth information.

Say, "We are going to do a short Web search to get some background on a few of the different types of cancers that affect young people."

Have students log on to the Web and lead them to the first Web site.

Activity:
Pass out the Worksheet "Cancer in My Classroom – From Cells To Cancer" to your students and have them complete the activity sheet. Students might need help recording detailed information and should be reminded to use examples. You might want to stop periodically to make sure that all students are recording the correct

information.

When all students have completed the Web search review all information as a whole class.

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Enrichment Options

Community Connection:
There are many opportunities for students to take what they have learned in this unit and reach out. Where there is a local Ronald McDonald House, students should be encouraged to contact them (or other places where children and families who are affected by cancer stay) to see what can be done. Many hospitals would gladly accept donations of video games and other child-centered activities. Students in some schools have "toy drives" where they encourage students to bring in new toys and arrange delivery to children's hospitals. There may also be older cancer patients who could be visited by your students – this can become a community service learning project.

Guest Speakers:
Students will have a lot of questions about cancer throughout this unit. If there is a way to bring in a cancer survivor to discuss their experiences this is an excellent opportunity to bring a face to cancer.

Arrange for a Doctor to come and discuss treatment.

Interdisciplinary Extensions:

- **Language Arts**

Have students research what books are available that deal with cancer from a kids perspective. Ask students to read and review a book. Students might want to put up a cancer book display in the office area of the school.

Students may also want to write letters to children's cancer wards. Encourage them to write open-ended letters. Kids staying in a hospital would be glad to get mail from someone their own age.

- **Mathematics**

Students can do some statistical comparisons to the information presented with their school and town population.

- **Technology**

Students who want to go farther with the Web information should be encouraged to design Web searches of their own that they can present to other classes. Students should be encouraged to create a***Filamentality*** Web site.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Doug Fireside & Felicity Ross

Name _____ Class _____ Date _____

"A Question of Cancer" Pre Assessment

How much do you already know? See how many you get correct:

1. Of first, second or third, which place is cancer a killer of adults? _____
2. Of first, second or third, which place is cancer as a killer of kids? _____
3. How many types of cancer are there? _____
4. What is the number one type of cancer that people under 18 get? _____
5. Of 5%, 20%, 50% or 80%, which number represents the survival rate for young people diagnosed with leukemia? _____
6. You can catch cancer from someone who has it (true or false). _____
7. If your parents have cancer you are more likely to get cancer (true or false). _____
8. Cancer affects cells (true or false). _____
9. Over a million people will be diagnosed with cancer this year (true or false). _____
10. Some cancer is caused by too much exercise, true or false? _____
11. If you chew tobacco instead of smoking it you won't get cancer (true or false). _____
12. What you eat is a factor in getting some types of cancers (true or false). _____
13. Men can get breast cancer. _____
14. Getting lots of sun can reduce your risk of skin cancer. _____

Name _____ Class _____ Date _____

"A Question of Cancer" Pre Assessment

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14. Getting lots of sun can reduce your risk of skin cancer. _____

Name _____ Class _____ Date _____

Cancer in My Classroom - From Cells to Cancer

By now you should have a basic understanding of what cancer is and how it affects cell growth. Most of the time when we hear about cancer we think of older people who get cancer from something they did, like smoking or being out in the sun too long. We are going to search for some information about some of the cancers that affect young people.

Let's start with the ***National Children's Cancer Foundation*** just to get some basic information. Go to http://www.nccf.org/nccf/cancer/Cncrinfo.htm and read the short paragraph there to answer the following questions:

- According to the Web page, how common is childhood cancer?

  _____

  _____

- At the top of the page, under the words **About Childhood Cancer**, click on *some facts about childhood cancer*. Read through the chart. List one piece of good news and one piece of bad news:

  _____

  _____

- Go back to the top of the page and click on *Childhood Cancer is Different*. Read through this information. List things that are unique to cancers that affect young people:

  _____

  _____

- According to the graph, what are the two most common types of childhood cancers?

  _____

  _____

- Read the section of leukemia towards the bottom of the page. Describe, in your own words, what happens to the body when someone has leukemia:

  _____

  _____

- Let's see what information we can find out about leukemia. Let's go to ***the Trigen Oncology Associates*** Web page http://www.tirgan.com/leukemia.htm to answer the following questions:

- What are the four types of leukemias?
  1. _____
  2. _____
  3. _____

4. _____

- According to what you have read, what is the difference between acute and chronic?

  _____

  _____

  _____

- Choose one of these types of leukemias and list some general facts and three of the symptoms of that type of leukemia:

  _____

  _____

  _____

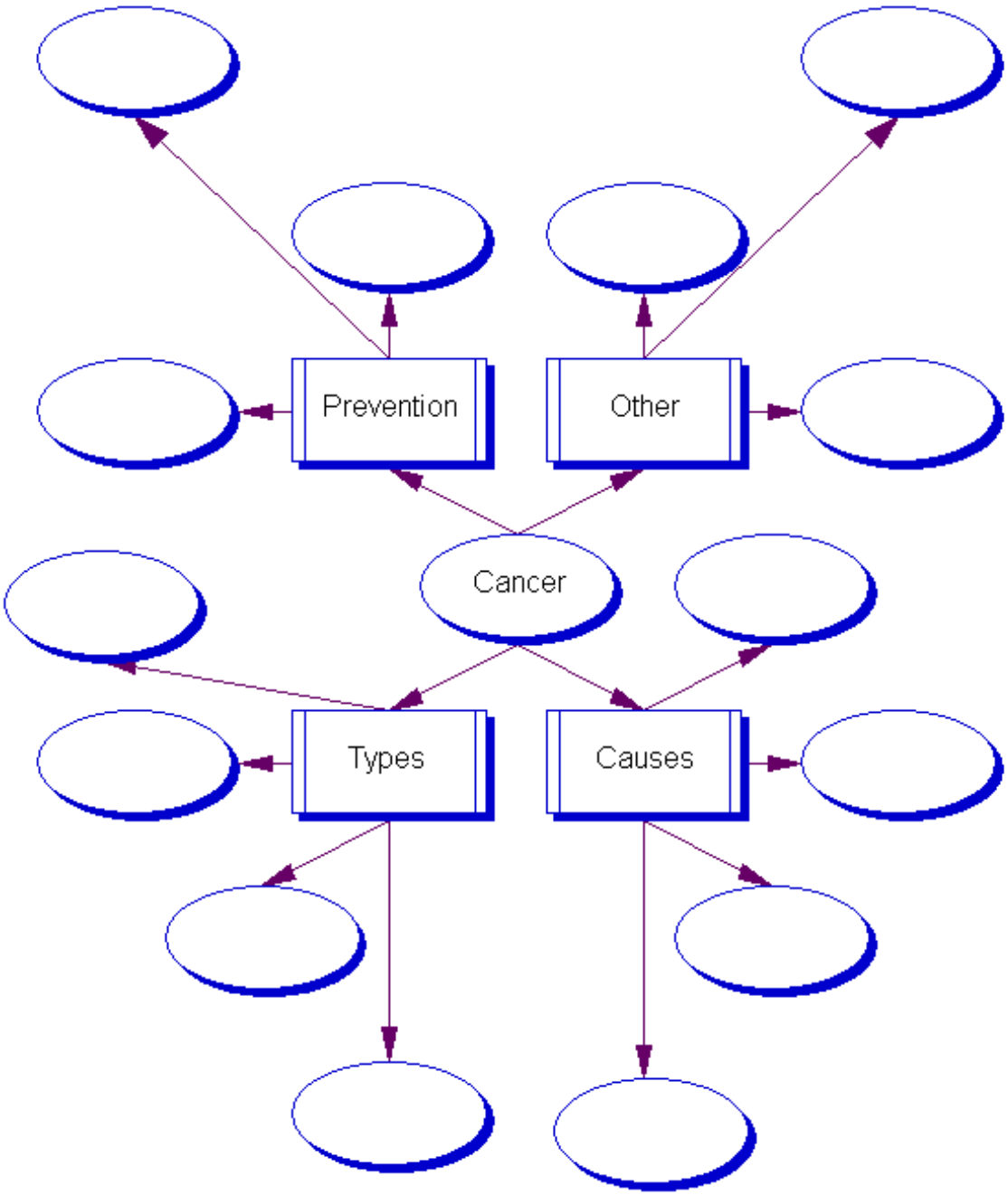
- The term *Prognosis* means what chances do treatments have to make people better. According to this Web site, what is the prognosis for the type of cancer you are investigating?

  _____

  _____

- The last thing we are going to do is draw "normal" blood cells and leukemic blood cells. Click the BACK button on your Web browser. Click on the link for leukemic cells. Draw 5 samples of those cells in box 1. When you are done, go to ***Cells Alive!*** http://www.cellsalive.com/ and draw 5 normal blood cells in box 2. Under the pictures, write a short description of the difference you can observe.

Cancer In My Classroom



Name _____ Class _____ Date _____

A Question of Cancer - Cells On The Web

We are going to use the Internet to gather information about cells, their parts and functions. We are going to use a few different search engines to locate information

1. Let's start out at ***Ask Jeeves for Kids*** http://www.ajkids.com. What are two possible questions we might ask?

   _____

   _____

2. Try typing "What do cells do?" without the quote marks. How many responses did we find at ***Education World***?

   _____

3. The first choice should be "Where can I see an animated movie about cells?" Click on the ASK button at http://www.brainpop.com. Watch the animated movie about cells. Use the information to answer the following questions:

   a) According to the video, what is the definition of a tissue?
   _____

   _____

   b) Here is a list of the other parts of the cell described in the video. Next to each part write a short description of the part.

   Nucleus: _____

   Cytoplasm:_____

   Cell membrane: _____

   Mitochondria: _____

   c) How big are cells? _____

   d) How many cells do you have? _____

   e) What is the process of cell division called? _____

   f) Describe what happens during mitosis: _____

   _____

   _____

   _____

4. We have learned about some of the parts of cells, but there are others. Let's try another Web site: http://esg-www.mit.edu:8001/bio/cb/org/organelles.html This site lists some of the other **Organelles** found in the cell. Read the descriptions and write a summary of the parts listed:

   Ribosomes:_____

   _____

   _____

   _____

   Chloroplasts:_____

   _____

   _____

   _____

   ER:_____

   _____

   _____

   _____

   Gogli apparatus:_____

   _____

   _____

   _____

   Lysosomes:_____

   _____

   _____

   _____

5. Draw a cell and label the parts:

6. If you were going to build a model of a cell out of ingredients you might find in a kitchen, what would you use for each part? Make a list of the parts, describe what you might use in your model and describe why you made the choice you did:

   - _____
   - _____
   - _____

- _____
- _____
- _____
- _____

Could There Be Cancer in My Classroom? Part II: Researching & Determining a Childhood Cancer

Time Commitment: Three to Five 55-Minute Class Periods
Grades 6-8

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Overview

In this second part of the "Could There Be Cancer In My Classroom?" unit, students are introduced to Tanya, a fictitious student who lives in Maryland and has cancer. Students are turned into doctors who must determine what type of cancer Tanya has and what the appropriate treatment would be. Students work in small research teams and use video and the Internet to gather information. Student teams then come back together to share what they have found and come up with one recommendation based on the information they have gathered. At the

end of the investigation, student teams create a ***PowerPoint*** presentation about their investigation and recommendations, which can be shared with other students and with parents.

The first lesson in this unit is designed to introduce students to Tanya. They meet her on a Web site and can read about her and her symptoms. Students take notes and then break into teams to begin their research.

During the second day, students work on their assigned research. Each student in a research team is given some specific information to gather. One group uses a ***Newton's Apple*** video that is teacher directed while the other two groups use the Web to gather information.

Teaming in this activity can be done in a couple of different ways. You may want each member of the team to take on a different role (that of researcher on causes, researcher on treatments, and researcher on types of cancers) or you may want all researchers to work with other researchers of their kind and then go back to solve the original question.

Expected products from this lesson:
At the end of this unit students will have learned a great deal about the types, causes and treatments of common childhood cancers. Students will each have completed an individual worksheet focusing on the topic researched. When they work back in their teams they will also be completing a group report on paper. Finally, student teams are asked to create a ***PowerPoint*** presentation to share with others.

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Instructional Technology Resources

Internet sites:
BioHealth Link Site http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html

Meeting Tanya http://members.aol.com/teacher643/cancer
This Web site is your students' introduction to their case study.

Yahooligans http://www.yahooligans.com
This is a search engine designed especially for young people. It is a "kids" version of the Yahoo search engine.

Ask Jeeves For Kids http://www.ajkids.com

This is another search engine designed for use by young people. This search engine allows students to type in questions and receive answers. This site is a little easier to use for Web beginners and has a lot of good content.

Brain Pop http://www.brainpop.com
This site uses flash technology to show short animated movies on a variety of different topics. Students will be using this site to watch two animated videos, one on cells and one on cancer.

Your Cancer Health Risks http://www.yourcancerrisk.harvard.edu/index.htm
This site was created by the Harvard Center for Cancer Prevention. It provides very good background information for both students and teachers. A risk assessment geared towards adults is available on this site.

Cells Are Us http://www.icnet.uk/kids/cellsrus/cellsrus.html
Produced by the Imperial Cancer Research Fund, this site offers some very good, easy to understand information about cancer and about cell growth.

About Cancer http://cyberdiet.com/modulecos/ca/outline.html
This site has a lot of information about diet and its connection to cancer and cancer treatments. It offers very easy to understand information.

Kidshealth.org http://kidshealth.org
An incredible resource for information on cancer and cancer treatment. Check out sections specifically designed for parents and for kids.

Trigan Oncology Associates http://www.trigan.com
This Web site offers easy to read and locate information about a variety of different types of cancers, symptoms and treatments.

Educational Software:

- **The Ultimate Human Body**

This CD ROM has great images, a searchable index and on-line video and animation that make the systems of the human body come alive.
DK Multimedia
95 Madison Ave.
New York City, NY 10016
(800) 356-6575
http://www.dk.com

- **Microsoft *PowerPoint*** http://www.microsoft.com/office/powerpoint/default.htm

Go right to the source for information, tips, tricks and updates of this presentation software. The ***Microsoft*** Web site allows you to access the latest information about ***PowerPoint.***

Video:

- ***Newton's Apple:*** Program Number 905

Contact information: GPN 1-800-228-4630

Other Technology:

- Overhead Projector
- Television/VCR

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Teacher/Student Background Information

Cancer remains a mysterious and deadly disease. The term cancer is actually used to describe any number of different illnesses where cells grow out of control and tumors form.

Childhood cancer occurs in about one of every 600 young people. The most common forms of cancer found in young people are leukemia, brain tumors, lymphoma and sarcomas. Each type of cancer has many different forms. Basically, with all tumor- causing cancers, cell growth does not follow its normal cycle. Cells that would normally die off fail to do so and continue to reproduce out of control. The symptoms for each type of cancer are different. When most people think of treating cancer they think of chemotherapy (using drugs to treat cancer) or radiation (using strong doses of radiation to deal with out of control cell growth). For each type of cancer, different treatments are indicated. Treatment for cancers has changed drastically in the past 20 years. Death rates from cancers in almost all areas have also changed for the better in the past 20 years.

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Vocabulary

Carcinogen--A substance or agent that encourages the growth of cancer cells.
Carcinoma--A cancer which is a malignant growth of epithelial tissue or the tissue that forms the skin or blood vessels in an organism (e.g., the surface cells of the skin and the inside of the blood vessels).
Sarcoma--A cancer which is the malignant growth of connective tissue.
Leukemia--Cancer of the blood-forming tissues.
Malignant--Describes an abnormal growth which can often spread to other areas and may eventually cause death, e.g. a cancer.
Metastasis-- Transfer of a disease-producing agency from the site of disease to another part of the body. A secondary metastatic growth of a malignant tumor
Tumor--A lump in the body, without inflammation, it is caused by an abnormal growth of cells. It may be due to the presence of an infectious organism or it may occur spontaneously. In the latter case it can be benign or malignant.

Benign--Describes an abnormal growth which does not spread.
Cancer--The growth of abnormal cells in epithelial , or in connective tissue. The growth increases with time and eventually may cause death.
Biopsy -- The removal of bits of tissue from the body for diagnostic examination.
Chemotherapy -- The use of drugs to treat cancer.

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Learning Objectives

Content:
- Use data collected to solve a problem

Technology:
- **Record data** from a variety of Web sites
- **Gather information** from video using Maryland Public Television's "Video Utilization Techniques"

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Lesson Assessment

The teacher will be able to use a variety of different activities and worksheets to assess student understanding.

Content:
Worksheet "Treatments and Side Effects" – Scoring rubric provided.
Worksheet, "A Doctors Report" - Scoring rubric provided.

Technology:
Web search "Childhood Cancer's – What Are They?" – Scoring rubric provided.
Web Search "Cancer's Symptoms" – Scoring rubric provided.

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Materials Needed

(Per class)
- ***Newton's Apple*** video program number 905
- Internet connected computer or ***WebTV***
- Overhead
- Television/VCR
- Maryland Public Television's "Video Utilization Techniques"

(Per student team/group of three)

- One copy of each worksheet:
- "Treatments and Side Effects"
- "Childhood Cancers – What are They?"
- "Cancer Symptoms – A Web Investigation"
- "A Doctor's Report"

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Procedures

In part II of this lesson plan, students are presented with a "case study" of a fictitious young person named Tanya. This information is presented at http://members.aol.com/teacher634/cancer

Students first get to know something about Tanya and the symptoms that brought her to the doctor's office. Students are then broken into research teams. Each member of the team is asked to research a different aspect of childhood cancer: types of cancers that affect young people, symptoms of those cancers, and different treatment options. When each member of the team completes the research they come back together to complete a doctor's report detailing the type of cancer they think Tanya has and the treatment method they recommend.

The students who are researching treatment types need to have access to a VCR and television. They can watch the video together and record the necessary data. This is the activity that is the most teacher directed. A script for the video has been provided as part of the second day's activities. The other two members of the research team need to have access to the Internet so they can complete the Web searches and data gathering.

The use of video allows students who have reading accommodations indicated to gather data and to be an active member of the team.

Day 1: Meeting Tanya

Set-up Directions:
Before this lesson, decide on your three person teams. Make sure that you have access for the class to the Internet and that you have previewed the Web site.

Teacher Presentation & Motivation:
Begin the discussion with the following question: "How many of you know a young person who has had cancer?"

Tell students that today they are going to be "meeting" a young person named Tanya through the Internet. Tell them that for the next few days they will be gathering information about different types of cancers that affect young people. Tell

your students that they will be working in three-person research teams to try and figure out what is wrong with Tanya and what treatment should be offered.

Activities:
Have student teams gather at the computers. If you have a large monitor that all students can see, you can do this as a whole class activity. Have them access the Web site http://members.aol.com/teacher643/cancer and have them read about Tanya. Provide each team with a packet of handouts. Included in their handouts should be one copy each of the following:

- "Treatments and Side Effects"
- "Childhood Cancers – What are They?"
- "Cancer Symptoms – A Web Investigation"
- "A Doctor's Report"

Also needed are 3 copies (one for each team member) of the worksheet, "Meeting Tanya"

Have teams work together to complete the first activity sheet "Meeting Tanya."

When each team is finished bring the class together to review the information. Tell students that they will be working in small research teams to try and answer the following questions:

- Do Tanya's symptoms point to any specific type of cancer?
- What types of cancers are most common for young people to get?
- What treatments are available for the different types of cancers and how successful are those treatments?

Finally, student teams will complete a doctor's report summarizing their findings and making a recommendation for treatment. Preview each of the worksheets with the class and have them decide who is going to take on the different rolls for each team. Tell the students to choose one person in the team to be in charge of paperwork. It will be that person's responsibility to keep track of all paper work for the team. This person should be both organized have good attendance.

You may do this first activity as a whole class. If you decide to do this you will need to provide each student with a copy of the "Meeting Tanya" worksheet.

Day 2: Teams Get Working!

Set-up Directions:
Make sure that you have an extra worksheet packet or two in case one of the students in charge of paperwork is absent. Preview each Web site to ensure that they are still active. Set up one area of your classroom with the VCR and TV so students can see and hear the video.

Teacher Presentation & Motivation:
When students first enter, have them sit with their research groups. Have students

brainstorm information they recorded and remember from ***Tanya's Story*** Web page. Ask the person in charge of paper work to distribute the worksheets to the proper people in their teams. Tell students who will be working on the Internet that they might want to work together to locate some of the information. Tell them that when they finish gathering information they should find someone else who has the same worksheet and compare answers to ensure that they have the correct information.

Activities:
Break the class up and send those students who are working with the Internet to the computers. Bring the other students over to the TV area and use the following script with the***Newton's Apple*** video:

Say, "We have already learned some things about cancer. We have learned for example that cancer happens when cells grow out of control. These cells form a tumor. Some tumors can be easily removed by surgeons, while others must be treated with strong drugs. Sometimes radiation is use to try and kill the cancerous cells. Different types of cancers require different types of treatments."

"Today we are going to watch short video that describes some of the different ways to treat cancer."

"The first section of video describes the two most important factors that determine if someone with cancer will survive. You are responsible for recording what those two factors are."

PLAY

PAUSE when Dr Dan says, "you might have a 100% chance of cure."

Say, "So, what are the two factors that can determine the success of cancer treatment?" Allow students a chance to respond.

Say, "We already know that there are a lot of different types of cancers. Detecting cancer early for some of those types is done by your doctor. Sometimes, a blood test can be done that will determine if your blood is carrying signs of cancer. Other types of cancers can be checked for by you, or your parents at home."

"On the tape you are going to hear about three different things that can be done to detect cancers. You are responsible for recording two of those three techniques and what type of cancer's they are able to detect."

PLAY

PAUSE when Dr Dan says, "Without doing any harm or painto the patient."

Review with students the three different types of detection that were given on the tape and the different types of cancers they detect. Say, "Most people think of breast cancer as only happening to women, but actually men are susceptible to

breast cancer as well. Self exams should be done monthly and you should ask your doctor how to do one the next time you go for a checkup."

Point out to students the difference between the left side of the brain on the MRI and the right side.

Say, "As you can clearly see, there is a large mass on the left side of the image. This mass is the tumor."

With the video still in pause mode, tape an overhead gel to the screen and use an overhead marker to outline the image of the brain. Ask a student to come up and outline the right and left hemisphere of the brain and then outline the tumor. Take the overhead gel from the television and place it on the overhead. Say, "Before the technology that allowed us to take images of the inside of the brain, doctors needed to open up the human body just to see of there was a tumor. That is before there was even any thought of how to treat it."

Say, "Before we go any further, we are going to see some video images that show the difference between normal cells and cancerous cells. Dr. Dan is also going to describe what the current thinking on cancer development is. Record where cancer begins and how cancer cells are different from normal cells."

PLAY

PAUSE when Dr. Dan shows a cancer tumor going to the brain from the lungs and says, "Now you have a cancer in your brain"

Review general information with students. Allow them to share their observations about the look of the lung cells of a healthy lung and a cancerous lung.

Say, "In that video, Dr. Dan was using a copy machine to demonstrate something. What was he trying to show with the copy machine?" Allow students a chance to answer (He was trying to show that cancer cells reproduce out of control and that the copies they make can be "bad copies" of themselves). Say, "Dr. Dan described how cancer got from one location, where the cancer cells begin to grow out of control, to other areas of the body. Who can recall what was demonstrated?" Allow students a chance to answer. Say, "The word for when cancer spreads is **metastasis**. This is one important reason why early detection is so important. If cancer can be caught before it spreads there is a better chance that treatment will be effective."

Say, "We will now hear about some of the different treatments for different types of cancers. You are responsible for recording the different types of treatments, what type of cancers they will be effective for, and some reasons why those specific treatments might not be effective for other types of cancers."

PLAY

PAUSE after each treatment method is discussed. The tape goes through the

different methods quickly so **REWINDING** the tape will be important to ensure that students record the information.

PAUSE when Dr. Dan says, "Those are some of the ones who have the best cure rates."

Review the three different treatments with students. List each treatment type on the overhead or chalkboard. When reviewing the different types of treatments, here are some questions you might want to pose:

- What type of cancer could not be treated by removal of the organ affected?
- What type of cancer is best treated by chemotherapy?
- What are some side effects that might occur from cancer treatment?

Say, "There are side effects from each treatment for cancer. In this next segment you are going to hear from three people who have each experienced cancer and cancer treatment. Record the side effects that they experienced with the different types of treatments." Pass out the ***Inspiration*** Graphic Organizer titled "Treatments and Side Effects." Say, "I am providing a worksheet that will help you organize the information."

PLAY

STOP tape when host says, "We'll be right back."

Review information with students.

Bring all groups back together. Have each member of each group return their worksheet's to the person responsible for keeping track of the papers.

Day 3: A Doctors Meeting

Set-up Directions:
In this activity, students will be working in their research teams to share information. Student teams will be trying to answer the original questions about Tanya. Put those questions on the board before students enter.

Activities:
When students enter, have them sit with members of other teams that had their same job from last class. Have students spend 10 minutes comparing answers with other students and completing worksheets. Tell students that they will get multiple grades for this unit. Students will each get an individual grade for the worksheet they completed on their own. They will also get a group worksheet entitled "A Doctor's Report". Remind them to put all team member's names on the "Doctor's Report" and that you expect to see three different handwritings on that worksheet.

Have students gather with their research teams. Ask them to read over the worksheet "A Doctor's Report" and complete it. Monitor each group to make sure

they are sharing responsibility for completing the worksheet. When all groups are done ask them to go to the computers and, using the "***PowerPoint*** Presentation Instructions" handout, create an 8 slide ***PowerPoint*** presentation.

Students will present their slide shows to each other, or, as an extension, to other classes to raise awareness.

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Enrichment Options

Community Connection:
Have students gather cancer brochures from area doctors offices. Have a cancer awareness day where students present information to other classes. Have students encourage students to tell their parents to do self exams once a month (breast for males AND females, testicular for male members of the family). Also encourage the male members of their families who are over 40 years old to get regular prostrate exams.

Have students do "Self Exam" awareness posters. Ask local shop owners if they will display the posters.

Get students involved with the "March for a Cure."

Guest Speaker:
Bringing a young person in who has cancer to talk about their experience is an invaluable experience and gives a "face" to cancer. Contact the American Cancer Society for names and contact information.

Interdisciplinary Extensions:

- **Language Arts**

Have student's read A Summer To Die by Lois Lowery. This story is about a young girl who dies from Leukemia.

- **Science**

Have students make "Cancer Information Brochures." Each brochure should describe one type of cancer and also give information about early detection. Students can make copies of these available in the school office or in a school nurse's office.

- **Mathematics**

Have students research how survival rates have changed in the past twenty years. Have them make a graph showing the percentages of people who are surviving different types of cancers today compared with 20 years ago.

- **Social Studies**

Have students research what doctors in other countries do to treat cancer. Have them look at countries that rely on "alternative" methods of treatment such as countries in Asia.

- **Technology**

Have student teams work together to design a Web resource. Break the class into three (or more) teams, each team choosing a different type of cancer and completing an information page on that type of cancer.

- **Independent Projects**

Have students who are interested research a famous person who survived (or didn't survive) cancer. Have students make "Inspiring Story" posters about these people.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Doug Fireside & Felicity Ross

Video Utilization Strategies

Viewing must be ***interactive*** . The following practices are useful in strategically integrating video in the classroom:

- Preview each program regarding the lesson's objectives and the students' learning outcomes.

- Select segments that are most relevant to your lesson topic. Often a program has a great deal of information that cannot be digested at once; in that event, it is useful to show the program in segments so that its content can be more easily understood.

- Provide a Focus for Viewing: students' specific responsibility while viewing instructional video.
    - A question,
    - Things to look for,
    - Unfamiliar vocabulary, and/or
    - An activity that will make the program's content more clear or meaningful.
      Follow-up with a discussion or an activity after viewing the tape.

- Conduct Pre- or Post-Viewing Activities - experiential component to the lesson. Activities can be done prior to viewing the segment to
    - Set the stage,
    - Provide background information,
    - Identify new vocabulary words,
    - Introduce the topic, and/or
    - Review, reinforce, apply, or extend the information conveyed by the program.

- Pause while viewing to check the students' comprehension, ask questions, have students record information, make predictions, analyze what they've seen; examine a chart, formula, or image on the screen more closely; or have the students draw a diagram. Again, it's important to make the viewing as interactive as possible. (NOTE: Clean your VCR Head often with a brush-type cartridge, as pausing can clog the "reader" on the head. The highest-rated brand of cartridge is from Radio Shack.)

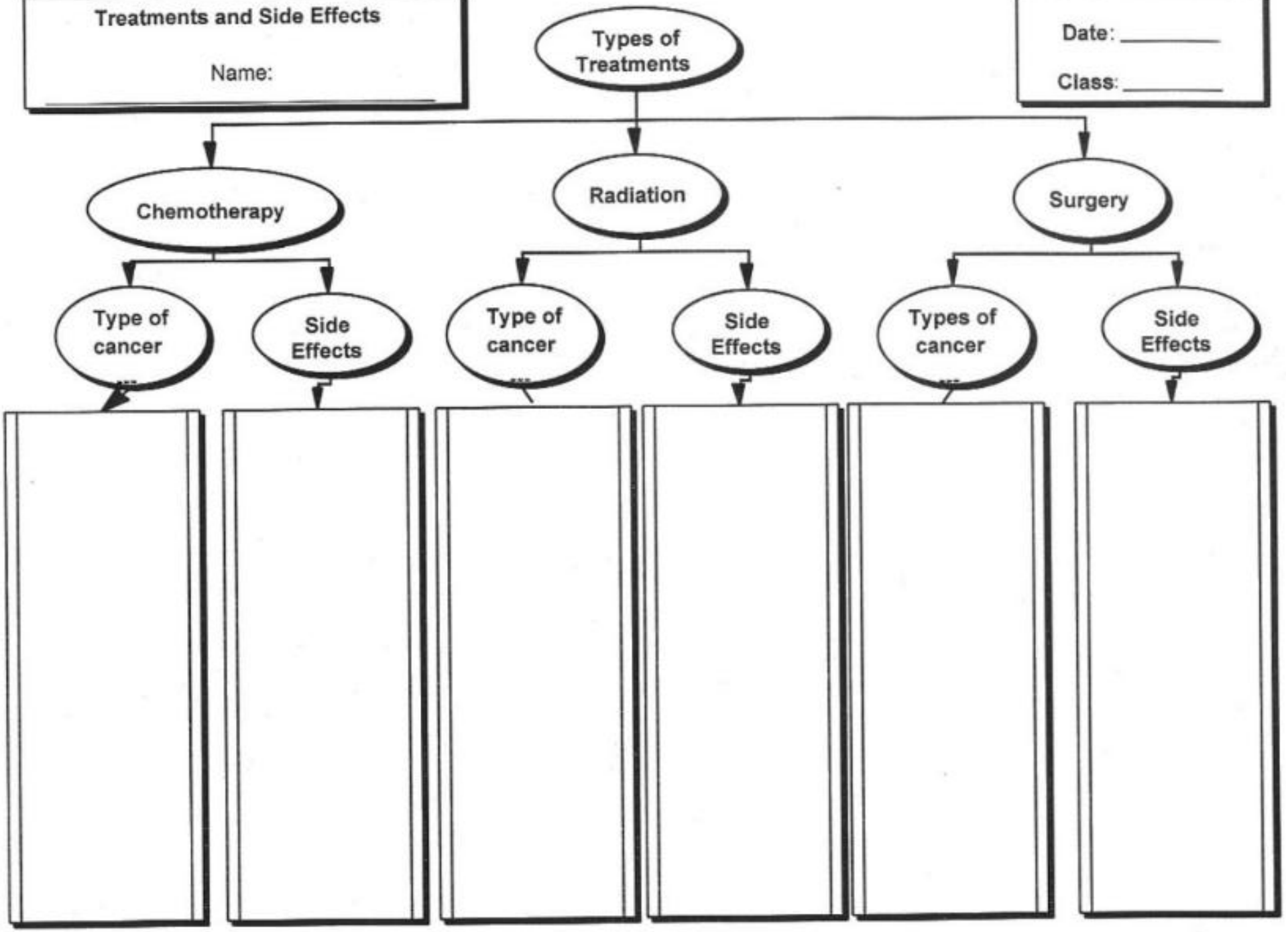
- Eliminate either the sound or the picture - Turn down the volume and provide your own narration. Another strategy is to eliminate the sound and have students describe the images they see. Alternatively, isolate the soundtrack by covering the monitor, and have students guess what is happening based on the narration alone.

Treatments and Side Effects

Name: _____

Date: _____

Class: _____



Name _____ Class _____ Date _____

Childhood Cancers – What Are They?

As you already know, cancer describes a group of diseases. Some types of cancers you are more likely to get when you are older, some are related to life style choices (like smoking, nutrition and sun exposure), and others are more likely to show up in young people. To help your team of doctors figure out which type of cancer Tanya might have, we need to do some research on the different types of cancers young people are most likely to get. You are going to use the Internet to **locate** and **record** information. Some answers will be easy to find while other answers will take a bit more digging to find. Good luck. Your team and Tanya are counting on you!

Before we get to the Web, describe, in your own words, what cancer is and how it gets started in the body:

_____

_____

_____

_____

Now, let's get on the Web and track down some information. We are going to start at http://www.ncl.ac.uk/child-health/guides/guide2c.htm which is the site for the ***Children's Cancer Web***. According to the graph, list the four most common types of childhood cancers in order from most common to least common:

_____

_____

_____

_____

According to this Web site, what is leukemia?

_____

_____

_____

_____

How is leukemia different from most other types of cancers?

_____

_____

_____

_____

Click on the link to read more about leukemia. What are two different types of leukemia?

_____

_____

_____

_____

Click the back button.

What is different about brain cancer and leukemia?

_____

_____

_____

_____

We need to learn more about the different types of cancers that affect kids. To do that we are going to go to http://kidshealth.org/parent/medical/cancer/cancer.html which is the site for ***Kidshealth.org***. According to this site, how does the growth of cancer cells change for different types of cancers?

_____

_____

_____

_____

On this site, there is a statistic about the number of kids who are affected by cancer. How does this statistic compare with the statistic from the last page we surveyed?

_____

_____

_____

_____

How might you account for the difference in the two numbers?

_____

_____

_____

_____

For each of the main types of cancers that affect young people, you will need to record some specific information. Here is a chart to help you organize the information you collect

	Lymphoma	**Leukemia**	**Osteosarcoma**	**Other Type**

Age at which cancer strikes				
General description of how cancer acts in the body				
Sub categories of this type of cancer				
What makes people more likely to get this type of cancer?				
Who is most likely to get this type of cancer?				

Based on the information you have collected so far, what type of cancer do you think Tanya has? Explain your answer:

_____

_____

_____

_____

Are there any cancers that you think Tanya's cancer is NOT? Explain your answer:

_____

_____

_____

_____

If your team needs more information, they will look to you to provide it. Continue looking on the Web for information and sites that your team might be able to use to help diagnose Tanya. Make sure you either bookmark those sites or that you record the URL's for those sites so you can easily find them again.

Name _____ Class _____ Date _____

Meeting Tanya

Today you will be meeting a new student. Her name is Tanya. She is just like you. She is in middle school, likes to be outdoors and goes to school in Maryland. There is one thing you should know about Tanya, she is sick. Tanya has cancer. Right now, her doctors are not sure which type of cancer Tanya has, that is where you and your team members come in. You have been chosen to help figure out what is wrong with Tanya. Each of you will be doing some research that will help us solve the mystery. Before your team begins to investigate, you will meet Tanya.

Go to http://members.aol.com/teacher643/cancer and read all about her. As you read, you should take some notes. Just like all doctors you should look for the following to help you figure out what is wrong:

Read her history carefully. There might be something in her past that is contributing to her illness.

- Make note of her symptoms. What brought her to the doctor's office today? What do you think her symptoms might be telling you?
- Look for risk factors. That is, are there things about Tanya that might make it easier for her to get one type of cancer over another?
- Look at her age and other personal information. Each factor might play a part in helping figure out what is wrong, and what we should do about it.

Below there is room for you to take notes while you read. You should not copy everything from her history and information, rather, just list what you think is important from what you read. Doctors Notes:

Compare notes with the other members of your team. List two things they thought were important that you might have missed:

Name _____ Class _____ Date _____

Cancer Symptoms – A Web Investigation

You have already met Tanya. You are responsible for figuring out, from her symptoms, what type of cancer she might have. Each common type of childhood cancer has some specific symptoms. Here is some background information.

The most common types of childhood cancers are lymphoma, leukemia, brain cancer and osteosarcoma. Lymphoma is a type of cancer that begins in the lymphatic glands. These glands include the spleen, tonsils, adenoids and bone marrow, as well as the tissue that connect them together. This is the 3rd most common type of childhood cancer. Leukemia is the most common type of cancer that affects young people. This type of cancer affects the white blood cells. These cells are part of the body's immune system. White blood cells are created in the bone marrow. Once cancer begins to affect the production and function of the white blood cells, they are no longer able to do their job. Osteosarcoma is the most common type of cancer that affects the skeletal system. Tumors can grow on and in the bones causing them to weaken. A brain tumor is an abnormal growth in the brain.

Section A
First let's review the specific symptoms that Tanya mentioned. Make a list of those here:

_____

_____

_____

_____

Now, let's get to the Web to do some research for your team. Below is a list of links which will help you locate the information you need. Remember, you are trying to figure out what symptoms occur for the different types of cancers that young people get. There is a table on the back of this page. As you read about the different types of cancers, fill in information on the table. When you are done, complete the questions at the end of this worksheet.

- http://news.bbc.co.uk/hi/english/static/in_depth/health/2000/cancer/default.stm. Let's start at the BBC's Web site to see what information we can find out about the symptoms of different types of cancers. Go to your Web browser and type in "Leukemia". Follow the links to information about Leukemia. You might need to dig a little, but there is a listing for symptoms.
- http://kidshealth.org/parent/medical/cancer/cancer.html This site provides information about three different types of cancers that young people get. Again, you need to read and follow the links to the different types of cancers to find your information
- http://cancernet.nci.nih.gov/Young_People/yngconts.html is a Web site from the National Institutes of Health. The NIH is a government organization. Compare information you get from other sites to the information provided here.
- http://www.abta.org/information/dictionary.htm gives you a good reference for terms you might not understand or need defined.
- http://www3.cancer.org/cancerinfo/load_cont.asp?ct=7&prevURL=load_cont.asp&language=ENGLISH is the Web site from the American Cancer Society. Very good information can be found hereb.

You should check out at least two Web sites for each of the different types of cancers to ensure that you have a complete list of the symptoms.

Section B

Type of cancer	Symptoms associated with this type of cancer	Which of these symptoms does Tanya have?

Section C

Compare the symptoms Tanya complained about to those of the different cancers. Complete the information based on what you researched:

Type of cancer:	Could Tanya have it?	Why or why not?
_____	_____	_____
		_____
_____	_____	_____
		_____
_____	_____	_____
		_____

Name _____ Class _____ Date _____

A Doctor's Report

Team Members:

- _____
- _____
- _____

Section A
Each member of the team researched a different area in the detection and treatment of childhood cancer. Each of you needs to summarize your findings in the space below:

Treatment for Cancers	**Symptoms of Cancers**	**Types of Cancer**
I think Tanya has	**I think Tanya has**	**I think Tanya has**
_____	_____	_____
Because	**Because**	**Because**
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

As a team we believe Tanya has _____ because _____

_____

_____

The best type of treatment for her is _____ and some side effects of the treatment

she might expect are _____

_____

_____

PowerPoint Presentation Instructions

For your team's ***PowerPoint*** presentation, include the following:

- A title slide including each "doctor's" name, and a title for your presentation
- A listing of Tanya's symptoms
- A list of the three different types of cancers that are most common for young people to get and their symptoms
- Current methods of treating cancer
- What type of cancer they think Tanya has and supporting evidence
- Treatment options for Tanya's type of cancer and survival rates
- Possible side effects from the treatment

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- What type of cancer they think Tanya has and supporting evidence
- Treatment options for Tanya's type of cancer and survival rates
- Possible side effects from the treatment

Treatments and Side Effects

3 points:

- All three treatments covered in notes
- Complete description for all three types of treatments
- Complete description of symptoms for all three types of side effects

2 points:
Either:
- Two treatment types completely described AND
- Symptoms for two types of treatment completely described OR
- Three types of treatment listed AND
- Symptoms for three types of treatment listed

1 point:
Either:
- One type of treatment completely described AND
- Symptom for one type of treatment completely described OR
- Two types of treatment list AND
- Symptoms for two types of treatment listed

0 points:
- Other

Childhood Cancers - What Are They?

3 Points:
- Complete answers given to all questions on page one
- Data chart completely filled out with details from the Web sites listed
- Recommendations given at end of page 2 with supporting evidence

2 points:
- Incomplete answers given for questions on page one
- Data chart completely filled out (no details given from specific Web sites)
- Recommendations given at end of page 2 with supporting evidence

1 point:
- Incomplete answers given on page one
- Data chart filled out with some missing information
- Recommendations given at end of page two. Supporting evidence given

0 points:
- Other

Cancer Symptoms - A Web Investigation

3 points:
- At least 4 symptoms listed for Tanya on section A
- Section B data chart complete with details given for data

Section C has all four types of cancers listed and all sections complete

2 points:
- At least 2 symptoms listed in section A
- Section B data chart complete with little details given for data
- Section C has all four types of cancers listed and all sections complete

1 point:
- At least 2 symptoms given in section A
- Section B data chart mostly complete, but no details given
- Section C has all four types of cancers listed and all sections complete

0 points:
- Other

A Doctor's Report

3 Points:
- All sections complete in first part with details and recommendations.
- Group recommendation given with full supporting details
- Information about options not recommended given with details

2 points:
- All sections complete in first part with few details and recommendations.
- Groups recommendation given with full supporting details
- Information about options not recommended given with little or no explanation

1 point:
- All sections complete in first part with little or no detail given
- Group recommendation given with so supporting detail
- Information about options not recommended given with little explanation

0 points:
- Other

Radon Raiders Incorporated, Part I: Investigating and Synthesizing the Dangers of Radon in Maryland

Time Commitment: Four 80-Minute Periods
Grade Levels: 9 – 12

Table of Contents

Overview

Students focus their understanding of the consequences of human exposure to radon by collaboratively investigating and discussing the video, ***Radon – Risks and Remedies***. They also obtain first hand knowledge of radon testing kits by measuring radon levels in their homes and school. Once the radon-tests have been completed, students plot data on a map of the community to evaluate and interpret their results. Then students individually work through a ***Radon Internet Investigation*** (*WebQuest*) to clarify and enhance their knowledge of radon and its link to cancer. Finally, students working in collaborative groups use

Inspiration to develop and present a diagram that links the major concepts of the element radon, how it is measured, and its importance to residents in the community and state.

Cooperative structure of the lesson:
The following is one way of creating Radon-Raider Teams. This method is designed for a class of 32 or less students but can be adapted to meet the needs of the teacher.

Step One: The teacher begins by writing eight student names alphabetically and horizontally across the **Radon-Raider Teams Table** into the **Red Team Members** row (See the "Radon-Raider Teams" Activity Sheet for a larger version of this table).

	Team 1	**Team 2**	**Team 3**	**Team 4**	**Team 5**	**Team 6**	**Team 7**	**Team 8**
Red Team Member								
Yellow Team Member								
Blue Team Member								
Green Team Member								

Step Two: The teacher then lists the next eight students horizontally across the table to create the yellow team members.

Step Three: The teacher then lists the next eight students horizontally across the table to create the blue team members.

Step Four: The teacher then lists the next eight students horizontally across the table to create the green team members.

A bulletin board in the classroom is designated for the Radon-Raiders collaborative

learning station. It contains a large image of each of the collaborative roles (Web Master, Supply Administrator, Project Spokesperson, and Web Developer – these are provided in the appendix), a card for each team color (red, yellow, blue, and green), and a list of every student and their collaborative group assignment. When the bulletin board has been constructed, a colored card will be placed next to each collaborative role. At the beginning of each class period, the colors next to the collaborative roles are shifted. This ensures that every student has the opportunity to participate in every role.

To ensure effective participation and teamwork the **Collaborative Multimedia Team Daily Scoring Tool** is applied. At the end of each period, the student acting as the Web Master completes the **Collaborative Multimedia Team Daily Scoring Tool** referring to the **Collaborative Group Members 5-Point Rubric** to evaluate each member of the group except him or herself. To ensure the Web Master has successfully completed all of their requirements, the teacher evaluates the Web Master.

Expected products from lesson:
Upon completion of this lesson students will develop an ***Inspiration*** diagram that defines in detail the importance of radon and its linkage to cancer.

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Instructional Technology Resources

Internet Sites:

BioHealth Link Web site
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html
A comprehensive site containing cancer links developed for the 2000 BioHealth Link: Questions of Cancer program summer institute.

Internet Project Web Resources
http://www.kn.pacbell.com/wired/fil/pages/listinternetcy1.html

Radon Raiders Incorporated -- Radon's Connection to Cancer WebQuest
http://www.pgcps.org/~nwest/biohealth/Lungs.htm
An Internet investigation designed for students to: chemically define radon and its radioactive nature, describe the effects of radon on the human body, describe how and when humans come into contact with radon, define the scale used to measure radon levels, describe the typical radon levels in Maryland and its bordering states, and explain how radon levels can be decreased if they are found to be at dangerous levels.

BrainPop Flash Videos on Cancer
http://www.brainpop.com/health/diseases/cancer/index.asp
An award winning Flash video site that explains the differences between malignant

and benign cells, cancer at the cellular and system level, metastasis, and how cancer can be treated in language design for students.

BrainPop Flash Videos on Respiration http://www.brainpop.com/health/ respiratory /respiration /index.asp
An award winning Flash video site that explains the respiratory system in language design for students.

Radon-Specific IAQ Publications from the EPA
http://www.epa.gov/docs/RadonPubs/
A comprehensive list of publication produced by the EPA on radon. Titles include A Citizen's Guide to Radon (second edition), Radon – A Physician's Guide, and Radon in Schools. The Web page also includes ordering information.

A Physicians Guide – Radon http://www.epa.gov/iaq/radon/pubs/physic.html
The EPA in consultation with the American Medical Association (AMA) developed this Web page on radon for physicians. Its purpose is to enlist physicians in the national effort to inform the American public about the serious health risks posed by indoor radon gas. It is more comprehensive than other EPA publications available online.

What is Your Annual Radiation Dose?
http://www.epa.gov/radiation/students/calculate.html
An interactive Web page developed by the EPA that allows visitors to determine the amount of radiation they are exposed to each year.

Multimedia Software:

1. An Internet browser such as ***Internet Explorer 5.0*** or ***Netscape Communicator 4.7***

2. ***Inspiration***
   Inspiration Software, Inc.
   7412 SW Beaverton Hillsdale Hwy, Suite 102,
   Portland, OR 97225-2167
   www.inspiration.com

3. ***Macro Media's Flash Plug-in*** for Internet Explorer and Netscape Communicator (can be downloaded at Macro Media's home page at http://www.macromedia.com).

Video:

- For a free copy of the video contact Brenda Blann with the Division of Public Information, International Atomic Energy Agency at B.Blann@iaea.org.

OTHER INSTRUCTIONAL RESOURCES
Journals:

- Scientific American Special Issue: What You Need To Know About Cancer. September 1996.

Radon Detection Kits:

1. Associated Radon Services http://www.radonserv.com/product_information.htm advertises $10 kit (price includes shipping, materials, and processing)

2. "PRO-LAB" Radon Test Kit, $29.95 http://www.radontestkits.com/cart/index.html

3. INFILTEC http://www.infiltec.com/inf-catr.htm#testing Model RN-TEST 3, $24.99

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Teacher/Student Background Information

Although radon received more critical press a few years ago, it is still a major concern as the second largest cause of lung cancer next to cigarette smoking. Residents of Maryland should understand and interpret:

- The radioactive nature of radon
- How it affects the human body and causes cancer
- How cancer begins in the body and how it spreads
- How and what radon test-kits measure and identify
- How radon enters houses, schools, and other buildings
- How to prevent radon from entering a house, school, and other buildings
- How and why the natural levels of radon in Maryland tend to be high

Radon is a naturally occurring, radioactive, colorless, odorless, heavy gas that is a part of the Nobel Gas Family. Radon is one step in uranium's decay series. Uranium's decay series begins with uranium's decay into thallium. Multiple decays occur and unstable, radioactive elements are produced along with high-energy, radioactive particles and electromagnetic waves. The decay series ends when lead is produced.

Radon's name comes from its parent element radium. Radium is an uncommon element in nature making radon naturally rare too. Radon is also scarce because its longest lasting isotope has a half-life of 3.823 days. When radium and its isotopes disintegrate they tend to produce one of three isotopes ^{219}Rn, ^{220}Rn, or ^{222}Rn and an alpha particle. Alpha particle radiation cannot penetrate the skin but causes genetic mutations upon entering the body through the lungs. Radiation comes in two general forms: natural and man-made. Radon accounts for two-thirds of the total natural radiation dose incurred by humans annually.

By the late 1980's radon had been recognized as a ubiquitous human health

concern. It was during this time that radon was quantitatively observed, researched, and documented. In the United States radon levels are measured in picocuries per liter of air. An unhealthy level is commonly determined to be 4 picocuries per liter of air and above. Residents in the state of Maryland should be aware that many of the counties report high occurrences of unhealthy levels of radon.

When radon makes its way through the Earth it usually enters into the lower atmosphere where it quickly diffuses and decays. Health consequences arise when radon is trapped and humans have regular exposure to the gas. Radon is typically measured at its highest levels in the basement or bottom level of houses and buildings. A variety of solutions are available to evacuate the radon gas. These methods vary in initial cost, maintenance, and effectiveness. Most of the methods involve rerouting the gas out of the building and into the atmosphere.

Before beginning the lesson students should have a strong understanding of the subatomic particles that make up an atom (protons, neutrons, and electrons). They should recognize that the number of protons defines an atom's uniqueness and that changing the number of protons in an atom changes its identity; that radioactive decay involves the transition of one element into another along with a high-energy particle or electromagnetic wave.

Students should be able to turn on a computer, use a mouse, and open an application. They should be given general background information on using an Internet browser, ***Microsoft Word***, and ***Inspiration***.

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Vocabulary

action level – a defined concentration of radon that is considered unhealthy. Action levels tend to differ from country to country but the standard in the United States is 4 picocuries per liter of air.
alpha particle – a helium nucleus
benign cells – tumorous cells that are non-cancerous
electromagnetic radiation (waves) – radiant energy that exhibits wavelike behavior and travels through space at the speed of light in a vacuum
electron – a negatively charged particle that moves around the nucleus of an atom
EPA – the Environmental Protection Agency of the United States
half-life (of a radioactive sample) – the time required for the number of nuclides in a radioactive sample to reach half of the original value
isotopes – atoms of the same element with different numbers of neutrons
malignant cells – tumorous cells that are cancerous
metastasis – the spreading of cancer from its original location to one or more places elsewhere in the body
neutrons – a particle in the atomic nucleus with mass virtually equal to the proton's but with no charge. Variations in the number of neutrons in an element

define its isotopes.
nuclide – the general term applied to each unique atom
protons – a positively charged particle in an atomic nucleus. The particle used to define the uniqueness of an element.
radioactive decay – the spontaneous decomposition of a nucleus to form a different nucleus
tumor – a confined mass of tissue that develops without inflammation from normal tissue, but has an abnormal structure and rate of growth and serves no function

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Learning Objectives

The following content and technology objectives come for the "Core Learning Goals and Skills for Success" (http://www.mdk12.org/mspp/high_school/what_will/index.html).

Content:
3.12.1 - explain that most life functions involve chemical reactions regulated by information stored within the cell and may be influenced by the cell's response to its environment

4.12.6 - analyze the interrelationship of mass and energy associated with chemical, physical, and nuclear changes

5.12.19 - describe developments in modern Physics (i.e. nuclear fission, photoelectric effect, wave-particles duality, energy of light) and their applications

Technology:
1.12.6 - interpret and communicate findings through speaking, writing, and drawing using developmentally appropriate methods including technology tools and telecommunications

1.12.12 - explain that when designing a device or process (e.g., manufacturing, marketing, operating, maintaining, replacing, and disposing of) risk analysis and technology assessment determines how it will be employed

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Lesson Assessment

The student and the teacher, using the Comprehensive Student Evaluation Scoring Tool, will evaluate student's overall performance**.** This tool consists of a quantitative piece and a reflective piece.

Content:

The content included in the culminating project will be evaluated using the Content-Infusion Piece of the Multimedia Presentation and Inspiration 5-Point Rubric. The ***Content-Infusion Piece*** focuses on the areas of grammar, spelling, language use, relevance, and scientific significance.

Technology:
The technology piece developed for this lesson will be evaluated using two different rubrics. The first, **Collaborative Group Members 5-Point Rubric** with the **Collaborative Multimedia Team Daily Scoring Tool**, will evaluate the individual student's contribution to the project be evaluating his/her daily collaboration. The second, the ***Technology-Infusion Piece 1 and 2*** of the **Multimedia Presentation and Inspiration 5-Point Rubric**, will evaluate the group's presentation and the incorporation of appropriate and required images, graphics, and text.

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Materials Needed

- **(Per student)**
- pencils, pens, and paper
- a computer with Internet access, an Internet browser, and a word processor in a lab setting
- "Multimedia Collaborative Team Scoring Tool"
- "Comprehensive Student Evaluation Scoring Tool"
- "Quick Glossary of Internet Terms and Buttons"

(Per student groups of 4)
- Computer disk
- Collaborative ***Radon Raiders, Inc.*** role cards that clearly detail the responsibilities of each group member
- Computer with Internet access, an Internet browser, and ***Inspiration*** in a lab setting
- Radon test kit

(Per class)
- At least one computer with Internet access, an Internet browser, and ***Inspiration*** for presentations
- Large display device
- Computer-lab access
- Bulletin board
- A one meter by one meter map of the school's community that is detailed enough for students to locate their houses

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Procedures

The majority of this lesson has students working in collaborative, technology groups of four where each of the students has a clearly defined role for the day. Collaboration allows for every student in the group to successfully contribute to the culminating project and demonstrate their understanding of the lesson's objectives.

This lesson can be completed in a variety of classroom-technology settings. The more access to computers the groups have, the faster the project can be developed, presented, and reflected upon. When viewing the video ***Radon – Risks and Remedies*** it is important to follow the video utilization techniques to achieve a comprehensive learning experience. When working through the ***Radon Raiders Incorporated -- Radon's Connection to Cancer WebQuest*** it is recommended that students work in a computer lab and have an individual computer or work in pairs. The focus of the first two activities is building and reinforcing prior knowledge.

Purchasing the radon testing kits should be done in a timely manner to guarantee their arrival before the lesson begins. Teachers should read the directions thoroughly before distributing them to students.

When students begin developing their ***Inspiration*** diagrams, it is recommended that there be at least four computers in the classroom. In this scenario, half of the groups would have access to a computer. Then the teacher can break the class into odd and even groups and share the resources equally. When students are not directly using the group's computer, they can be working on activities that do not require the computer. When students communicate their presentations, it is recommended that there be a large display device available (either a large monitor of 30 or more inches or an LCD projector).

No special accommodations are required for this lesson as students will be working in groups and will be collaborating to develop and present their culminating product.

Day 1: Viewing the Video and Obtaining the Radon Test Kit

Set-up Directions:
Students should be maneuvered into collaborative groups of four and situated for easy group discussions and writings. The VCR and monitor should be placed in the room so that every student can easily observe the video. Radon testing kits should be purchased in a timely manner.

Teacher Presentation & Motivation:
The teacher should instruct students that the video is a valuable resource. Many of the images, diagrams, and animations clearly demonstrate concepts that are abstract and hard to understand.

The majority of this lesson involves students distilling and discussing information from the film ***Radon – Risks and Remedies***. The final part of the activity has

students learning how to operate a store-bought radon detection kit.

Before beginning the film, students should be put into their collaborative groups. Each group, lead by the Web Master and recorded by the Web Developer, should discuss and answers to the following three questions for three minutes:

1. How many people in the United States of America die from radon exposure each day?
2. Which is a greater threat to most Americans: radon or large-scale nuclear disasters, such as nuclear power plant meltdowns?
3. Is radon a natural or man-made substance?

   Afterwards the Project Spokesperson should report the group's answers to the class. When the last group has completed their report, each group should be given an additional two minutes to reflect upon their answers and the answers of their classmates.

The focus for viewing is a specific responsibility or task(s) students are responsible for during or after watching the video, to focus and engage students' viewing attention. In this lesson students working in collaborative groups collectively observe and discuss how radon enters the atmosphere, how building can capture radon, how radon is measured, at what levels radon is considered unhealthy, how radon reacts in the body, and how radon can be evacuated from a building.

BEGIN the video and **PAUSE** it after the answer to the third question is answered. Collaborative groups should expend two minutes discussing the answers they have obtained from the film. The teacher should guide the class by asking such questions as: "Did anyone know that radon was such a killer?" "Why does the media tend to focus on short-term, major disasters and not radon?" and "If it is a natural substance is there any way that we can prevent being exposed to it?"

RESUME and **PAUSE** at 1 minutes and 50 seconds. At this point the film states that uranium's usual decay results in the natural formation of radon gas. It continues to describe how the gas typically makes it way to the surface of the Earth where it is released into the atmosphere and poses little to no threat to humans. **RESUME** and **PAUSE** the tape at 2 minutes and 5 seconds and have every student sketch a diagram summarizing how radon reaches the surface of the Earth. Working in their collaborative groups students should discuss their diagrams, making sure that every member has a detailed diagram. Before continuing the tape, ask students how and under what circumstances humans might be exposed to consistently high levels of radon. **RESUME** and **PAUSE** at 2 minutes and 30 seconds. Students should add a house or building to their diagram and summarize in their own words what is taking place in the illustration.

The next section of video describes how radon levels are measured in the United States and Internationally. **RESUME** and **PAUSE** at 2 minutes and 37 seconds. The Web Developer should sketch a diagram representing a box that contains radon similar to the one in the video. They should also include the picocurie of radon per

liter of air unit. **RESUME** and **PAUSE** at 2 minutes and 52 seconds. Ask students what are the differences between the two units? Are they measuring the same thing? Is a gallon in the United States measuring the same thing as a liter internationally?

RESUME and **PAUSE** at 3 minutes and 24 seconds. Collaborative groups should answer the following questions collectively with the Web Developer recording their responses:

1. What is an action level?
2. What is standard action level in the United States?

FAST FORWARD the tape to 6 minutes and 27 seconds, press **PLAY**, and **PAUSE** the tape. Ask students to refer back to their diagrams that explain how radon reaches the surface of the Earth. The image on the screen depicts the human breathing cycle. Every student should develop a detailed sketch of the diagram in the video. Ask students what might happen if radon enters into lungs. **RESUME** and **PAUSE** at 7 minutes and 7 seconds. In groups, students should spend three minutes discussing the implications of short-term and long-term radon exposure.

RESUME and **PAUSE** immediately. The teacher should point out the proximity of Pennsylvania to Maryland and ask how many students have visited the state or have friends and family that live there. The teacher should further ask if radon is a danger to those who live in Pennsylvania.

FAST FORWARD to 8 minutes and 14 seconds. Students should be instructed that the interview they are going to observe is between Stan Watars, a former worker at a nuclear power plant and a resident of Pennsylvania, and Friedrich Steinshauler from the University of Salzburg, Austria. Students should focus on Mr. Watars' discussion of how he was first introduced to the dangers of radon and why it greatly concerned him. **RESUME** and **PAUSE** at 9 minutes and 22 seconds. The teacher should instruct collaborative groups to discuss what they would do if they were in a similar situation. Was Mr. Watars acting responsibly or rash?

RESUME and **PAUSE** the tape at 10 minutes and 30 seconds. Students should construct a diagram, which resembles the diagram on the video screen, depicting radon being trapped within a house. **RESUME** and **PAUSE** at 11 minutes and 4 seconds. The teacher should ask students to reflect upon the standard activation level for radon levels, the Watars' house readings, and how many packs of cigarettes a day they would have to smoke to obtain a similar cancer risk.

RESUME and **PAUSE** at 11 minutes and 39 seconds. Students should make an additional sketch of the radon removal system that was used to remove the radon from the Watars' home. **RESUME** and **PAUSE** at 12 minutes and 28 seconds. The teacher should repeat the question that the film asks: "What about those families who are unaware of the radon levels in their homes?" Students in collaborative groups should reflect upon the question and determine what should be done to

determine the radon levels in their homes and school.

Afterwards students are given their radon detection kit and asked to read the directions carefully. The homework assignment will be for one student in each group to test their home for dangerous radon levels.

Day 2: Investigating Radon's Connection to Cancer WebQuest and Analyzing Student Radon Data

Set-up Directions:
A computer lab of computers should be reserved for the class period and the ***Radon Internet Investigation*** (*WebQuest*) saved as the Internet Browser's homepage (this way students do not have to key in the URL which can lead to frustration and unsupervised Internet exploration). Students should be assigned specific computers.

A large map of the community should be obtained and displayed in the classroom. Students should be able to easily locate their houses' on the map.

Teacher Presentation & Motivation:
The teacher should direct students to the ***Radon Internet Investigation*** by instructing them to open up an Internet Browser (either Netscape Communicator or Internet Explorer). Students should be encouraged to multitask and record their answers in a word processing document. The teacher should walk around the room clarifying questions and making sure that students are not viewing URLs that are not apart of the Internet Investigation.

Activities:
Students work through the ***Radon Internet Investigation*** by reading each of the questions and selecting the appropriate link that will direct them to the predetermined URL where they will find their answer. Students should record their answers either on paper or with a word processing application.

Day 3

Set-up Directions:
Students should be put into collaborative groups with the roles shifted so that each student has the opportunity to experience more that one role. Each group should have access to one computer. A large map of the school's community should be viewable and accessible to everyone in the classroom.

Teacher Presentation & Motivation:
The first part of the lesson involves sharing and plotting radon information on a map of the community. The second part of the lesson has students begin using ***Inspiration*** software to summarize information about radon that is most important to citizens of the community and the state of Maryland.

Afterwards, students working in their collaborative groups begin developing an ***Inspiration*** diagram that summarizes the important information associated with radon, cancer, and citizens of the community and state of Maryland. Near the end of the period groups print out copies of their diagrams and are asked to bring them home. At home they are to explain to at least one family member why it is important to study radon and its effect on humans. They are to encourage their family member to make comments and suggestions.

Day 4

Set-up Directions:
Students should be put into collaborative groups with the roles shifted so that each student has the opportunity to experience more that one role. Each group should have one computer to work with.

Teacher Presentation & Motivation:
The first part of the lesson has students editing and finalizing their ***Inspiration*** diagrams while completing the "Comprehensive Student Evaluation Scoring Tool." The second part of the lesson has student groups presenting their diagrams to the class.

Activities:
Students working in collaborative groups begin the class by sharing their ***Inspiration*** diagrams with the other members of their group. Collectively they compile their ***Inspiration*** flowcharts for the approximately twenty minutes. Then they are given ten minutes to coach the Project Spokesperson for a 3 to 5 minute class presentation.

Community Connection:
The culminating project for this lesson is for students working in their collaborative groups to produce an ***Inspiration*** diagram that summarizes the health related consequences associated with exposure to radon. On the first day of the lesson students examine radon-testing kits and bring them home to measure radon levels in their houses. After the data has been collected students plot their data and identify issues. On the third night students are required to share their finding with a family member and discuss the ***Inspiration*** diagram that was produced in class. On the fourth day students distill the information they have connected using Inspiration and present their findings to the class. The culminating project for this lesson is the starting point for part two where students use their diagrams an outline for a web site.

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Enrichment Options

Guest Speaker:
Arthur S. Lazerow has been accredited by the EPA to perform radon testing in residences. As both a home inspector and licensed (non-practicing) Realtor, he teaches about radon and cancer exposure due to radon in residential settings as a course to Realtors and to consumers. He is willing to come into schools and give presentations that last twenty minutes to an hour. He can be contacted at aslaz@mail.erols.com.

Interdisciplinary Extensions:

- **Language Arts –** After evaluating data collected by the class, students could write letters to appropriate people in the county and state discussing their findings. This extension would be particularly important if the radon levels found within the school or an individual home are greater than acceptable levels.

- **Science –** When radium and its isotopes disintegrate they tend to produce one of three isotopes ^{219}Rn, ^{220}Rn, or ^{222}Rn and an alpha particle. Students studying radioactive decay can follow uranium complete decay and how radon is only one step on the way to nuclear stability.

- **Mathematics –** Using chemical kinetics, radioactive decay can be explained and investigated as a first order chemical reaction. Students can use sample data to plot the natural decay of radon over a given period of time to determine its differential rate law, integrated rate law, rate constant, and half-life.

- **Social Studies –** Using the EPA's web site, students can study how different countries are affected by radon. Students investigate and compare and contrast how different countries alleviate their radon dilemmas.

- **Technology –** Toby,-Sidney; Toby,-Frina-S, Journal of Chemical Education "The simulation of dynamic systems" v 76 no11 Nov 1999. p. 1584-90. This article reviews a new freeware application that helps students better understand the natural radioactive decay process.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Edward R. Dieterle II and John Bois

Name _____ Class _____ Date _____

Radon-Raider Lesson One Activity Sheets

Radon-Raider Teams Activity Sheet Parts I & 2

Color	Team 1	Team 2	Team 3	Team 4	Team 5	Team 6	Team 7	Team 8
Red Team Member								
Yellow Team Member								
Blue Team Member								
Green Team Member								

Team Role	5 Points	4 Points	3 Points	2 Points	1 Point
Web Master	The group is consistently on task, focused, and aware of the scheduled time for the given activity. The Web Master acts as a highly effective leader	The group is usually on task, focused, and aware of the scheduled time for the given activity. The Web Master acts as an effective leader	The group is frequently on task, focused, and aware of the scheduled time for the given activity. The Web Master acts as a moderately effective leader	The group is sometimes on task, focused, and aware of the scheduled time for the given activity. The Multimedia Producer acts as an ineffective leader	The group is rarely on task, focused, and aware of the scheduled time for the given activity. The Web Master acts as an ineffective leader
Supply Administrator	Consistently collects, takes care of, and returns all of the group's materials. The group's activity area is thoroughly clean upon completing the activity.	Usually collects, takes care of, and returns all of the group's materials. The group's activity area is substantially clean upon completing the activity.	Frequently collects, takes care of, and returns all of the group's materials. The group's activity area is substantially clean upon completing the activity.	Sometimes collects, takes care of, and returns all of the group's materials. The group's activity area is partially clean upon completing the activity.	Rarely collects, takes care of, and returns all of the group's materials. The group's activity area is partially clean upon completing the activity.

Project Spokesperson	Thoroughly reads all of the directions and instructions to the group. Makes a highly effective presentation of the group's report to the class.	Completely reads all of the directions and instructions to the group. Makes an effective presentation of the group's report to the class.	Frequently reads the directions and instructions to the group. Makes an effective presentation of the group's report to the class.	Sometimes reads the directions and instructions to the group. Makes a moderately effective presentation of the group's report to the class.	Rarely reads the directions and instructions to the group. Makes an ineffective presentation of the group's report to the class.
Web Developer	Thoroughly records all of the group's data. Develops a through final report.	Completely records the group's data. Develops a complete final report.	Substantially records the group's data. Develops a complete final report.	Partially records the group's data. Develops an incomplete final report.	Rarely records the group's data. Develops an incomplete final report.

Collaborative Multimedia Team Daily Scoring Tool Parts I & 2

Date:_____ Period:_____

Student's Name	Group Role	Score
	Web Master	5 4 3 2 1
	Supply Administrator	5 4 3 2 1
	Project Spokesperson	5 4 3 2 1
	Web Developer	5 4 3 2 1

Multimedia Presentation and Inspiration 5-Point Rubric Parts I & II

Presentation Area	5 Points	4 Points	3 Points	2 Points	1 Point
Overall Presentation *(Technology-Infusion Piece 1)*	The project is highly effective, keeps the attention of the audience, and is very interesting.	The project is effective, keeps the attention of the audience most of the time, and is interesting.	The project is moderately effective and reasonably keeps the attention of the audience.	The project is minimally effective, disjointed, and the interest level is unconnected.	The project is ineffective and is poorly received by the audience.
TextInformation *(Content-Infusion Piece)*	The information used is consistently accurate, with proper grammar and punctuation.	The majority of the information used is accurate, with proper grammar and punctuation.	Most of the information used is accurate. Mistakes with grammar and punctuation can cause misunderstandings.	Text information is frequently inaccurate. Grammar and punctuation contain mistakes that cause misunderstandings.	Information is inaccurate. Grammar and punctuation are misused.
Graphics and Images *(Technology-Infusion Piece 2)*	Graphics and images are consistently used throughout the project. The graphics and images used are highly effective in strengthening the information and supporting the text.	Graphics and images are frequently used throughout the project. The graphics and images used are effective in strengthening the information and supporting the text.	Graphics and images are sometimes used in the project. The graphics and images used are moderately effective in strengthening the information and supporting the text.	Graphics and images are rarely used in the project. The graphics and images used are minimally effective and have some relevance.	Graphics and images are never used in the project.

Name:_____

Date:_____

Comprehensive Student Evaluation Scoring Tool Parts 1 & 2

For the Student:

The best thing about my project is _____

Why? _____

_____

I could improve my project if I _____

_____

Why? _____

_____

Things I learned doing this project were _____

_____

Why? _____

_____

Evaluation Area	Maximum Score	Group Self Evaluation	Teacher Evaluation	Final Grade
Collaborative Role Daily Score	10			
Presentation	10			

Internet Investigation Activity	5			
Presentation's Text information	15			
Presentation's Graphics and images	5			
Total	**45**			

Teacher comments and suggestions:

_____

_____

_____

Collaborative Role Cards Parts 1 & 2

Radon-Raiders Inc.

Web Master

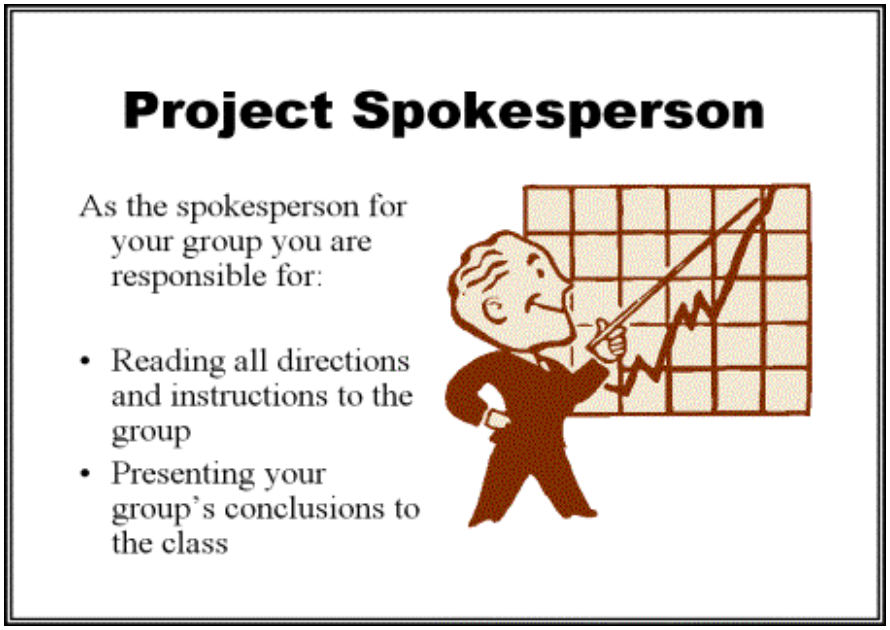
As the leader of your group you are responsible for:

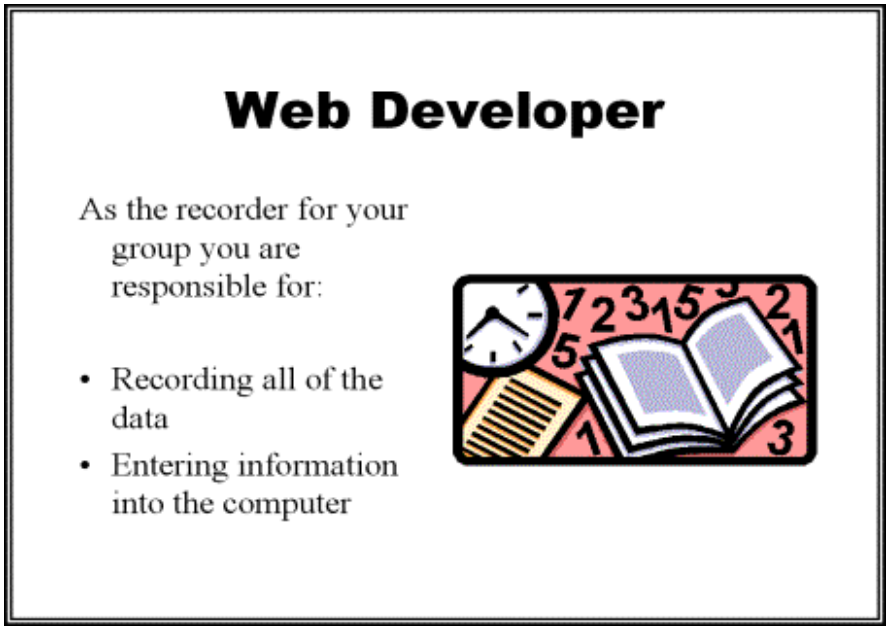
- Keeping your group on task
- Keeping your group focused
- Keeping track of time
- Setting a good example for everyone

Supply Administrator

As the supply administrator of your group you are responsible for:

- Collecting all necessary materials before the activity begins
- Taking care of the materials while they are in use
- Returning all materials after the activity has been completed
- Making sure the activity area is clean after completing the activity





Quick Glossary of Internet Terms and Buttons Parts 1 & 2

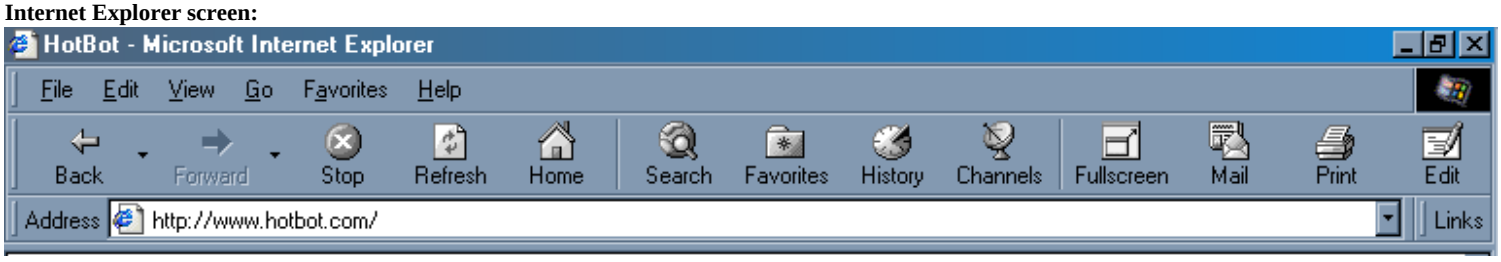
WWW: The World Wide Web is a collection of millions of interconnected pieces of information, mostly in graphic and text form. It grows exponentially by the week and it allows anyone to access an overwhelming volume of information in seconds.

URL: The name of a particular page (i.e., http://www.pgcps.org)

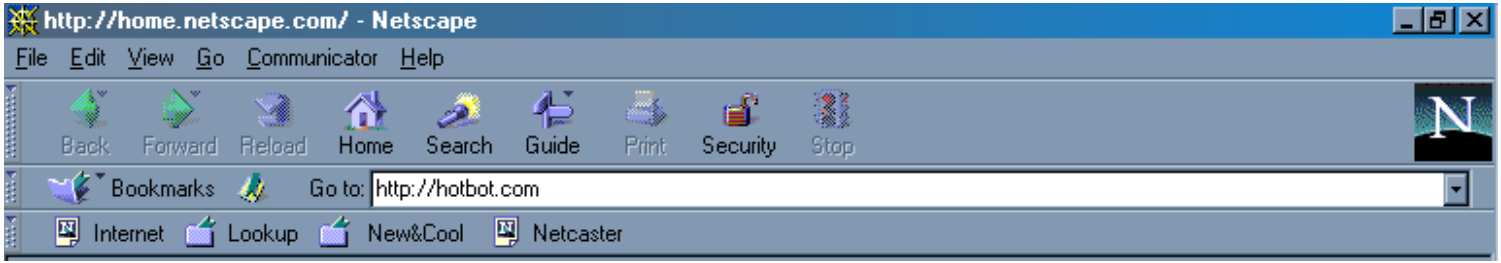
Link: It is a connection to another URL. By clicking on a link you will be taken to another URL.

Browser: A program that allows you to view WWW pages. The two most common browsers are Internet Explorer and Netscape.

Internet Explorer screen:



Netscape screen:



Address or ***Go to***: The long, thin open box at the top of the screen. It displays the URL of the page. Highlighting and typing over it can change the text in this box.

The ***Back*** Button. Your best friend when browsing, it will move you back one step to the page you were on previously. If, for some reason, it's not usable, do not panic. You can always just click on The ***Home*** Button, which will take you back to where you started.

The ***Forward*** Button does exactly the opposite of the ***Back*** button.

The ***Stop*** Button. This button will stop whatever your browser is doing. You will want to do this sometimes if things are taking too long. Just click the button and try again.

The ***Reload*** Button or ***Refresh*** Button resets the page in the browser.

Pay attention to the Bottom of Your Browser – It tells you what the browser is doing at any given time. If you move your mouse over a link, the URL for that link will show up in the bottom bar.

Radon Raiders Incorporated, Part II: Teaching the Dangers of Radon in Maryland Via a Web Site

Time Commitment: Five 80-Minute Periods
Grade Levels: 9 – 12

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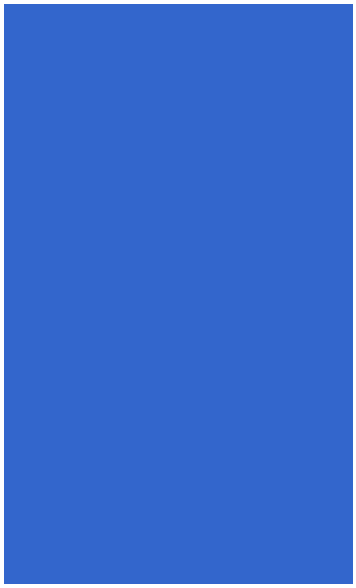
Overview

Students review their understanding of the consequences of human exposure to radon by collaboratively investigating and discussing the ***Inspiration*** diagrams developed in part one of the lesson. The diagrams network the major concepts of the element radon, how it is measured, and its importance to residents in the community and state. Then students use ***PowerPoint*** to develop effective multimedia presentations for a new radon detection device developed by ***Radon Raiders Inc.*** The presentations distill information collected in the first part of the lesson and provoke students' ability to



determine what information the community should understand. After developing and presenting their multimedia presentations, students convert their culminating projects into HTML documents. The presentations are then ftp-ed to the class Web site and individual students investigate their peer's work.

Cooperative structure of the lesson:
The following is one way of creating Radon-Raider Teams. This method is designed for a class of 32 or less students but can be adapted to meet the needs of the teacher.

Step One: The teacher begins by writing eight student names alphabetically and horizontally across the **Radon-Raider Teams Table** into the **Red Team Members** row (See the "Radon-Raider Teams" Activity Sheet for a larger version of this table).

	Team 1	**Team 2**	**Team 3**	**Team 4**	**Team 5**	**Team 6**	**Team 7**	**Team 8**
Red Team Member								
Yellow Team Member								
Blue Team Member								
Green Team Member								

Step Two: The teacher then lists the next eight students horizontally across the table to create the yellow team members.

Step Three: The teacher then lists the next eight students horizontally across the

table to create the blue team members.

Step Four: The teacher then lists the next eight students horizontally across the table to create the green team members.

A bulletin board in the classroom is designated for the Radon-Raiders collaborative learning station. It contains a large image of each of the collaborative roles (Web Master, Supply Administrator, Project Spokesperson, and Web Developer – these are provided in the appendix), a card for each team color (red, yellow, blue, and green), and a list of every student and their collaborative group assignment. When the bulletin board has been constructed, a colored card will be placed next to each collaborative role. At the beginning of each class period, the colors next to the collaborative roles are shifted. This ensures that every student has the opportunity to participate in every role.

To ensure effective participation and teamwork the **Collaborative Multimedia Team Daily Scoring Tool** is applied. At the end of each period, the student acting as the Web Master completes the **Collaborative Multimedia Team Daily Scoring Tool** referring to the **Collaborative Group Members 5-Point Rubric** to evaluate each member of the group except him or herself. To ensure the Web Master has successfully completed all of their requirements, the teacher evaluates the Web Master.

Expected products from lesson:
Upon completion of this lesson students will develop an ***Inspiration*** diagram that defines in detail the importance of radon and its linkage to cancer.

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Instructional Technology Resources

Internet Sites:
BioHealth Link Web site
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html
A comprehensive site containing cancer links developed for the 2000 BioHealth Link: Questions of Cancer program summer institute.

Internet Project Web Resources
http://www.kn.pacbell.com/wired/fil/pages/listinternetcy1.html

Radon Raiders Incorporated -- Radon's Connection to Cancer WebQuest
http://www.pgcps.org/~nwest/biohealth/Lungs.htm
An Internet investigation designed for students to: chemically define radon and its radioactive nature, describe the effects of radon on the human body, describe how and when humans come into contact with radon, define the scale used to measure radon levels, describe the typical radon levels in Maryland and its bordering states,

and explain how radon levels can be decreased if they are found to be at dangerous levels.

BrainPop Flash Videos on Cancer
http://www.brainpop.com/health/diseases/cancer/index.asp
An award winning Flash video site that explains the differences between malignant and benign cells, cancer at the cellular and system level, metastasis, and how cancer can be treated in language design for students.

BrainPop Flash Videos on Respiration http://www.brainpop.com/health/ respiratory /respiration /index.asp
An award winning Flash video site that explains the respiratory system in language design for students.

Radon-Specific IAQ Publications from the EPA
http://www.epa.gov/docs/RadonPubs/
A comprehensive list of publication produced by the EPA on radon. Titles include A Citizen's Guide to Radon (second edition), Radon – A Physician's Guide, and Radon in Schools. The Web page also includes ordering information.

A Physicians Guide – Radon http://www.epa.gov/iaq/radon/pubs/physic.html
The EPA in consultation with the American Medical Association (AMA) developed this Web page on radon for physicians. Its purpose is to enlist physicians in the national effort to inform the American public about the serious health risks posed by indoor radon gas. It is more comprehensive than other EPA publications available online.

What is Your Annual Radiation Dose?
http://www.epa.gov/radiation/students/calculate.html
An interactive Web page developed by the EPA that allows visitors to determine the amount of radiation they are exposed to each year.

Multimedia Software:

1. Multimedia software such as Microsoft ***PowerPoint 2000*** or ***PowerPoint 98*** for Macintosh

2. An Internet browser such as ***Internet Explorer 5.0*** or ***Netscape Communicator 4.7***

3. ***Inspiration***
   Inspiration Software, Inc.
   7412 SW Beaverton Hillsdale Hwy, Suite 102,
   Portland, OR 97225-2167
   http://www.inspiration.com

4. ***Macro Media's Flash Plug-in*** for Internet Explorer and Netscape Communicator (can be downloaded at Macro Media's home page at

http://www.macromedia.com)

OTHER INSTRUCTIONAL RESOURCES
Journal:

- Scientific American Special Issue: What You Need To Know About Cancer. September 1996.

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Teacher/Student Background Information

Although radon received more critical press a few years ago, it is still a major concern as the second largest cause of lung cancer next to cigarette smoking. Residents of Maryland should understand and interpret:

- The radioactive nature of radon
- How it affects the human body and causes cancer
- How cancer begins in the body and how it spreads
- How and what radon test-kits measure and identify
- How radon enters houses, schools, and other buildings
- How to prevent radon from entering a house, school, and other buildings
- How and why the natural levels of radon in Maryland tend to be high

Radon is a naturally occurring, radioactive, colorless, odorless, heavy gas that is a part of the Nobel Gas Family. Radon is one step in uranium's decay series. Uranium's decay series begins with uranium's decay into thallium. Multiple decays occur and unstable, radioactive elements are produced along with high-energy, radioactive particles and electromagnetic waves. The decay series ends when lead is produced.

Radon's name comes from its parent element radium. Radium is an uncommon element in nature making radon naturally rare too. Radon is also scarce because its longest lasting isotope has a half-life of 3.823 days. When radium and its isotopes disintegrate they tend to produce one of three isotopes ^{219}Rn, ^{220}Rn, or ^{222}Rn and an alpha particle. Alpha particle radiation cannot penetrate the skin but causes genetic mutations upon entering the body through the lungs. Radiation comes in two general forms: natural and man-made. Radon accounts for two-thirds of the total natural radiation dose incurred by humans annually.

By the late 1980's radon had been recognized as a ubiquitous human health concern. It was during this time that radon was quantitatively observed, researched, and documented. In the United States radon levels are measured in picocuries per liter of air. An unhealthy level is commonly determined to be 4 picocuries per liter of air and above. Residents in the state of Maryland should be aware that many of the counties report high occurrences of unhealthy levels of radon.

When radon makes its way through the Earth it usually enters into the lower

atmosphere where it quickly diffuses and decays. Health consequences arise when radon is trapped and humans have regular exposure to the gas. Radon is typically measured at its highest levels in the basement or bottom level of houses and buildings. A variety of solutions are available to evacuate the radon gas. These methods vary in initial cost, maintenance, and effectiveness. Most of the methods involve rerouting the gas out of the building and into the atmosphere.

Before beginning the lesson students should have a strong understanding of the subatomic particles that make up an atom (protons, neutrons, and electrons). They should recognize that the number of protons defines an atom's uniqueness and that changing the number of protons in an atom changes its identity; that radioactive decay involves the transition of one element into another along with a high-energy particle or electromagnetic wave.

Students should be able to turn on a computer, use a mouse, and open an application. They should be given general background information on using an Internet browser, ***Microsoft Word***, ***PowerPoint***,and ***Inspiration***.

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Vocabulary

action level – a defined concentration of radon that is considered unhealthy. Action levels tend to differ from country to country but the standard in the United States is 4 picocuries per liter of air.
alpha particle – a helium nucleus
benign cells – tumorous cells that are non-cancerous
electromagnetic radiation (waves) – radiant energy that exhibits wavelike behavior and travels through space at the speed of light in a vacuum
half-life (of a radioactive sample) – the time required for the number of nuclides in a radioactive sample to reach half of the original value
isotopes – atoms of the same element with different numbers of neutrons
malignant cells – tumorous cells that are cancerous
metastasis – the spreading of cancer from its original location to one or more places elsewhere in the body
neutrons – a particle in the atomic nucleus with mass virtually equal to the proton's but with no charge. Variations in the number of neutrons in an element define its isotopes.

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Learning Objectives

The following content and technology objectives come for "Core Learning Goals and Skills for Success"

(http://www.mdk12.org/mspp/high_school/what_will/index.html).

Content:
3.12.1 - explain that most life functions involve chemical reactions regulated by information stored within the cell and may be influenced by the cell's response to its environment

4.12.6 - analyze the interrelationship of mass and energy associated with chemical, physical, and nuclear changes

5.12.19 - describe developments in modern Physics (i.e. nuclear fission, photoelectric effect, wave-particles duality, energy of light) and their applications

Technology:
1.12.6 - interpret and communicate findings through speaking, writing, and drawing using developmentally appropriate methods including technology tools and telecommunications

1.12.12 - explain that when designing a device or process (e.g., manufacturing, marketing, operating, maintaining, replacing, and disposing of) risk analysis and technology assessment determines how it will be employed

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Lesson Assessment

The student and the teacher, using the **Comprehensive Student Evaluation Scoring Tool,** will evaluate student's overall performance**.** This tool consists of a quantitative piece and a reflective piece.

Content:
The content included in the culminating project will be evaluated using the ***Content-Infusion Piece*** of the **Multimedia Presentation and Inspiration 5-Point Rubric**. The ***Content-Infusion Piece*** focuses on the areas of grammar, spelling, language use, relevance, and scientific significance.

Technology:
The technology piece developed for this lesson will be evaluated using two different rubrics. The first, **Collaborative Group Members 5-Point Rubric** with the **Collaborative Multimedia Team Daily Scoring Tool**, will evaluate the individual student's contribution to the project be evaluating his/her daily collaboration. The second, the ***Technology-Infusion Piece 1 and 2*** of the **Multimedia Presentation and Inspiration 5-Point Rubric**, will evaluate the group's presentation and the incorporation of appropriate and required images, graphics, and text.

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Materials Needed

(Per student)
- Pencils, pens, and paper
- Computer with Internet access, an Internet browser, and a word processor in a lab setting
- "Collaborative Multimedia Team Scoring Tool"
- "Comprehensive Student Evaluation Scoring Tool"
- "Quick Glossary of Internet Terms and Buttons"
- "Quick Guide to Using ***PowerPoint***"
- "Peer Evaluation 5 Point Rubric"

(Per student groups of 4)
- Computer disk
- Collaborative ***Radon Raiders, Inc***. role cards that clearly detail the responsibilities of each group member
- Computer with Internet access, an Internet browser, and ***PowerPoint*** in a lab setting
- "Culminating Project Storyboard Activity Sheet"

(Per class)
- At least one computer with Internet access, an Internet browser, ***PowerPoint*** and ***Inspiration*** for presentations
- Large display device
- Computer-lab access
- Bulletin board

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Procedures

The majority of this lesson has students working in collaborative, technology groups of four where each of the students has a clearly defined role for the day. Collaboration allows for every student in the group to successfully contribute to the culminating project and demonstrate their understanding of the lesson's objectives.

This lesson can be completed in a variety of classroom-technology settings. The more access to computers the groups have, the faster the project can be developed, presented, and reflected upon.

Before beginning their culminating projects students should edit a printout of their ***Inspiration*** diagrams. When students begin developing their ***PowerPoint*** presentations it is recommended that there be at least four computers in the classroom. In this scenario, half of the groups would have access to a computer. Then the teacher can break the class into odd and even groups and share the

resources equally. When students are not directly using the group's computer, they can be working on activities that do not require the computer. When students communicate their presentations it is recommended that there be a large display device available (either a large monitor of 30 or more inches or an LCD projector).

No special accommodations are required for this lesson as students will be working in groups and will be collaborating to develop and present their culminating product.

Day 1: The Planning Process

Set-up Directions:
Students should be maneuvered into collaborative groups of four and situated for easy group discussions and writings. A printout of each group's ***Inspiration*** diagram should be given to each group. Ideally each group will have access to a computer with ***PowerPoint***.

Teacher Presentation & Motivation:
The teacher should instruct students that the final edit of the diagram is a valuable resource. Each group should reconsider and justify every connection. The storyboard should be used to illustrate what the group wants on each of their slides. The storyboard should be very clear before students begin using the computers. When using ***PowerPoint*** students should be instructed to enter all of their text information before inserting images, pictures, or colors.

The first part of the lesson involves students reviewing and editing their ***Inspiration*** diagrams. Then the teacher directs students to the "Culminating Project Storyboard Activity Sheet"***.*** The teacher should walk around the room clarifying questions. Upon successful completion and approval of the group's storyboard, groups should begin using ***PowerPoint*** to develop their culminating projects.

Day 2: The Development Stages

Set-up Directions:
Students should be put into collaborative groups with the roles shifted so that each student has the opportunity to experience more that one role. Students should be situated for easy group discussions and writings. Ideally each group will have access to a computer with ***PowerPoint*** and Internet access.

Teacher Presentation & Motivation:
Upon successful completion and approval of the group's storyboard, groups should begin using ***PowerPoint*** to develop their culminating projects.

Activities:
Students should continue developing their culminating projects on the computer using ***PowerPoint.***

Day 3

Set-up Directions:
Students should be put into collaborative groups with the roles shifted so that each student has the opportunity to experience more that one role. Students should be situated for easy group discussions and writings. Ideally each group will have access to a computer with ***PowerPoint*** and Internet access.

Teacher Presentation & Motivation:
The first part of the lesson involves groups completing their culminating projects. The second part of the lesson has students coach one another in preparation for group presentations.

Activities:

Students should continue developing their culminating projects on the computer using ***PowerPoint.*** At least one-third of the class period should be devoted to peer coaching. At home students should complete the "Comprehensive Student Evaluation Scoring Tool."

Day 4

Set-up Directions:
Students should be put into collaborative groups with the roles shifted so that each student has the opportunity to experience more that one role. At least one large display device should be available for group presentations. Ideally each group will have access to a computer with ***PowerPoint*** and Internet access.

Teacher Presentation & Motivation:
The first part of the lesson has students presenting their culminating projects. The teacher should use the "Comprehensive Student Evaluation Scoring Tool" to evaluate groups while they are presenting. The second part of the lesson has student groups converting their projects into HTML documents.

Activities:
Students groups should be given four to eight minutes to present their culminating projects. Afterwards each group should convert their presentation to HTML.

Day 5: Exploring and Evaluating the Web Sites of Others

Set-up Directions:
A computer lab of computers should be reserved for the class period and the class Website saved as the Internet Browser's homepage. Using this technique, students do not have to key in the URL which can lead to frustration and unsupervised

Internet exploration. Students should be assigned specific computers.

Teacher Presentation & Motivation:
Students are to work through each of their classmates' presentations and complete the "Peer Evaluation Grading Tool."

Activities:
Students are to work through each of their classmates' presentations and complete a (I don't know what it is called yet) rubric.

Community Connection:
The culminating project for this lesson is for students working in their collaborative groups to produce a ***PowerPoint*** presentation that summarizes the health related consequences associated with exposure to radon. In part one of the lesson, students examine radon testing kits and bring them home to measure radon levels in their houses. After the data has been collected students plot their data and identify issues. Then students are required to share their finding with a family member and discuss the ***Inspiration*** diagram that was produced in class. On the final day of part one of the lesson, students distill the information they have connected using ***Inspiration*** and present their findings to the class. The culminating project for this lesson is the starting point for part two where students use their diagrams an outline for a Website. Once the presentations have been developed an posted to the class Website, students are given copies of the class URL and instruct students to share it with their family and friends.

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Enrichment Options

Guest Speaker:
Arthur S. Lazerow has been accredited by the EPA to perform radon testing in residences. As both a home inspector and licensed (non-practicing) Realtor, he teaches about radon and cancer exposure due to radon in residential settings as a course to Realtors and to consumers. He is willing to come into schools and give presentations that last twenty minutes to an hour. He can be contacted at aslaz@mail.erols.com.

Interdisciplinary Extensions:
- **Language Arts –** After evaluating data collected by the class, students could write letters to appropriate people in the county and state discussing their findings. This extension would be particularly important if the radon levels found within the school or an individual home are greater than acceptable levels.

- **Science –** When radium and its isotopes disintegrate they tend to produce one of three isotopes ^{219}Rn, ^{220}Rn, or ^{222}Rn and an alpha particle. Students studying radioactive decay can follow uranium complete decay and how radon is only one

step on the way to nuclear stability.

- **Mathematics –** Using chemical kinetics, radioactive decay can be explained and investigated as a first order chemical reaction. Students can use sample data to plot the natural decay of radon over a given period of time to determine its differential rate law, integrated rate law, rate constant, and half-life.

- **Social Studies –** Using the EPA's web site, students can study how different countries are affected by radon. Students investigate and compare and contrast how different countries alleviate their radon dilemmas.

- **Technology –** Toby,-Sidney; Toby,-Frina-S, Journal of Chemical Education "The simulation of dynamic systems" v 76 no11 Nov 1999. p. 1584-90. This article reviews a new freeware application that helps students better understand the natural radioactive decay process.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Edward R. Dieterle II and John Bois

Name _____ Class _____ Date _____

Radon-Raider Lesson One Activity Sheets

Radon-Raider Teams Activity Sheet Parts I & 2

Color	Team 1	Team 2	Team 3	Team 4	Team 5	Team 6	Team 7	Team 8
Red Team Member								
Yellow Team Member								
Blue Team Member								
Green Team Member								

Team Role	5 Points	4 Points	3 Points	2 Points	1 Point
Web Master	The group is consistently on task, focused, and aware of the scheduled time for the given activity. The Web Master acts as a highly effective leader	The group is usually on task, focused, and aware of the scheduled time for the given activity. The Web Master acts as an effective leader	The group is frequently on task, focused, and aware of the scheduled time for the given activity. The Web Master acts as a moderately effective leader	The group is sometimes on task, focused, and aware of the scheduled time for the given activity. The Multimedia Producer acts as an ineffective leader	The group is rarely on task, focused, and aware of the scheduled time for the given activity. The Web Master acts as an ineffective leader
Supply Administrator	Consistently collects, takes care of, and returns all of the group's materials. The group's activity area is thoroughly clean upon completing the activity.	Usually collects, takes care of, and returns all of the group's materials. The group's activity area is substantially clean upon completing the activity.	Frequently collects, takes care of, and returns all of the group's materials. The group's activity area is substantially clean upon completing the activity.	Sometimes collects, takes care of, and returns all of the group's materials. The group's activity area is partially clean upon completing the activity.	Rarely collects, takes care of, and returns all of the group's materials. The group's activity area is partially clean upon completing the activity.

Project Spokesperson	Thoroughly reads all of the directions and instructions to the group. Makes a highly effective presentation of the group's report to the class.	Completely reads all of the directions and instructions to the group. Makes an effective presentation of the group's report to the class.	Frequently reads the directions and instructions to the group. Makes an effective presentation of the group's report to the class.	Sometimes reads the directions and instructions to the group. Makes a moderately effective presentation of the group's report to the class.	Rarely reads the directions and instructions to the group. Makes an ineffective presentation of the group's report to the class.
Web Developer	Thoroughly records all of the group's data. Develops a through final report.	Completely records the group's data. Develops a complete final report.	Substantially records the group's data. Develops a complete final report.	Partially records the group's data. Develops an incomplete final report.	Rarely records the group's data. Develops an incomplete final report.

Collaborative Multimedia Team Daily Scoring Tool Parts I & 2

Date:_____ Period:_____

Student's Name	Group Role	Score
	Web Master	5 4 3 2 1
	Supply Administrator	5 4 3 2 1
	Project Spokesperson	5 4 3 2 1
	Web Developer	5 4 3 2 1

Multimedia Presentation and Inspiration 5-Point Rubric Parts I & II

Presentation Area	5 Points	4 Points	3 Points	2 Points	1 Point
Overall Presentation *(Technology-Infusion Piece 1)*	The project is highly effective, keeps the attention of the audience, and is very interesting.	The project is effective, keeps the attention of the audience most of the time, and is interesting.	The project is moderately effective and reasonably keeps the attention of the audience.	The project is minimally effective, disjointed, and the interest level is unconnected.	The project is ineffective and is poorly received by the audience.
TextInformation *(Content-Infusion Piece)*	The information used is consistently accurate, with proper grammar and punctuation.	The majority of the information used is accurate, with proper grammar and punctuation.	Most of the information used is accurate. Mistakes with grammar and punctuation can cause misunderstandings.	Text information is frequently inaccurate. Grammar and punctuation contain mistakes that cause misunderstandings.	Information is inaccurate. Grammar and punctuation are misused.
Graphics and Images *(Technology-Infusion Piece 2)*	Graphics and images are consistently used throughout the project. The graphics and images used are highly effective in strengthening the information and supporting the text.	Graphics and images are frequently used throughout the project. The graphics and images used are effective in strengthening the information and supporting the text.	Graphics and images are sometimes used in the project. The graphics and images used are moderately effective in strengthening the information and supporting the text.	Graphics and images are rarely used in the project. The graphics and images used are minimally effective and have some relevance.	Graphics and images are never used in the project.

Name:_____

Date:_____

Comprehensive Student Evaluation Scoring Tool Parts 1 & 2

For the Student:

The best thing about my project is _____

Why? _____

_____

I could improve my project if I _____

_____

Why? _____

_____

Things I learned doing this project were _____

_____

Why? _____

_____

Evaluation Area	Maximum Score	Group Self Evaluation	Teacher Evaluation	Final Grade
Collaborative Role Daily Score	10			
Presentation	10			

Internet Investigation Activity	5			
Presentation's Text information	15			
Presentation's Graphics and images	5			
Total	**45**			

Teacher comments and suggestions:

_____

_____

_____

Collaborative Role Cards Parts 1 & 2

Radon-Raiders Inc.

Web Master

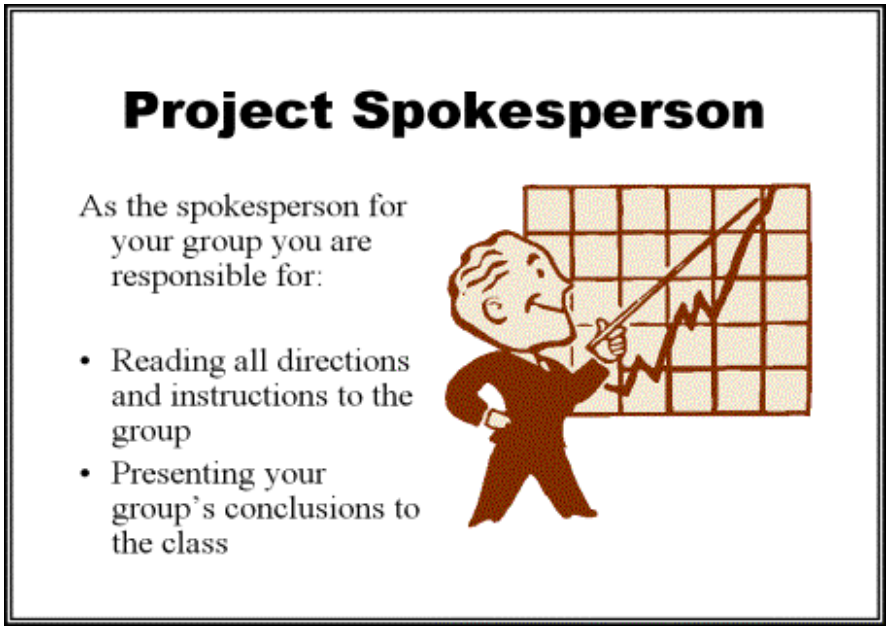
As the leader of your group you are responsible for:

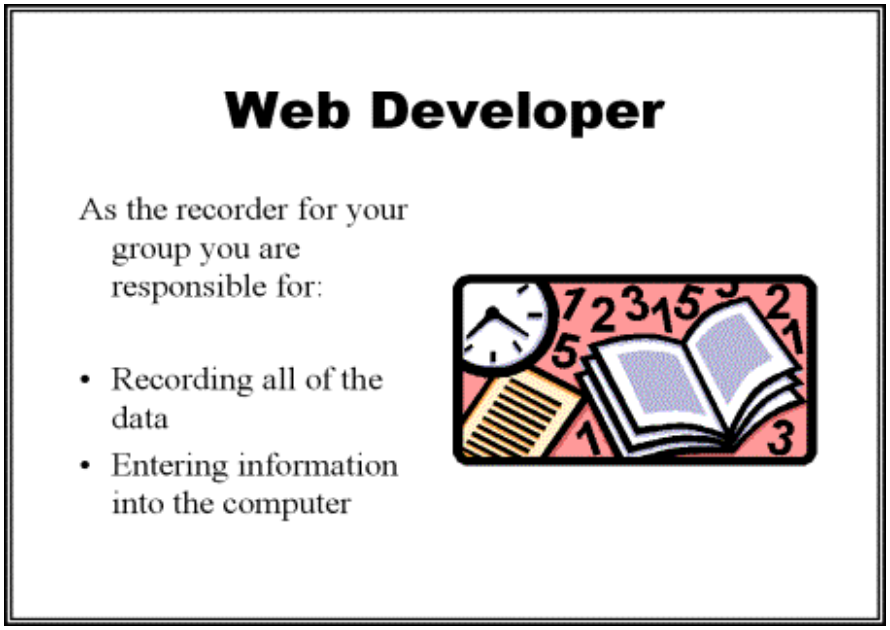
- Keeping your group on task
- Keeping your group focused
- Keeping track of time
- Setting a good example for everyone

Supply Administrator

As the supply administrator of your group you are responsible for:

- Collecting all necessary materials before the activity begins
- Taking care of the materials while they are in use
- Returning all materials after the activity has been completed
- Making sure the activity area is clean after completing the activity





Quick Glossary of Internet Terms and Buttons Parts 1 & 2

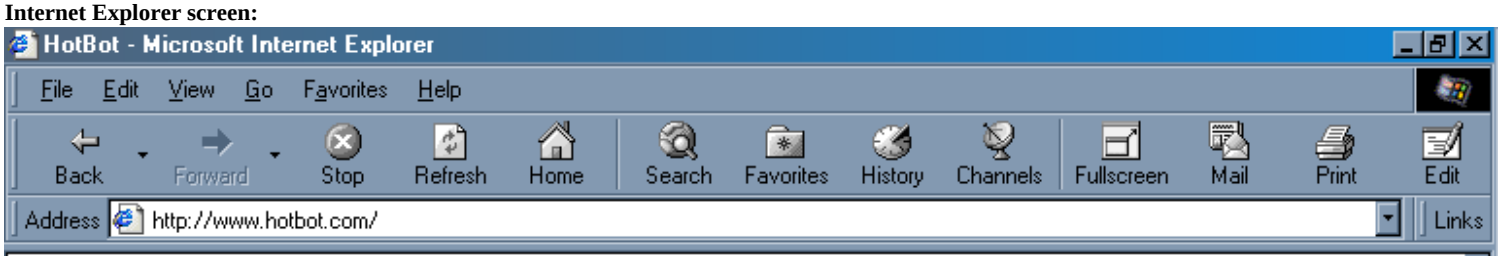
WWW: The World Wide Web is a collection of millions of interconnected pieces of information, mostly in graphic and text form. It grows exponentially by the week and it allows anyone to access an overwhelming volume of information in seconds.

URL: The name of a particular page (i.e., http://www.pgcps.org)

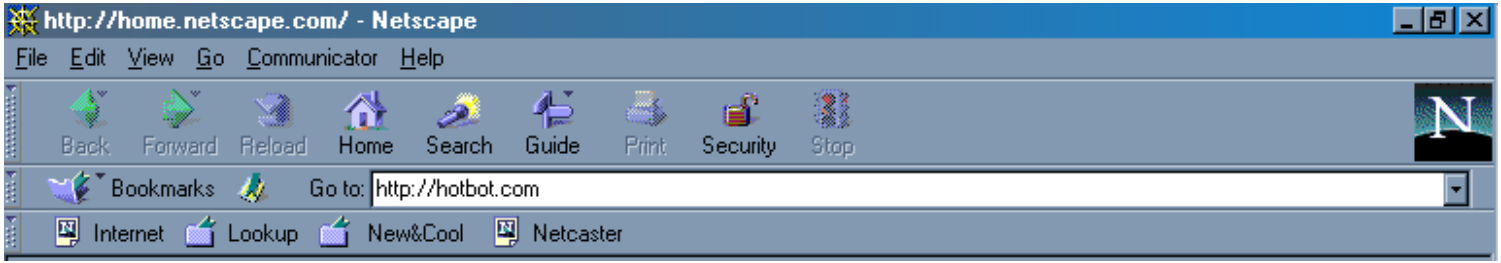
Link: It is a connection to another URL. By clicking on a link you will be taken to another URL.

Browser: A program that allows you to view WWW pages. The two most common browsers are Internet Explorer and Netscape.

Internet Explorer screen:



Netscape screen:



Address or ***Go to***: The long, thin open box at the top of the screen. It displays the URL of the page. Highlighting and typing over it can change the text in this box.

The ***Back*** Button. Your best friend when browsing, it will move you back one step to the page you were on previously. If, for some reason, it's not usable, do not panic. You can always just click on The ***Home*** Button, which will take you back to where you started.

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The ***Reload*** Button or ***Refresh*** Button resets the page in the browser.

Pay attention to the Bottom of Your Browser – It tells you what the browser is doing at any given time. If you move your mouse over a link, the URL for that link will show up in the bottom bar.

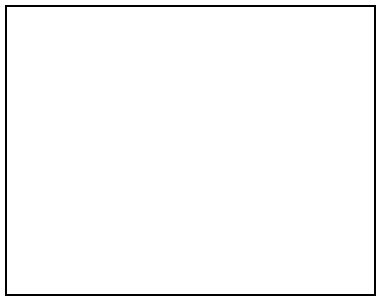
Name:_____
Date:_____

Peer Evaluation 5-Point Rubric

Presentation Area	5 Points	4 Points	3 Points	2 Points	1 Point
Overall Presentation	The project is highly effective, keeps the attention of the audience, and is very interesting.	The project is effective, keeps the attention of the audience most of the time, and is interesting.	The project is moderately effective and reasonably keeps the attention of the audience.	The project is minimally effective, disjointed, and the interest level is unconnected.	The project is ineffective and is poorly received by the audience.
Text Information	The information used is consistently accurate, with proper grammar and punctuation.	The majority of the information used is accurate, with proper grammar and punctuation.	Most of the information used is accurate. Mistakes with grammar and punctuation can cause misunderstandings.	Text information is frequently inaccurate. Grammar and punctuation contain mistakes that cause misunderstandings.	Information is inaccurate. Grammar and punctuation are misused.
Graphics and Images	Graphics and images are consistently used throughout the project. The graphics and images used are highly effective in strengthening the information and supporting the text.	Graphics and images are frequently used throughout the project. The graphics and images used are effective in strengthening the information and supporting the text.	Graphics and images are sometimes used in the project. The graphics and images used are moderately effective in strengthening the information and supporting the text.	Graphics and images are rarely used in the project. The graphics and images used are minimally effective and have some relevance.	Graphics and images are never used in the project.
Community Value	The project is highly effective in raising the communities understanding of radon and its importance.	The project is effective in raising the communities understanding of radon and its importance.	The project is moderately effective in raising the communities understanding of radon and its importance.	The project is minimally effective in raising the communities understanding of radon and its importance.	The project is ineffective in raising the communities understanding of radon and its importance.

Evaluation Area	Maximum Score	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
Overall Presentation	10								
Text Information	10								
Graphics and Images	5								
Community Value	5								
Total	35								

Culminating Project Storyboard Activity Sheet



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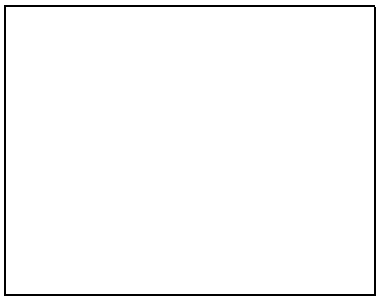

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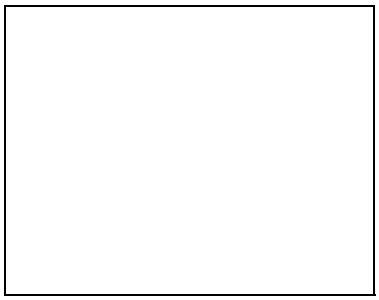

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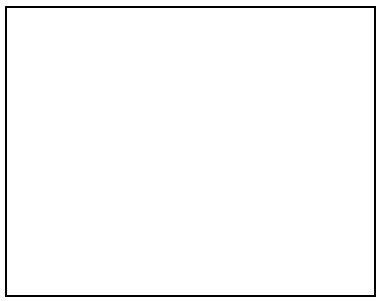

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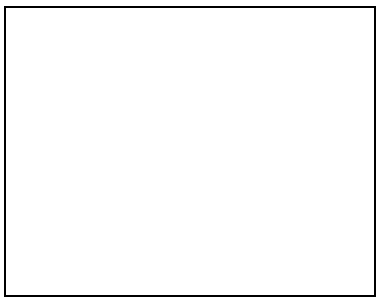

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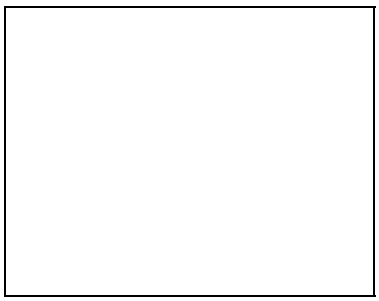

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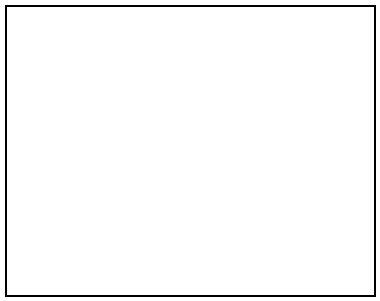

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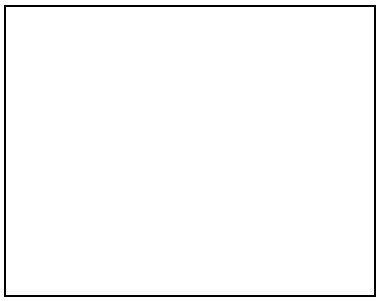

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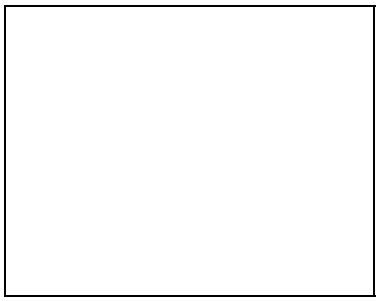

9

MEAT: Diet Choice and Coercion, Part I: Man's Evolving Diet

Time Commitment: Two 60-Minute Periods
Grade Levels: 11-12

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Overview

Cooperative structure of the lesson:
Some activities will be done in pairs. Students may self-select partners. There is a role playing activity. Groups will be required to cast themselves in these roles. In the ***Inspiration*** activity, students will form groups of three to five (depending on computer access).

Expected products from lesson:
Students will produce role plays illustrating chimp and hunter-gatherer behavior; they will understand the evolutionary background, physiology, and the genetics of dietary choice and will become familiar with***Inspiration*** software.

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Instructional Technology Resources

Internet Sites:

Biohealth Link Web site
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html

EnviroHealth Review, Edition Two
http://www.mpt.org/learningworks/teachers/ehl/review/990910.html
The lesson contains readings from **Guns, Germs, and Steel**. Follow the link to "This Issue's Theme." Scroll to: "The past is the key to our health's destiny". Several valuable links for research may be found here.

Ditto,com http://www.cancergenetics.org/home.htm
A comprehensive look at the role of genes in cancer, includes tutorials, images, and case studies of cancer patients.

Chronic Hunger and Obesity Epidemic Eroding Global Progress
http://www.worldwatch.org/alerts/000304.html
This is a press release from the Worldwatch Institute. It is a summary of a 68-page paper on world-wide malnutrition—including obesity—and its affect on health. Students will do a reading based on this site.

InteliHealth http://www.intelihealth.com/IH/ihtIH/WSIHW000/408/7046.html
Sign on to this free subscription of Johns Hopkins University, and teachers (or students) will be kept abreast of latest medical developments.

Educational Software:

- ***Inspiration***

Inspiration Software, Inc.
7412 SW Beaverton Hillsdale Hwy, Suite 102,
Portland, OR 97225-2167
http://www.inspiration.com

Spreadsheet Software:

- ***Microsoft Excel***

For graphing activity, teacher has option of using graph paper or spreadsheet software.

Multimedia Software:

- ***Microsoft PowerPoint***

PowerPoint is used in all lecture/discussions. It will also be used for making "instant scenery".

Video:

- ***Senses and Sensitivity***

#1 Sensory Transduction: Getting the message. Howard Hughes Medical Institute Holiday lectures on Science, 1997. For availability see Web site at: http://www.hhmi.org

Other Technology:

- Scanner
- Digital Projector

OTHER INSTRUCTIONAL RESOURCES

Books:

Chagnon, N.A. 1977, Yanamamo, the fierce people. Holt, Rinehart and Winston

Diamond, J. 1999, Guns, Germs, and Steel. Norton and Company, New York, NY

Goodall, J. 1986, The Chimpanzees of Gombe. Belknap Press, Cambridge, MA

Murphy, R.F. 1979, Cultural and Social Anthropology. Prentice Hall Inc. Englewood Cliffs, New Jersey

Wilson, E.O. 1978, On Human Nature. Harvard University Press, Cambridge, MA

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Teacher/Student Background Information

The historical/evolutionary expanse of this lesson was informed by **Guns, Germs, and Steel**, by the biologist, Jared Diamond. This is a must-read for teachers in that it demonstrates invaluable connections between biology and history. The paper, *Overfed and Underfed: The Global Epidemic of Malnutrition* is also worth reading in its entirety. This is a work that is at the intersection of biology, economics, and politics. It may be downloaded from http://www.worldwatch.org for $5.00. Lastly, the McLibel site, http://www.mcspotlight.org/case/index.html gives an insight on how people in other countries approach marketing and its social relations. Particularly interesting is the protection given in Britain to children against advertisers.

Students engaging in this lesson must have had exposure to molecular heredity concepts (protein synthesis, etc.), the cell cycle, gene regulation, and evolution. The lesson would be suitable as a culminating activity after these topics have been taught. Or, alternatively, it may be used to teach them.

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Vocabulary

Evolution—the change in a population's genetic composition

Hunter-Gatherer Society—the way of life practiced by our ancestors.
Forage—to search for food
Protein Synthesis—the making of protein from a DNA and RNA template
DNA—a molecule which codes for proteins and its own replication
Domestication—in an evolutionary context, an organism whose genetic nature has been altered to better serve the needs of Man
Altruism—the performance of a behavior which is apparently in the interest of someone else

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Learning Objectives

The following Core Learning Goals are addressed in this lesson:
Content:
Expectation 3.1
The student will be able to **explain** the correlation between the structure and function of biologically important molecules and their relationship to cell processes.

Expectation 3.2
The student will **demonstrate** an understanding that all organisms are composed of cells, which can function independently or as part of multicellular organisms.

Expectation 3.4
The student will **explain** the mechanism of evolutionary change

Expectation 3.5
The student will **investigate** the interdependence of diverse living organisms and their interactions with the components of the biosphere.

Expectation 3.6
The student will **investigate** a biological issue and develop an action plan.

Technology:
Expectation 4.2
The student will use technologies effectively for a variety of purposes and situations.

Indicator 4.2.1
The student will use technologies in a safe and effective manner.

Indicator 4.2.2
The student will use technologies in a legal and ethical manner.

Indicator 4.2.3
The student will use appropriate technologies to access, store, manage, analyze, and communicate information.

Indicator 4.2.4
The student will use appropriate technologies for research, creativity, and problem solving.

Indicator 4.2.5
The student will monitor, evaluate, and plan to improve personal uses of technologies.

Expectation 4.3
The student will demonstrate an understanding of the impact of technologies on individuals, society, and the environment.

Indicator 4.3.1
The student will analyze the effects of technologies on individuals, society, and the environment.

Indicator 4.3.2
The student will evaluate the effects of technologies in individuals, society, and the environment.

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Lesson Assessment

Content:
- Four point rubrics for "Meat Society", "Physiology and Genes for Taste" worksheets

Technology:
- Four point rubric for "Domesticating Beasts Timeline" ***Inspiration*** activity
- Four point rubric for "Mammalian Candidates" graphing activity using ***Excel*** software

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Materials Needed

(Per student)
- Student Resource Packet including all worksheets and readings
- "Meat Society" Readings
- "Biting Zebras" ***PowerPoint*** Worksheet
- "Enticing Children" Script
- "Tongue Physiology and the Genetics of Taste" Worksheet and Concept Map
- "Yali's Question" Homework Assignment

- "Mammalian Candidates" Graphing Worksheet
- "Ancient 14" Reading
- "Domesticating Beasts" Timeline
- *Inspiration* activity

(Per class)
- Computer with Internet access
- VCR and monitor
- Digital Projector
- Steel sheet and cut magnetic business cards
- Taste papers may be ordered from *Carolina Science and Math* catalogue: Human Genetics Set BA-17-3850 @ $25.50 per set (for a class of 30)

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Procedures

This lesson uses many group activities. In its dramatizations it uses unique sensory modalities. Contructivism is the guiding pedagogic philosophy. Students are required to build on current knowledge and to question their misconceptions. Above all, they are active participants in this lesson.

The technology configuration may be adjusted to the teacher's requirements. Ideally, there should be five or six computers with Internet access in the classroom. To facilitate ***PowerPoint*** presentations and "instant scenery", teacher should have access to a digital projector.

No special accommodations for special needs students are required as students will be working in teams (or cooperative groups) and will be able to assist each other.

Day 1: Man and Meat: the evolution of man's fondness for meat

Set-up Directions:
Teacher will need to photocopy student resource packets, and set up a computer with a digital projector and video capability. Teacher will need to purchase taste strips from Carolina Biological Co.

Teacher Presentation & Motivation:
This part is accompanied by a ***PowerPoint*** presentation **(recommended for use with Windows operating system and Microsoft Internet Explorer 4.0 or later)**. Images and information may be found at *The Jane Goodall Institute* Web site at http://www.janegoodall.org/When Jane Goodall was a young woman she went to live at Gombe Stream National Park in Tanzania, Africa. Since the 1960s she has been studying chimpanzees. She is now the world's expert on chimp behavior. When our closest relatives make a kill they use the meat to establish and solidify relationships. If you are chimp who is trying

to get ahead, kill a bush-pig and offer it to some other chimps. If you don't like a chimp, or want to show it how out-of-favor it is, deny it your meat. Such behaviors are very similar in hunter-gatherer societies. We and the chimps may have inherited this meat altruism from a common ancestor.

Activity 1: Meat Society readings and role play:
Student groups interpret separate readings and act them out for the class. Teacher encourages discussion on the role of meat and meat eating in shaping chimp and human societies.

After this the teacher says: "Why do we like meat? Do we *learn* to appreciate some foods or is there a genetic component to our diet choice? Newborn babies will suckle longer from a bottle of sugar water than pure water. What can you infer from this? (the fondness for sugar is genetic). Okay. But what about meat? Did you read anything that might convince you one way or the other? (Almost all human societies eat a diet in which meat takes up about 35%.) Let us assume for a minute that our fondness for meat is genetic. How can genes *make* you like a certain food? Look at this short video. At the end I will ask you: How does the brain receive flavors?" **FAST FORWARD** *Sensory Transduction: Getting the message* to the part where Dr. Hedgpeth is showing taste buds. **STOP** film before he does taste strip lab with students. Say: "We studied genes and protein synthesis. You know that we inherit our genes from our parents. But what does this have to do with protein synthesis and taste? Can you connect these concepts?"

Activity 2: Taste Strips:
Teacher and students try different taste strips. This activity demonstrates that different receptors on the tongues of different people, sense tastes differently.

Activity 3: Physiology and Genes of Taste:
Students complete "Tongue Physiology and Genetics of Taste" Worksheet and Concept Map.

Activity 4: **Yali's Question homework assignment:**
Say: "Before we leave today I would like to introduce tomorrow's activity. We are going to look at a very controversial question: 'Yali's question.' This reading is for homework tonight. In the space provided write a paragraph giving your answer to Yali's question. I will read these answers in class tomorrow."

Day 2: Yali's Question and the domestication of meat-giving species

Set-up Directions:
Same as Day 1.

Teacher Presentation & Motivation:
Students re-read Yali's question. Teacher reads homework responses anonymously and discusses this central issue with the class. The issue is why did Europeans and Asians acquire more technology than other countries? Why was it they who

conquered Africans, native Australians and Americans? One answer to this question brings us closer to our goal of understanding why we eat what we do. On the dust jacket of *Guns, Germs, and Steel* is a picture of Pizarro seizing the Inca. It is a portrayal of the Breviary incident. Discuss this with students as an example of technology-assisted colonialism. Pizarro's priest, Father Val Verde, attempted to offer the Inca King the word of God. The king may have thrown the Breviary (a priest's Bible) to the ground. This was seen as justification for the subsequent massacre of the Inca soldiers, and the ransom of the King. The Inca brought a room full of gold for the release of their king. But he was exectuted anyway. With only 62 horsemen and 106

foot-soldiers, Pizarro was able to conquer Peru, a land with millions of inhabitants. Again, why was it that the Europeans possessed the technologies of conquest: artillery, armour, horses, and metallurgical superiority in forging swords and other implements of war? The most obvious answer to Yali's question, to the Eurasian's at least, was that they were more advanced; they deserved to conquer the world. One of the most commonly cited examples was their cultural superiority in being able to domesticate wild animals. These animals provided milk, products, fertilizer, transport, plow power, wool—and, of course, meat. But it was the big domesticated animals that were the most important. And only the Eurasians maintained domesticated herds of big animals. Teacher shows slide of history of domestication, and does slide show of the "Ancient Fourteen Species of Big Herbivorous Domestic Mammals." Students refer to this reading (see student resource packet). After this, pose the question again: Why the Eurasians?

Activity 1: Domesticating Beasts Timeline *Inspiration* activity:
Students construct a timeline using ***Inspiration*** software. They learn where and when familiar meat species were domesticated.

Activity 2: "Mammalian Candidates" graphing worksheet:
Students are given data and graphing paper. They must graph the data and answer questions on worksheet. They should come to the conclusion that continents other than Eurasia did not take advantage of the animals they had. Say: "From this activity you should conclude that the early Africans, Americans and Australians should have been able to domesticate animals."

Activity 3: Biting Zebras worksheet
This worksheet uses ***PowerPoint*** Notes Page function. Students should respond that the kind of animals available to non-Eurasians were unsuitable for domestication.

Say: "Tomorrow we are going to look at the mass production and marketing of meat. But, to get us in the mood, we are going to do a little play.

Activity 4: Enticing Children:
Using ***PowerPoint*** instant scenery, students perform short sketch. (see Student Resource Packet—"Enticing Children" script) dramatizing marketing strategies of food companies. After performance, say: "For homework tonight write a paragraph

about what you think the play means."

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Enrichment Options

Community Connection:
Students perform morality plays, such as *Enticing Children*, for community groups.

The answer to Yali's question is empowering. Students should carry this into their communities by advocating the reading of Guns, Germs, and Steel. To do this they must first have read it (see next section).

Interdisciplinary Extensions:

- **Social Studies**

Social studies teachers assign passages from Guns, Germs, and Steel, and work on interdisciplinary units with science teachers. Students study the conquest of Peru

- **Technology**

In a science or social studies class, students study the effect of critical technologies, e.g., the printing press, or the automobile, on the development of human society. Students study the unintended consequences of certain technologies, e.g., the automobile causing suburban sprawl. Another focus could be the technologies of domination: which technologies contributed the most to the ability of Europeans to colonize the Third World?

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

John Bois & Ed Dieterle

Name _____ Class _____ Date _____

Rubrics for Lesson 1

Rubric for "Meat Society"

Point value	Concept attainment	Performance/Presentation
3	In their performance/presentation, students demonstrate full understanding of readings	Students performance/presentation is well organized and interesting
2	…good understanding of readings but they have missed an important point	…well organized but not interesting
1	…some understanding but missed the main point of the reading	..disorganized and uninteresting
0	…no understanding	Students have not prepared any presentation

Rubric for "Tongue Physiology and the Genetics of Taste" Worksheet and Concept Map

Point value	Concept attainment	Completion
3	Student demonstrates concept attainment in all questions	Student has completed all sections of worksheet
2	…in most questions	…most sections…
1	…in some questions	…some
0	…in no questions	…no…

Rubric for "Mammalian Candidates" graphing activity

Point Value	Graph Characteristics	Data Presentation
3	Both axes are labeled (including units); scale is accurate on axes; the graph has a title	Data is presented accurately and neatly

2	Any one of the above is missing or inaccurate	Data is presented accurately, but not neatly
1	Any two of the above are missing or inaccurate	Data is presented with some inaccuracy regardless of neatness
0	More than two of the above are missing or inaccurate	Data is completely inaccurate

Rubric for Inspiration activities: "Domesticating Beasts Timeline"

Point Value	**Quality of work**	**Mastery of Software**
3	Student group has effectively used software to generate creative research ideas/an accurate timeline	All members of the group are able to use the software
2	…effectively used software to generate research ideas/a mostly accurate timeline	Most members of the group…
1	…used software but few ideas have been generated/timeline is inaccurate	Some members of the group…
0	Students have produced nothing	No members of the group…

Name _____ Class _____ Date _____

Meat Society Readings

Underlined words should be defined by the whole class before reading begins. A game modeled on the $64,000 Pyramid may be used to reinforce meanings. Teacher points to a word on the blackboard. One student gives clues (verbal and/or action) to another student who cannot see the blackboard. How many words can a pair of students define in one minute?

After vocabulary exercise, students are broken into six acting troupes. Four groups read their assigned reading and perform it for the class. However, the first performance should be by two groups who have not read anything about the subject. One will be asked to simply act out chimpanzee behavior in hunting; the other will role play how they think meat was obtained and shared in early hunter-gatherer society.

Reading 1: On Human Nature, by E.O. Wilson.

Like primitive human beings, chimpanzees gather fruit and other vegetable foods primarily and hunt only secondarily. The difference between their diets is one of proportion. Where all of hunter-gather-societies considered together derive an average of 35 percent of their calories from fresh meat, chimpanzees obtain between 1 and 5 percent. And whereas primitive human hunters capture prey of any size, including elephants on hundred times the weight of a man, chimpanzees rarely attack any animal greater than one-fifth the weight of an adult male. Perhaps the most remarkable form of manlike behavior among chimpanzees is the use of intelligent, cooperative maneuvers during the hunt. Normally only adult males attempt to pursue animals – another humanoid trait. When a potential victim, such as a vervet or young baboon, has been selected, the chimpanzees signal their intentions by distinctive changes in posture, movement, and facial expression. Other males respond by turning to stare at the target animal. Their posture is tensed, their hair partially erected, and they become silent – a conspicuous change from the human observer's point of view, because chimpanzees are ordinarily the noisiest of animals. The state of alertness is broken by a sudden, nearly simultaneous pursuit.

The distribution of meat is also cooperative, with favors asked and given. The begging chimpanzee stares intently while holding its face close to the meat or to the face of the meat eater. It may also reach out and touch the meat and the chin and lips of the other animal, or extend an open hand with palm upward beneath his chin. Sometimes the male holding the prey moves abruptly away. But often he acquiesces by allowing the other animal to chew directly on the meat or to remove small pieces with its hands. On a few occasions males go so far as to tear off pieces of meat and hand them over to supplicants. This is a small gesture by the standards of human altruism but it is a very rare act among animals—a giant step, one might say, for apekind.

Reading 2: The Chimpanzees of Gombe, by Jane Goodall

When eating small prey, such as infant colobus or piglets, a chimpanzee typically begins with the head. He bites open the skull, sucks the blood then consumes the brain. This was the method employed in thirty-two out of the thirty-four well-observed infant or small juvenile colobus prey, most bushipglets, and the three bushbuck fawns when only one or two individuals were present at the capture. When an older prey is involved, the viscera are typically eaten first (as they were in the remaining two colobus infants).

Meat is a highly coveted food and often there is intense aggressive competition around a kill. This aggression comprises (a) attacks on possessors of meat by those who have none, (b) attacks or, more usually, displays or threats by possessors toward individuals trying to share their prey. And (c) attacks or threats directed by those who have not managed to acquire portions toward lower-ranking individuals who are also trying to get some meat.

At Gombe adult chimpanzee rarely share plant foods. Excluding bananas, Wrangham noted only five instances during his eighteen-month study; four times this involved…fruits. McGrew (1975) analyzed the sharing of bananas: 86 percent of the observed cases involved family members, almost always mothers sharing with infants. Most of the remaining instances were adult males sharing with females (and, occasionally, their infants).

By contrast, meat, which is not only highly prized but also available in relatively small amounts, is almost always shared (unless one individual manages to escape with a whole carcass). A possessor shares meat for a variety of reasons. For one thing, as Wrangham (1975) points out, the individual may have more than he needs, particularly after he has been feeding for a time, and it is not worth his while to keep moving from and/or threatening others who are eager for portions. There are occasions when the solicitations of begging chimpanzees makes it all but impossible for the possessor to feed; at the very least they are a source of irritation. If he dispenses pieces of meat, the recipients usually move off, sometimes followed by others. Even if the possessor only relinquishes chewed leaf-meat wedges, social harmony will temporarily be restored and he will be able t eat a few mouthfuls in peace.

Quite often a supplicant may be allowed to share the carcass with the possessor, or to break off a portion. Leaf-meat wedges are frequently deposited in the outstretched hand of a begging individual or are transferred directly from mouth, usually after the meat eater has extracted all he wants but sometimes after only a few chews. Occasionally the possessor breaks off a portion of meat and places it in the outstretched hand of a supplicant. On a few occasions possessors gave meat to individuals close by who were not overtly begging, although their intense interest in the food was obvious. This happened most often at the end of long meat-eating sessions. When a male sometimes handed over the entire remains of the carcass to the individual closest to him. Frequently this was a female.

Reading 3: Cultural and Social Anthropology, by Robert Murphy.

Reciprocity goes far beyond gift giving in all societies. American parents give freely to their children, who may not directly reciprocate by supporting them later but will pay back indirectly by raising their own children. Reciprocity underlies the family, but it is also found in almost all aspects of life in the simple performance of favors. "You scratch my back, and I'll scratch yours," goes a favorite American saying, which can be applied to economic transactions, political tradeoffs, and the mutual accommodations of friendship. Important though reciprocity may be, it does not bind our economy together by any means, for all of this is taking place within the framework of a vast system of markets and public finance.

There are, however, many primitive societies in which reciprocity is the only mode of exchange, in which there is no buying or selling, no taxing authority, no money. Nobody goes without food among the Mundurucu Indians, for most food is shared. An unfortunate group whose garden failed will be supported by their community. Kills of large game animals are distributed throughout the village. This is a form of risk sharing, for a man might be unlucky in hunting for weeks, and yet eat meat almost every night. If a man wants an arrow or some other object belonging to another man, he will usually be given it, with the tacit understanding that a similar claim can be made in return. Gift giving among the Mundurucu, and in most primitive societies, follow lines of kinship. A Mundurucu can make a heavier claim on a fellow clan member than on somebody from the opposite moiety, but reciprocity is also expected between neighbors regardless of kinship ties.

Reading 4: Yanomamo, the Fierce People, by Napoleon Chagnon.

The biggest meal of the day is prepared in the evening. The staple is plantain, but frequently other kinds of food are available after the days' activities. Meat is always the most desirable food and is always considered to be in short supply. It is a happy occasion when one of the hunters bags a tapir, for everyone gets a large share of it.

It is good to share meat with others. This attitude is expressed in the sentiment that a hunter should give away most of the game he kills. One of the obligations men take very seriously is providing adequate quantities of meat for their wives and children. They genuinely abhor hearing their children cry for meat; this calls into question their abilities as hunters and marksmen, both of which are associated with prestige. Rerebawa, for example, collected a large supply of game on one trip we took together. He gave it all to his wife and children and to his wife's parents. At the evening meal he refused to take a portion of the meat so that the others could have more. Later in the evening, he appeared at my hut begging for a can of sardines to satisfy his hunger for meat. He preferred to go hungry rather than risk the onus of being accused of poor marksmanship or stinginess.

Both sexes participate in the cooking, although the women do the greater share of it. Food preparation is not elaborate and rarely requires much labor, time, or paraphernalia. Spices are never used, although the salty ashes of a particular kind of tree are sometimes mixed with water to form a condiment of sorts. The food is dunked into the salty liquid and eaten.

Everyone eats in his hammock using his fingers for utensils. Some meals cannot be eaten from a reclining position, so the members

of the family squat in a circle around the common dish. For example, large quantities of tiny fish are cooked by wrapping them in leaves and cooking them in the hot coals. When the fish are done, the package is spread open, and everyone shares its contents.

Animals are never skinned before cooking. They are merely put over the fire after their entrails have been removed, and roasted head, fur, claws, and all. Most of the fur is singed off in the process of cooking. The animal is dismembered by hand. The head, particularly the head of a monkey, is highly prized because the brain is considered a delicacy. The most common meat is monkey, of which there are several varieties, so that this delicacy is enjoyed rather frequently by the Yanomamo.

Name _____ Class _____ Date _____

Enticing Children Script

Puppy: (*in a very sleazy voice***)** Psst! Hey, little kid. Come 'ere.

Little Kid: Hello, nice Puppy.. Ha, ha. You're so funny.

Puppy: Look at all these nice toys.

Kid: Gee! Thanks, Puppy.

Puppy: Sure, help yourself kid. Here, have some yummy food. It's delicious and it's almost **100 per cent pure animal fat**.

Kid: Mmmmm. Animal fat. Yummy.

Puppy: (*the Puppy waves a hamburger in front of the Kid's face. The Kid becomes hypnotized*.) Kid…

Kid: (*in monotone hypnotized voice*) Yes, Puppy.

Puppy: Whenever you see my picture I want you to think "Hamburger, made with 100 per cent yummy animal fat. And find a way, I don't care how you do it, but find a way to come to my meat store. OK, then?

Kid: OK, then.

Puppy walks off to side of stage but observes action.

Kid and parents are in a car (four chairs). Father is driving. Billboard of Puppy starts kid off.

Kid: (super whinny) I'm hungry. The Puppy. The Puppy. The Puppy. 100 per cent animal fat.

Puppy: (*from side of stage, evil laughter. Gives thumbs up sign to audience*). That's my boy.

Parents pull into a quaint Bed and Breakfast..

Father: I read about this quaint Bed and Breakfast in the travel section. They said the food here is world famous. It is the most delicious food in the whole world. Oh, boy! I can hardly wait *(begins getting out of the car).*

Kid: No! No! The Puppy. Take me to the Puppy.

Evil laughter from the Puppy.

Father: No, really. The food is great here.

Kid: (*tantrum)* The Puuuuppy! The Puuuuuppy!

Kid shakes his head uncontrollably from side to side.

Mother: Come on dear. Let's take him to the Puppy.

Father: You win. Puppy it is.

Puppy: That's my boy!.

For homework tonight:

Are you persuaded by advertisers to eat certain kinds of food?

1. Can you think of at least three comic characters used in the marketing of meat products today.

2. What age group do you think these characters are meant to influence?

3. Have you ever nagged your parents to go to a certain restaurants? Which fast food restaurant do you prefer? Why?

4. Write a short paragraph saying what this play means to you.

Name _____ Class _____ Date _____

Tongue Physiology and the Genetics of Taste Worksheet & Concept Map

1. Taste the brown strip. What do you taste?
2. Try the other two taste strips. Describe the flavor (or lack of flavor) of each.
3. Look at the picture of a taste bud. Observe the receptors on the microvilli. What do these receptors bind?
4. What organic macromolecules are all receptors made of?
5. Can you give some examples of other receptors in other specialized cells?
6. Proteins are constructed from monomers called_____.
7. The sequence of these monomers is determined by the sequence of _____.
8. Complete this concept map. Write words that complete the syntax. For example: in the space between "Genes" and "DNA", write "are made of".

Here is a quote from The Worldwatch Institute's latest news release: "In theory, companies could promote nutritious foods, such as apples and carrots, instead of potato chips and cookies. (But) they know that consumers will always have a special interest in these products (because they have) an innate preference for them." Write a paragraph arguing whether it is possible to have innate preferences for a particular kind of food.

Name _____ Class _____ Date _____

Mammalian Candidates Graphing Worksheet

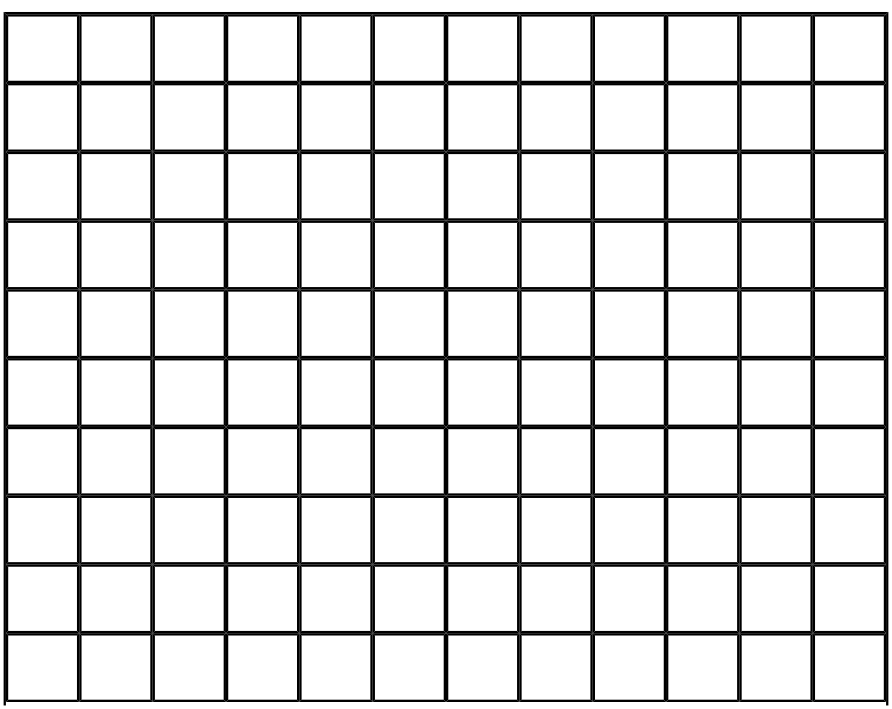
Mammalian Candidates for Domestication

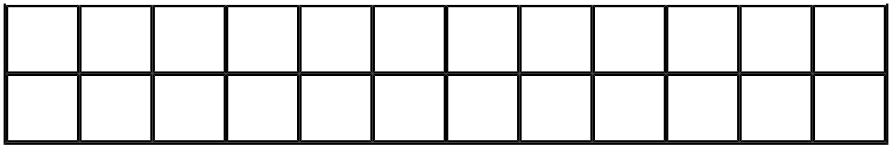
	Eurasia	**Sub-Saharan Africa**	**The Americas**	**Australia**
Candidates	72	51	24	1
Domesticated Species	13	0	1	0
Percentage of Candidates Domesticated	18%	0%	4%	0%

A "candidate" is defined as a species of terrestrial, herbivorous or omnivorous, wild mammal weighing on the average over 100 pounds

Draw a bar graph showing Candidates, Domesticated species, and Percentage of candidates domesticated for each of the four regions.

Title: _____





What conclusions can be drawn from this graph? Which Continent domesticated the most animals?

1. What can be said of Sub-Saharan Africa?

2. In what sense does this confirm the philosophies of European superiority?

3. Can you explain the low number of Australian candidates?

Name _____ Class _____ Date _____

Ancient Fourteen Reading

The Ancient Fourteen Species of Big Herbivorous Domestic Mammals

The Major Five

1. Sheep. Wild ancestor: the Asiatic mouflon sheep of West and Ventral Asia. Now worldwide.

2. Goat. Wild ancestor: the bezoar goat of West Asia. Now worldwide.

3. Cow; alias ox or cattle. Wild ancestor: the now extinct aurochs, formerly distributed over Eurasia and North Afirca. Now worldwide.

4. Pig. Wild ancestor: the wild boar, distributed over Eurasia and North Africa. Now worldwide. Actually an omnivore (regularly eats both animal and plant food), whereas the other 13 of the Ancient Fourteen are more strictly herbivores.

5. Horse. Wild ancestor: now extinct wild horses of southern Russia; a different subspecies of the same species survived in the wild to modern times as Przewalski's horse of Mongolia. Now worldwide.

The Minor Nine

6. Arabian (one-bumped) camel. Wild ancestor: now extinct, formerly lived in Arabia and adjacent areas. Sitll largely rstricted ot Arabia and northern Africa, though feral in Australia.

7. Bactrian (two-bumped) camel: Wild ancestor: now extinct, lived in Central Asia. Still largely confined to Central Asia.

8. Llama and alpaca. These appear to be well-differentiated breeds of the same species, rather than different species. Wild ancestor: the guanaco to the Andes. Still largely confined to the Andes, although some are bred as pack animals in North America.

9. Donkey/ Wild ancestor: the African wild ass of North Africa and formerly perhaps the adjacent area of Southwest Asia. Originally confined as a domestic animal to North Africa and western Eurasia, more recently also used elsewhere.

10. Reindeer. Wild ancestor: the reindeer of northern Eurasia. Still largely confined as a domestic animal to that area, though now some are also used in Alaska.

11. Water buffalo. Wild ancestor lives in Southeast Asia. Still used as a domestic animal mainly in that area, though many are also used in Brazil and others have escaped to the wild in Australia and other places.

12. Yak. Wild ancestor: the wild yak of the Himalayas and Tibetan plateau. Still confined as a domestic animal to that area.

13. Bali cattle. Wild ancestor: the banteng (a relative of the aurochs) of Southeast Asia. Still confined as a domestic animal to that area.

14. Mithan. Wild ancestor: the guar (another relative of the aurochs) of Indian and Burma. Still confined as a domestic animal to that area.

Name _____ Class _____ Date _____

Domesticating Beasts Timeline

Using the data below, and Inspiration software, construct a timeline illustrating the domestication of animals.

Species	Date (B.C)	Place
Dog	10,000	South Asia, China, North America
Sheep	8,000	Southwest Asia
Pig	8,000	China, Southwest Asia
Cow	6,000	Southwest Asia, India, (?) North Africa
Horse	4,000	Ukraine
Camel	2,500	Central Asia, Arabia

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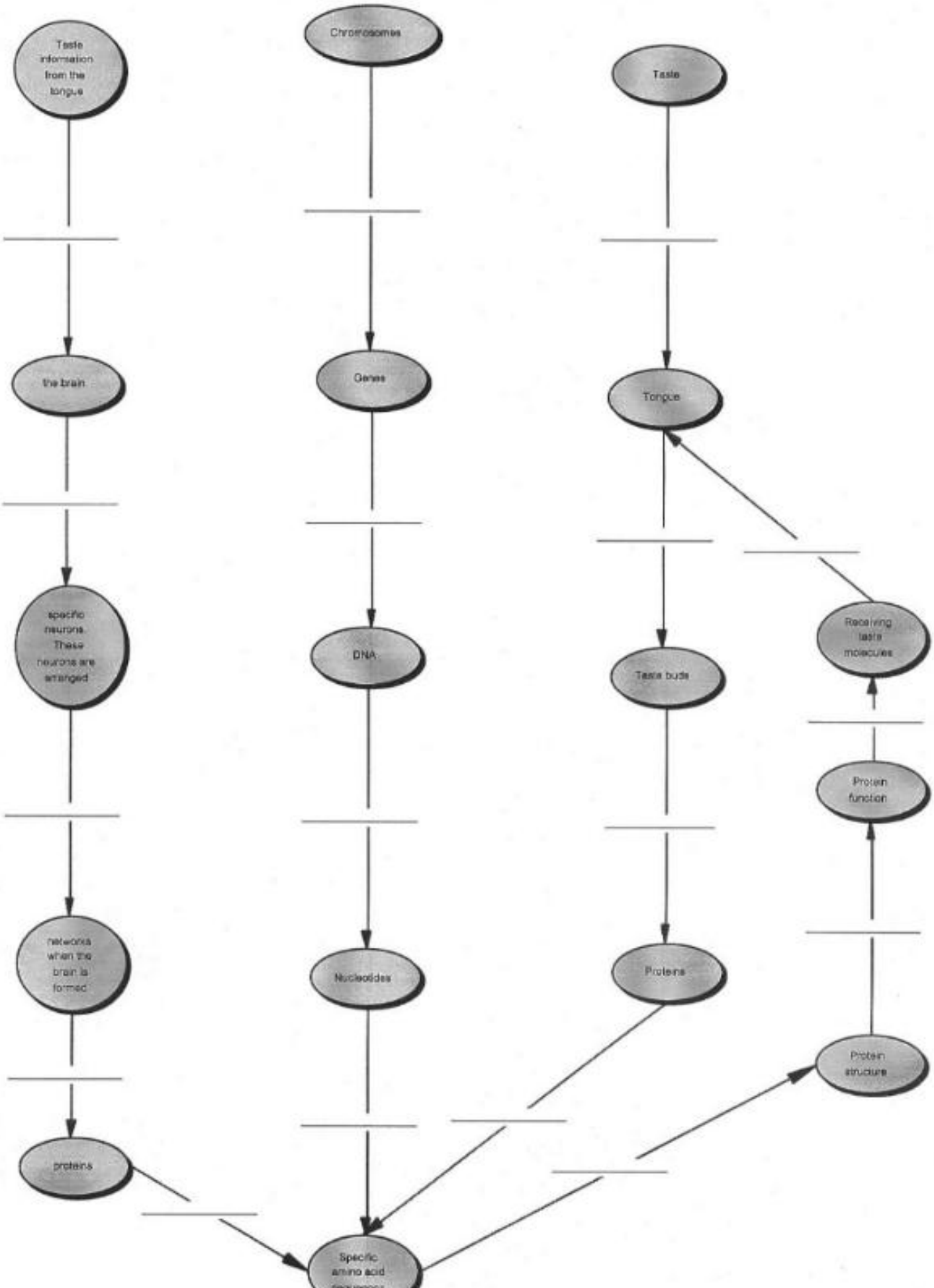

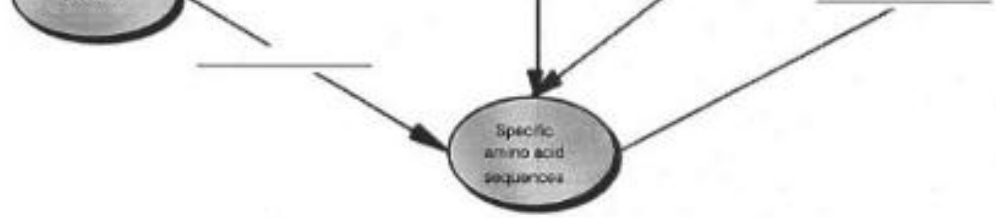
Specific
amino acid
sequences

Name _____ Class _____ Date _____

Yali's Question Homework Assignment

From, Guns, Germs, and Steel, by Jared Diamond.

After a while, Yali turned the conversation and began to quiz me. He had never been outside New Guinea and had not been educated beyond high school, but his curiosity was insatiable. First, he wanted to know about my work on New Guinea birds (including how much I got paid for it). I explained to him how different groups of birds had colonized New Guinea over the course of millions of years. He then asked how the ancestors of his own people had reached New Guinea over the last tens of thousands of years, and how white Europeans had colonized New Guinea within the last 200 years.

The conversation remained friendly, even though the tension between the two societies that Yali and I represented was familiar to both of us. Two centuries ago, all New Guineans were still "living in the Stone Age." That is, they still used stone tools similar to those superseded in Europe by metal tools thousands of years ago, and they dwelt in villages not organized under any centralized political authority. Whites had arrived, imposed centralized government, and brought material goods whose value New Guinea instantly recognized, ranging from steel axes, matches, and medicines to clothing, soft drinks, and umbrellas. In New Guinea all these goods were referred to collectively as "cargo."

Many of the white colonialists openly despised New Guinea as "primitive." Even the least able of New Guinea's white "masters," as they were still called in 1972, enjoyed a far higher standard of living than New Guineans, higher even than charismatic politicians like Yali. Yet Yali had quizzed lots of whites as he was then quizzing me, and I had quizzed lots of New Guineans. He and I both knew perfectly well that New Guineans are on the average at least as smart as Europeans. All those things must have been on Yali's mind when, with yet another penetrating glance of his flashing eyes, he asked me, "Why is it that you white people developed so much cargo and brought it to New Guinea, but we black people had little of our own?"

It was a simple question that went of the heart of life as Yali experienced it. Yes, there still is a huge difference between the lifestyle of the average New Guinean and that of the average European or American. Comparable differences separate the lifestyles of other peoples of the world as well. Those huge disparities must have potent causes that one might think would be obvious.

Although Yali's question concerned only the contrasting lifestyles of New Guineans and of European whites, it can be extended to a larger set of contrasts within the modern world. Peoples of Eurasian origin, especially those still living in Europe and eastern Asia, plus those transplanted to North Americas, dominate the modern world in wealth and power. Other peoples, including most Africans, have thrown off European colonial domination but remain far behind in wealth and power. Still other peoples, such as the aboriginal inhabitants of Australia, the Americas, and southernmost Africa, are no longer even masters of their own lands but have been decimated, subjugated, and in some cases even exterminated by European colonialists.

Thus, questions about inequality in the modern world can be reformulated as follows. Why did wealth and power become distributed as they now are, rather than in some other way? For instance, why weren't Native Americans, Africans, and Aboriginal Australians the ones who decimated, subjugated, or exterminated Europeans and Asians?

QUESTIONS

1. Explain what Yali meant by the word, "cargo"?

2. New Guineans are described as "Stone Age". List four other countries or continents that Diamond considers behind Eurasian cultures in wealth and power.

3. Have you ever wondered, like Yali, why things are the way they are? Do have an answer to Diamond's important question: "…why weren't Native Americans, Africans, and Aboriginal Australians the ones who decimated, subjugated, or exterminated Europeans and Asians?" Write a paragraph (at least three sentences) stating why you think this is true.

MEAT: Dietary Choice and Coercion, Part II:
The Effect of Diet Choice on Community Health and Happiness

Time Commitment: Four 60-Minute Periods
Grade Levels: 11-12

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Overview

This lesson, which concerns meat in modern human ecology, is a four period long unit and views many aspects of the human condition through one filter: our fondness for meat. Students will learn how meat marketers control dietary choice, and how such choices may lead to an increase in cancer rates. They will also study the cellular mechanisms, epidemiology, and the potential cures, diagnosis, and prevention of colorectal cancers.

Cooperative structure of the lesson:
(Note: The play "Enticing Children" is performed in Lesson one as a lead in to Lesson 2. If Lesson 1 is omitted, the play should be performed to start Lesson two).

One of the class readings is a jigsaw activity. Each group shall have the following roles: reader, note-taker, discussion director, and presenter. The culminating class project should be done in groups of four to five. Depending upon the kind of research project chosen by a group, roles should be established in class and accountability assured.

Expected products from lesson:
Students will design and present a research project. They will know how most cancers begin; they will complete two interactive on-line activities; they will learn that large profits are a strong motivation for selling unhealthy foods, specifically, foods high in fat content; they will discuss and debate in a mock trial the ethics of marketing to young children in order to create life-long consumers.

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Instructional Technology Resources

Internet Sites:
Biohealth Link Web Site
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html

Internet Project Web Site
http://www.kn.pacbell.com/wired/fil/pages/listinternetcy1.html

The Genetics of Cancer http://www.cancergenetics.org/home.htm
A comprehensive look at the role of genes in cancer, includes tutorials, images, and case studies of cancer patients.

Chronic Hunger and Obesity Epidemic Eroding Global Progress
http://www.worldwatch.org/alerts/000304.html
This is a press release from the Worldwatch Institute. It is a summary of a 68 page paper on world-wide malnutrition—including obesity—and its affect on health. Students will do a reading based on this site.

Howard Hughes Medical Institute's Biomedical Research: "p53 Molecule of the year" http://www.hhmi.org/communic/annrep/research/p53.htm
Details some of the molecular events of tumor development.

CancerNet: Colon and Rectal Cancer
http://cancernet.nci.nih.gov/Cancer_Types/Colon_And_Rectal_Cancer.shtml#genetics
A comprehensive resource for specific cancer types. Will be used by students in their research.

InteliHealth http://www.intelihealth.com/IH/ihtIH/WSIHW000/408/7046.html
Sign on to this free subscription of Johns Hopkins University, and teachers (or students) will be kept abreast of latest medical developments.

NCBI Genes and Disease http://www.ncbi.nlm.nih.gov/disease/p53.html
This site contains some molecular imagery, including sites of genetic diseases.

Your Cancer Risk http://www.yourcancerrisk.harvard.edu/index.htm
One of the lesson's activities: students estimate their chance of getting colon cancer by entering information into this risk calculator.

BrainPop Flash Videos on Cancer
http://www.brainpop.com/health/diseases/cancer/index.asp
An award winning Flash video site that explains the differences between malignant and benign cells, cancer at the cellular and system level, metastasis, and how cancer can be treated in language design for students.

Educational Software:

- ***Inspiration***

Inspiration Software, Inc.
7412 SW Beaverton Hillsdale Hwy, Suite 102,
Portland, OR 97225-2167
http://www.inspiration.com

Multimedia Software:

- ***Microsoft PowerPoint***

PowerPoint is used in all lecture/discussions. It will also be used for making "instant scenery".

Other Technology:

- Scanner
- Digital Projector

OTHER INSTRUCTIONAL RESOURCES
Books:

Gardner, G. and B Halwell 2000, Overfed and Underfed. Worldwatch Paper 150 Worldwatch Institute Washington, DC

Klein, N. 2000, No Logo. Alfred A. Knopf Canada, Toronto Ontario

Lasn, K. 1999, Culture Jam: The Uncooling of America.Eagle Brook William Morrow and Co., New York, NY

Sinclair, U., 1906, The Jungle. Penguin Books, New York, NY

The paper, Overfed and Underfed: The Global Epidemic of Malnutrition is worth reading in its entirety. This is a work that is at the intersection of biology, economics, and politics. It may be downloaded from http://www.worldwatch.org for $5.00. The McLibel site, http://www.mcspotlight.org/case/index.html gives an insight on how people in other countries approach marketing and its social relations. Particularly interesting is the protection given in Britain to children from advertisers.

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Teacher/Student Background Information

Students engaging in this lesson may have had exposure to molecular heredity concepts (protein synthesis, etc.), the cell cycle, gene regulation, and evolution. The lesson would be suitable as a culminating activity after these topics have been taught. Or, alternatively, it may be used to teach them.

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Vocabulary

Cell Cycle – sequence of events in the life of a cell
Gene regulation – control of gene expression
Tumor – the structure formed when there is loss of control of cell division
Polyp – pre-cancerous growth
Malignant – a tumor whose cells are spreading beyond the original site
Benign – a tumor which is not yet spreading
Metastasis – the process of spreading cancer cells

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Learning Objectives

The following Core Learning Goals are addressed in this lesson:
Content:

Expectation 3.1
The student will be able to **explain** the correlation between the structure and function of biologically important molecules and their relationship to cell processes.

Expectation 3.2
The student will **demonstrate** an understanding that all organisms are composed of cells which can function independently or as part of multicellular organisms.

Expectation 3.5
The student will **investigate** the interdependence of diverse living organisms and their interactions with the components of the biosphere.

Expectation 3.6
The student will **investigate** a biological issue and develop an action plan.

Indicator 4.1.2
The student will **identify** and **describe** current technologies used to meet a variety of needs, including accessing and managing information, communicating, performing work, and solving problems in a variety of situations.

Indicator 4.1.4
The student will **identify** needs not being met by current technologies and emerging technological solutions that may meet those needs.

Technology:
Expectation 4.2
The student will use technologies effectively for a variety of purposes and situations.

Indicator 4.2.1
The student will use technologies in a safe and effective manner.

Indicator 4.2.2
The student will use technologies in a legal and ethical manner.

Indicator 4.2.3
The student will use appropriate technologies to access, store, manage, analyze, and communicate information.

Indicator 4.2.4
The student will use appropriate technologies for research, creativity, and problem solving.

Indicator 4.2.5
The student will monitor, evaluate, and plan to improve personal uses of technologies.

Expectation 4.3
The student will demonstrate an understanding of the impact of technologies on individuals, society, and the environment.

Indicator 4.3.1
The student will analyze the effects of technologies on individuals, society, and the environment.

Indicator 4.3.2
The student will evaluate the effects of technologies in individuals, society, and the environment.

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Lesson Assessment

Content:
- Four point rubrics for "Epidemiology", "Underfed and Overfed" activity worksheets
- Four point rubric for "Fast Food Debate"

Technology:

- Four point rubric for "Research Brainstorming" ***Inspiration*** activity
- Four point rubric and scoring tool for Research Presentation

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Materials Needed

(Per student)
Student Resource Packet including all worksheets and readings

- "Underfed and Overfed" Worksheet
- "Epidemiology" Worksheet
- "Fiber No Help" Reading
- "Topics For Research" Activity
- The Jungle Reading

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Procedures

Day 1: Symptoms and cells

Set-up Directions:
If computers are available, check they are operational and can connect to the Internet.

Teacher Presentation & Motivation:
Say: "All right. What was that little play about?

The Worldwatch Institute, an organization dedicated to the idea of sustainable growth and stewardship of the environment, has just announced the following health facts:

'For the first time ever the number of underweight people equals the number of overweight (1.1 billion).

Obesity costs Americans $118 billion each year, diseases caused by smoking cost only $47 billion.

According to Worldwatch, 'In the modern food environment, we're like children in a candy shop, everyday of our lives.' And: 'The corporations have made a food environment in which unhealthy food is everywhere. The industry has shaped consumer demand, largely by advertising.'

Today we are going to look closely at one health problem that is affected by a fatty diet—colon cancer. Tomorrow, we'll look more closely at the marketing of meat.

Teacher introduces subject of cancer. First, symptoms (via ***PowerPoint***).

Activity 1: Epidemiology Worksheet:
Students toss small magnetic strips onto a steel sheet. The pattern is random but appears clustered. Teacher directs the completion of the **Epidemiology Worksheet**. Teacher continues with instruction on symptoms.

Activity 2: Cancer Assessment Web Site:
Students go to Web site, *Assessing Your Cancer Risk,* to assess their own risk of getting colon cancer. http://www.yourcancerrisk.harvard.edu/index.htm

Activity 3: Cell Cycle Web Site:
Teacher and/or students go to Web site to engage in activity.
http://www.biology.arizona.edu/cell_bio/activities/cell_cycle/cell_cycle.html

This interactive activity teaches students that cells are programmed to spend specific amounts of time in certain phases. When this system goes awry, a tumor may result.

Teacher then instructs the class as to how cancer operates at the cellular level. Teacher reviews (or teaches) the cell cycle. The stages of tumor development are shown via ***PowerPoint***

Day 2: Debating the Marketing of Diet

Set-up Directions:
Teacher sets up a mock trial (see instructions **Activity 2: Mock Trial**).

Teacher Presentation & Motivation:
Say: "One of the fascinating things about biology is how it intersects with so many issues. Today we're going to explore how society should confront the issue of increasing obesity. Who is to blame? Can anything be done to improve the health of our country?"

Activity 1: Underfed and Overfed Reading:
Students participate in a jigsaw in which seven groups read a section of an article (see instructions in **Underfed and Overfed Reading**).

Activity 2: Mock Trial:
"The Puppy" fast food chain has been accused of targeting children. Say: "Listen to this question: Is "The Puppy" really so different from Joe Camel? On a sheet of paper, write one argument for each side. We will read them out loud in a minute." After statements have been read, say: "Now, write down 'yes' if you agree with that statement; 'No' if you don't." Divide class into two sides based on student's answer. Select three judges from among students who can't decide. Say: "Each group must pick a lawyer to give opening statements. After that anyone can contribute. Now, gather together and plan your best arguments in order to convince our three wise judges that you are right."

Tell the judges to step outside for five minutes. Tell them to control the proceedings fairly, asking questions of both sides. Ask them to prepare questions before they walk back into the class.

After five minutes announce judges entry. Class rises. Judges are seated. Opening statements begin. Leave enough time for judges to retire and make their decision. They leave classroom to consider their verdict on "The Puppy." All rise on their return. They explain and then give their verdict.

Day 3: Good News—Advances in Research; Advances in Prevention—the Process of Science

Set-up Directions:
Same as Day 1.

Teacher Presentation & Motivation:
Say: "Science plays a critical role in society. Today we are going to investigate a range of interactions between science and society. Firstly, society pays for research it thinks will help its people. Here are some of the latest findings which may provide a final cure for victims of cancer. We recently discussed how cancer forms and is spread." Teacher reviews Day 1 Lesson. Knowing what they now know, students are challenged to suggest likely targets for future treatments. Genetic susceptibility is discussed in this context. Using images in ***PowerPoint*** presentation current treatments are discussed; the p53 gene and its role in cell regulation is discussed.

Teacher says: "But technologies derived from scientific research are not always so benign. Early in the 1900s, science had provided the technology to slaughter thousands of animals. This process, as you will read, was inhumane.

Activity 1: The Jungle Reading:
As a class, students read a selection documenting the worst of the Chicago meat packing industry (see The Jungle Reading in Student Resource Packet). The point of this reading, though, is not to horrify students, it is to suggest that such revelations illuminate problems and bring about constructive change. Upton Sinclair's book was widely read and it forced the meat packing industry to clean up its act

The World Watch Institute's paper, **Underfed and Overfed,** detailed problems associated with a particular technology: the ability of firms to target children with a pervasive broadcast message. Is this a technology which needs tighter control—at least when it is directed to children?

Activity 2: Fiber No Help Reading:
Students are directed to the Fiber No Help **Reading**, a newspaper article based on the complete paper in The New England Journal of Medicine issue of April 20th, 2000. Teacher says: Science is a process of continuous refinement things we think of as truth. At least it has this as its goal. Sometimes, though, evidence is confusing or apparently contradictory. This article has a disappointing finding." Students take

turns reading as a class. Teachers says: "But one of the references for the World Watch report, The China Study, claims that China's increased consumption of meat products has led to an increase in colon cancer. Which is right? Are they really contradictory? These are hot topics for research both in the classroom and in laboratories around the world. The only way to find out the truth of this is by the continuous formulation and reformulation of hypotheses. Perhaps this particular subject is of interest to you. If so, check out our next activity, your research project.

Activity 3: Student Research and Presentation:
Students pick a research project (see Student Resource packet—Topics For Research Activity) and medium for presenting it. Groups should have four to five members. Roles should be established in class, and accountability assured. Students may research a subject of their choice or choose from topics in Student Resource Packet.

Day 4

Set-up Directions:
Teacher should have access to the Internet for research purposes. The teacher should also bring a number of books and journals for the use of students. This research could take place in the Media Center.

Teacher Presentation & Motivation:
Students continue research. Students present their project to the class. This does not have to happen on the fourth day. The research project can be spread out over some period of time

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Enrichment Options

Community Connection:
Students who do a ***PowerPoint*** presentation may put them up on the school web site. Students tell their parents, their parents tell their friends. In this way, school projects may have an influence in the community.

Students lobby to have input into what kind of food is served in the school cafeteria, and what kind of beverages are sold in soda machines.

Students investigate the colorectal cancer incidence in their own neighborhood/area.

Students investigate the correlation between colorectal cancer incidence and income level. Information and data for both of these topics may be found at the American Cancer Society's Web site at: http://www.cancer.org/

Interdisciplinary Extensions:
- **Social Studies**

The McLibel trial at: http://www.mcspotlight.org/case/index.html would provide an excellent frame for a debate. Students may argue for or against the pamphlet writers. This trial occurred when the McDonald's Corporation charged individuals with libel after they had distributed pamphlets critical of the fast food company. It took place in the United Kingdom and provides a comparison in with the US in such issues as slander and libel laws, freedom of speech, and the government's right to protect children from advertising.

- **Technology**

Animal feed technology is an area of concern. For example, the inclusion of antibiotics in feed increases the bacterial resistance. Recently, a boy in Ohio fell sick from a bacterial disease from a farm animal. The bacteria was resistant because of the regular addition of antibiotics in feed. Breeding technology, from cloning to artificial fertilization, could be studied. The rabid technologies of mass communication and their role in forcing dietary "choice" is a volatile and gripping topic—one that is practically ignored by everyone and is invisible to students.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

John Bois & Ed Dieterle

Name _____ Class _____ Date _____

Rubrics for Lesson 2

Rubric for "Underfed and Overfed" Readings

Point value	Concept attainment	Performance/Presentation
3	In their performance/presentation, students demonstrate full understanding of readings	Students performance/presentation is well organized and interesting
2	…good understanding of readings but they have missed an important point	…well organized but not interesting
1	…some understanding but missed the main point of the reading	..disorganized and uninteresting
0	…no understanding	Students have not prepared any presentation

Rubric "Epidemiology" Worksheet

Point value	Concept attainment	Completion
3	Student demonstrates concept attainment in all questions	Student has completed all sections of worksheet
2	…in most questions	…most sections…
1	…in some questions	…some
0	…in no questions	…no…

Rubric for "Fast Food Debate"

Point value	Level of participation	Expression and quality of ideas
3	Student participated in debate but did not shout or otherwise disrupt the free discussion of ideas	Student demonstrates originality of thinking and a full understanding of the issues

2	…participated but sometimes engaged in inappropriate behavior (shouting, interrupting, etc.)	Student demonstrates a full understanding of the issues
1	…participated but frequently engaged in inappropriate behavior	Student demonstrates some understanding of the issues
0	Student did not participate, or contributed only disruptive behavior	Students demonstrates no understanding of the issues

Rubric for "Mammalian Candidates" Graphing Activity

Point Value	**Graph Characteristics**	**Data Presentation**
3	Both axes are labeled (including units); scale is accurate on axes; the graph has a title	Data is presented accurately and neatly
2	Any one of the above is missing or inaccurate	Data is presented accurately, but not neatly
1	Any two of the above are missing or inaccurate	Data is presented with some inaccuracy regardless of neatness
0	More than two of the above are missing or inaccurate	Data is completely inaccurate

Rubric for Inspiration activity: "Research Brainstorming"

Point Value	**Quality of work**	**Mastery of Software**
3	Student group has effectively used software to generate creative research ideas/an accurate timeline	All members of the group are able to use the software
2	…effectively used software to generate research ideas/a mostly accurate timeline	Most members of the group…
1	…used software but few ideas have been generated/timeline is inaccurate	Some members of the group…
0	Students have produced nothing	No members of the group…

Rubric for Research Presentation

Point Value	**Content**	**Delivery**	**Time on task**	**Role performance**

3	Student presentation demonstrates a strong grasp of the content and relevant issues of their subject	Students chose effective media in making an interesting product	Students were never off task	Students collaborated effectively and used clearly delineated roles
2	…competent grasp…	Students chose effective media but presentation was not interesting	Students seldom off task	Students collaborated effectively but failed to clearly delineate roles
1	..some understanding..	Students chose ineffective media	Students often off task	Students did not collaborate/most of the work was done by two or three students
0	…little understanding…	Delivery was sloppy and showed little evidence of preparation	Students usually off task	Students did not collaborate/most of the work was done by one student

Scoring tool for Research Project

Category	**Weight**	**Student evaluation**	**Teacher evaluation**
	X 2		
Delivery	X 1		
Time on task	X 1		
Role performance	X 1		

Name _____ Class _____ Date _____

Epidemiology Worksheet

Cancer has been blamed on multiple causes: some people are more susceptible to cancer because they have genes that predispose them to it; but cancer is also known to be caused by environmental factors. Epidemiologists—scientists who study the causes of disease outbreaks—are very eager to know if some environmental factor is causing sickness. One of the first epidemiologists was Dr. John Snow who, in London in 1854, suspected that a sudden and deadly outbreak of cholera was caused by a water pump on Broad Street (in those days people had to get all their water from a pump out on the street). He made the following map. The small, black tiles indicate cholera fatalities and the houses where they occurred.

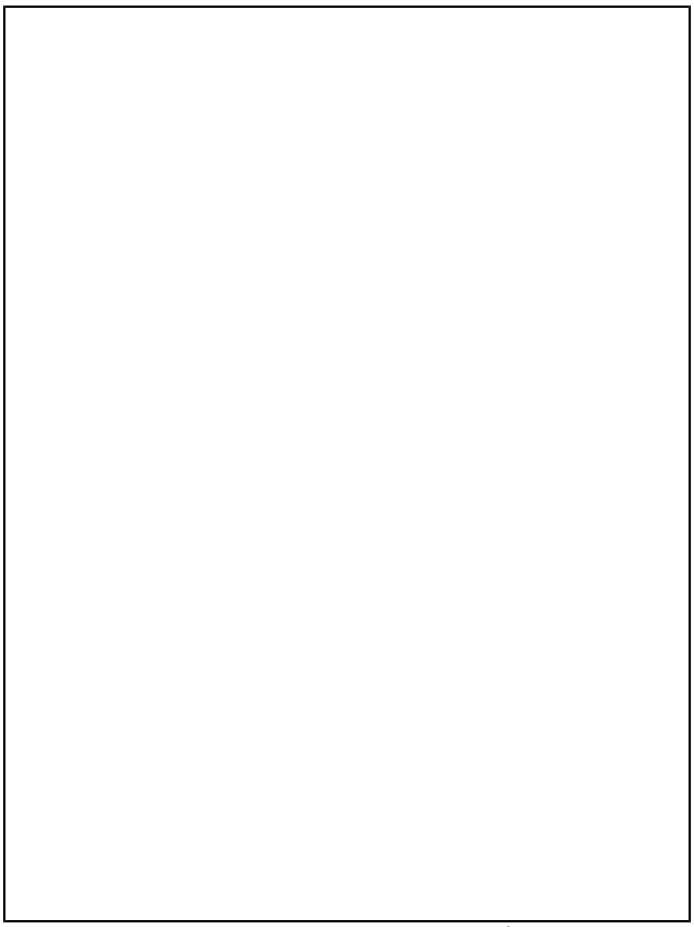
1. How do you assess Dr. Snow's conclusion about the Broad Street pump?

It was later discovered that sewage was leaking into the water pipes and spreading the bacteria that cause this disease.

Now we will do an activity that shows why it is not always that easy to identify the cause of a disease, or, even if it has any cause at all. Cancer, which occurs at a much lower frequency (much less often) than cholera in Dr. Snow's time, is much

more difficult. Here is why…

2. In the box below, draw the distribution of magnets on the steel tray.



3. 3. How would you describe the distribution of the magnets? Are they uniformly spread out, or do they form little clusters?

4. Was this distribution planned or were the magnets thrown up to the tray in a random way?

5. Now, pretend this is a town. Draw a river through it just to solidify this impression—to make it look more real. Look at the clusters. If you were told that these were instances of cancer, just like the cholera deaths on Dr. Snow's map, would you advise the Center For Disease Control (CDC) and tell them there was a cancer outbreak here? Should we suspect some environmental cause, such as the drinking water or air pollution? Why or why not?

6. In real life this clustering effect happens often. Unfortunately, it is often impossible to know if the cancers are due to genetic or environmental causes. Pretend you are an epidemiologist. Write a paragraph stating how you would try to find out if environmental factors contributed to colorectal cancers.

Name _____ Class _____ Date _____

Topics For Research Research Topics

Research Topics

Choose a topic from this list, or, with your teacher's permission, design your own project. Using *Inspiration* software, brainstorm some ideas for your presentation. Which medium (***PowerPoint***, lecture, role-playing, science fair backboard, etc) is the best for your presentation? Who should perform which roles? Which research media should you use (books, Internet, journals, etc.). What are some possible directions your research could lead?

1.McLibel

In Britain, in 1996, two people released a pamphlet accusing McDonald's of many criminal acts. McDonald's thought this was wrong and sued the two people. This sparked a long trial—known as the *McLibel* trial—in which McDonald's had to defend its operations. In some areas it was successful, in others, not. Do a research project describing this trial, and how it relates to you as consumers.

Check out: http://www.mcspotlight.org/case/index.html

2. Colon Cancer

One of the deadliest killers! Produce a research project on any aspect of this disease (more than one group may take on this topic as long as they have a different focus).

Check out: http://cancernet.nci.nih.gov/Cancer_Types/Colon_And_Rectal_Cancer.shtml#genetics

3. Overfed and Underfed: The Global Epidemic of Malnutrition

This Worldwatch Paper (number150) puts global diet choice in the year 2000 in sharp, critical focus. We cover one aspect of this paper in a debate. Students may find other issues for a project. Check out: http://www.worldwatch.org/alerts/000304.html

4. Meat additives and their effects on cancer risk

Students eat lunch and deli meats. These meats contain BHT and BHA. What is known about these additives? Do a presentation on these chemicals, their widespread use, and their effect on the incidence of cancer.

5. Guns, Germs, and Steel

Students interested in the historical/evolutionary/social aspects of this topic may do a research project based on Diamond's book. Check out: http://www.mpt.org/learningworks/teachers/ehl/review/990910.html

6. Is diet important in controlling cancer? A recent study found that fiber in the diet did *not* seem to affect rates of polyp formation (see Resource Packet item: Fiber No Help reading). Yet, The China Study (cited in the World Watch paper) notes increased rates in colo-rectal cancers as Chinas diet evolves to include more animal fats and protein. For information and links on The China Study, see http://www.vegsource.com/china/results2.htm#Specific This issue is discussed in the lesson. A wonderful research project would be to amplify the in-class discussion by more focused research on this topic.

Name _____ Class _____ Date _____

"Fiber No Help" Reading

April 20, 2000

The Associated Press

Two large studies cast doubt on the widely held belief that eating low-fat, high-fiber food will lower the risk of colon cancer.

Such a diet is recommended by health groups for many reasons, but evidence of the anti-cancer benefit has been unclear.

To help resolve doubts, researchers conducted two large experiments, putting people on different diets and counting potentially cancerous growths in their colons and rectums for up to four years. The researchers were disappointed to find no apparent effect from the low-fat, high-fiber diet or high-fiber supplements.

The two new studies were published Thursday in The New England Journal of Medicine.

Similar results were reported in a study published in the journal in January 1999. That study tracked the colon and rectal health of 88,757 women who participated in the Harvard-based Nurses Health Study over 16 years. It found that the risk of cancer of the same regardless of how much fiber the participants ate, and researchers said they believed those findings apply to men as well.

However, the issue is still not settled. Animal experiments and some studies of large populations suggest that fruits, vegetables and fiber do indeed help ward off such cancers. And even if they do not, experts maintain that this kind of food clearly carries other benefits, including preventing obesity, heart disease and possibly some other kinds of cancer.

"It's not a case of choosing the disease you don't want to get," said Melanie Polk, a dietitian at the American Institute of Cancer Research in Washington. "If we eat a diet that is high in vegetables, fruits, grains and beans we ... will protect our overall health."

About 130,000 cases of colon and rectal cancers were diagnosed last year in the United States. About 56,600 people died from the disease, which is second only to lung cancer in causing cancer deaths.

One of the new studies, conducted at the National Cancer Institute and eight other health centers, watched 1,905 patients for recurring adenomas, or polyps, which are precancerous growths in the colon, or large intestine. One group of patients limited fat to 20 percent of total calories and ate five to eight servings of fruit or vegetables daily; a virtually identical group kept up its usual eating habits.

Polyps were removed from both groups at the start. Over four years, they came back in 39 percent of patients in both groups. The average number per patient and size were about the same.

"It was very disappointing," said Dr. Arthur Schatzkin, a lead researcher at the National Cancer Institute. "A positive result would have been a very strong statement."

In the second study, of 1,303 patients, University of Arizona researchers also found no lower risk of colorectal cancer from a diet heavy on a high-fiber, wheat-bran cereal.

Researchers have theorized that a low-fat, high-fiber diet chemically neutralizes cancer agents, makes protective changes to cells, or curtails bile acids that irritate intestinal lining and promote polyps.

The two new studies did not consider actual cancers partly because doctors can readily remove polyps and do so under the accepted standard of good medical care. If undetected, only 5 to 10 percent of polyps turn cancerous within 10 years.

The researchers said low-fat, high-fiber diets could conceivably act on colon cancer in the later stages of development. Such diets may work only when eaten for more than just four years.

However, in an accompanying editorial, Dr. Tim Byers, at the University of Colorado School of Medicine, was not as hopeful.

"There may be many reasons to eat a diet that is low in fat and high in fiber, fruits, and vegetables ... but preventing colorectal adenomas, at least for the first three or four years, is not one of them," Byers said.

Name _____ Class _____ Date _____

Overfed and Underfed… Reading

Overfed and Underfed: The Global Epidemic of Malnutrition

A paper by G. Gardner and B. Halwell for The World Watch Institute.

Underlined words should be defined by the whole class before reading begins. A game modeled on the $64,000 Pyramid may be used to reinforce meanings. Teacher points to a word on the blackboard. One student gives clues (verbal and/or action) to another student who cannot see the blackboard. How many words can a pair of students define in one minute?

Share of Children Who Are Underweight and Adults Who Are Overweight, Selected Countries, Mid-1990s

Country	Share Underweight (percent)	Country	Share Overweight (percent)
Bangladesh	56	United States	55
India	53	Russian Federation	54
Ethiopia	48	United Kingdom	51
Viet Nam	40	Germany	50
Nigeria	39	Colombia	41
Indonesia	34	Brazil	36

Write a statement showing that you understand what this data means.

Teams of 4-5 read one passage. Team includes: reader, note taker, discussion leader, and a presenter. After reading, each team will present a summary of their reading to the class.

Reading 1:

While hunger has receded modestly, its opposite—overeating—is more prevalent today than ever. Indeed, WHO calls the swift spread of the condition of overweight and its extreme form, obesity, "one of the greatest neglected public health problems of our time." Worldwide, the number of overweight people now rivals the number who are underweight. Overweight and obesity are defined using body-mass index (BMI), a scale calibrated to reflect the health effects of weight gain. A healthy BMI ranges from 19 to 24; a BMI of 25 or above indicates "overweight" and brings increased risk of illnesses such as cardiovascular disease, diabetes, and cancer. A BMI above 30 signals "obesity" and even greater health risks.

The United States has spearheaded this overeating wave. Today it is more common than not for American adults to be overweight: 55 percent have a BMI over 25. Moreover, the share of American adults who are obese has climbed from 15 to 23 percent just since 1980. And one out of five American children are now overweight or obese, a 50 percent increase in the last two decades. Meanwhile, the incidence of overweight or obesity in Europe has risen at a similar rate in the last decade, although from somewhat lower levels.

The prevalence of obesity in England, for example, has doubled in the last 10 years to 16 percent.

Reading 2:

Today's dinner plates also contain larger servings of fat and sugar than yesterday's did as people eat more and more livestock products and as oil and sweeteners are increasingly added to foods of all kinds. In Europe and North America, fat and sugar account for more than half of caloric intake, and they have squeezed complex carbohydrates, such as grains and vegetables, down to just a third of total calories—a nearly complete reversal of the diet of our gatherer-hunter forebears. Moreover, whole grain products have been largely replaced with refined grains, which are stripped of fiber and of many vitamins and minerals; fully 98 percent of the wheat flour consumed in the United States is refined. And fast-food items, which often surpass government guidelines for daily intake of fat, sugar, cholesterol, and sodium in a single meal, may be displacing nutritious dark green and yellow vegetables: one fifth of the "vegetables" Americans eat are french fries and potato chips. These trends are rapidly spreading beyond industrial nations as the fast-food culture goes global.

Meanwhile, eating in industrial countries centers less and less on home, family, and three square meals. Changes in work and family, food availability and price have made eating a more frequent but less sacred activity. Snacking is commonplace: in 1996, only 24 percent of Americans ate breakfast, lunch, and dinner and nothing else, which is down from 33 percent in 1985. In the United Kingdom, per capita consumption of snack foods, including potato chips, salted nuts, and other savories, is up by nearly a quarter in the past five years; snack foods are now a $3.6 billion industry.

More than ever, meals are eaten out, often on the run: the average American eats one of every three meals outside the home, and one's car is the second most popular place to have breakfast. Given these trends, it is not surprising that Americans cook less than ever. In 1998, just 38 percent of meals eaten in American homes were "homemade"; a recent report from consulting firm McKinsey & Co. suggests that many consumers in 2005 will have never cooked a meal from basic ingredients. In consumption-oriented countries, especially the United States, the nutritional and cultural value of food is increasingly being overwhelmed by its transformation into a money-making product to be grabbed off the shelf.

Reading 3:

The story of dietary change begins not with these development threads but with humanity's innate love of sweets and fats. These preferences were crucial for enabling people to store energy and weather lean times in hunter-gatherer days when energy-dense foods were scarce. Compounding this preference is the fact that sugary and fatty foods are easy to over consume because the human body has weak satiation mechanisms for fat and sugar. By contrast, foods high in fiber and complex carbohydrates, such as whole grain bread and potatoes, leave us feeling full. Despite a craving for the calorie-charged foods, earlier societies consumed them in relatively small quantities simply because they were not extensively available.

Availability of food in general increased, of course, as economic and technological innovations revolutionized agriculture and society. Mechanization of farming, wide-spread use of fertilizer and irrigation, and the breeding of high-yielding crops all served to boost the supply of foods in wealthy and poor nations alike. And improvements in transportation, packaging, and marketing helped to distribute this cornucopian supply broadly. The increased availability of meat, milk, cheese, sugar, and other sweet and fatty foods—commodities once reserved for the affluent or for holidays—was instrumental in facilitating a transition to a richer diet.

Reading 4:

While urbanization, prosperity, and other social forces paved the way to poor diets for many in the 20th century, it was action—and sometimes, inaction—by consumers, food companies, and governments that led to overeating and the consumption of empty calories. None of these groups set out to sabotage public health, of course. But with no one acting as a nutritional watchdog, the overwhelming strength of the food industry and the relative passivity of governments left consumers vulnerable to overeating and poor diet. The strength of the food industry emerges from the same social trends that produced the nutrition transition. While urban migration stretched, weakened, and eventually snapped the connection between farmer and consumer, and while changing lifestyles and rising incomes encouraged more convenience in foods, the food industry stepped in to meet consumer demand—and to shape it. As processors and packagers, and especially as promoters of food, corporations grew in their capacity to create a food environment that makes unhealthy food ubiquitous in modern life. Food companies' most powerful tool for shaping this environment is advertising. In Austria, Belgium, France, and the United States, food companies spend more on advertising—an estimated $30 billion annually in the United States—than any other industry. Food ad expenditures in the developing world are lower, but they are growing fast as incomes rapidly increase. In Southeast Asia, for example, food ad expenditures tripled between 1984 and 1990, from$2 billion to $6 billion.

Such heavy spending would not be sustained, of course, unless it were having an impact. Sales and marketing figures are often protected information, which makes a direct connection between ad spending and sales difficult to establish. But even U.S.-

government-funded promotion campaigns—which are considerably less flashy than most private advertising efforts—have shown a clear relationship between ad expenditure and increased sales of milk, cheese, pork, and orange juice. And in the 1970s, the aggressive marketing of infant formula accounted at least in part for the reduced incidence and duration of breast-feeding worldwide.

Reading 5:

The most heavily advertised foods tend to be of dubious nutritional value. A 1996 Consumers International study found that candy, sweetened breakfast cereals, and fast-food restaurants accounted for over half of all food ads in Norway, Australia, the United States, and 10 European Union nations. In the United States, fast-food restaurants alone account for one third of food advertising expenditures. And among all companies—not just food companies—Coca-Cola and McDonald's are among the top 10 advertisers worldwide. Canny food advertisers disproportionately target children, the least savvy consumers, confident that early influences shape lifelong habits. Studies indicate that food ads boost children's consumption of heavily advertised foods, prompt children to request these foods from caretakers, and stimulate purchases by the children themselves. In a recent study of fourth- and fifth-grade students, heavy viewing of television—the dominant ad delivery mechanism for kids—was a strong predictor of poor nutritional habits, including frequent snacking, and heavy viewers were more likely to believe that fast food was as nutritious as a meal prepared at home. While a sweet tooth is a natural human characteristic, other studies establish that repeated exposure to sweet and fatty foods in childhood sets up a craving for these unhealthy items that is extremely difficult to resist.

In theory, companies could promote nutritious foods, such as apples and carrots, instead of potato chips and cookies. But two factors compel advertisers to focus on sweet and fatty foods. First, they know that consumers will always have a special interest in these products, given an innate preference for them. Second, processed foods are most likely to have "added value"—the alterations or packaging that allow a company to earn higher profits. Doughnuts, for example, will fetch a greater profit than the flour, oil, eggs, and sugar in them would if sold separately. Part of the profit is reinvested in advertising the product, which keeps the cycle of promotion and sales in constant motion. The disproportionate advertising attention on nutritionally bankrupt foods reinforces demand for such foods in a self-perpetuating cycle that neither seller nor buyer can easily break. John Connor, a food economist at Purdue University, notes that "once a company has created a high margin product with a stable market, the revenues are generally sunk into further advertising to keep the market share high and boost consumption of that category of products."

Whatever the corporate strategy, in most nations advertising and other forms of industry influence dwarf government efforts at nutrition education. In the United States, the 3 billion dollars of advertising by fast-food restaurants and the billions more spent promoting snack foods, soda, candy, and sugary breakfast cereals makes USDA's $333 million budget for nutrition education look like a pittance. Kellogg's spends $40 million to promote Frosted Flakes alone. This imbalance in information and power between industry, consumers, and government results in what Kelly Brownell, a Yale University psychologist, has labeled a "toxic food environment": unprecedented access to high-calorie foods that are low in cost, heavily promoted, and good-tasting. Foodsellers, of course, see such ubiquity as cause for celebration. In a recent annual report, the Coca-Cola Company described its goal to "make Coca-Cola the preferred drink for any
occasion," by putting its products "within reach, wherever you look: at the supermarket, the video store, the soccer field, the gas station—everywhere."

Reading 6:

Health Problems That Could Be Avoided through Dietary Change

Disease or Condition	Share of Cases Preventable through a Change in Diet (percent)	Public Initiatives That Could Lower the Risk of Disease or Condition
Cancer	30–40	Promote the consumption of fruits and vegetables; promote low-fat diets and higher levels of physical activity.
Coronary Heart Disease	17–22	Promote low-fat diets and higher levels of physical activity
Childhood Blindness	over 95	Establish vitamin A supple-mentation programs; promote consumption of vegetables.
Mental Retardation	33–43	Iodize salt.

Adult-Onset Diabetes	24–66	Promote low-fat diets and higher levels of physical activity.

Two long-term surveys have helped establish the link between dietary habits and the prevalence of chronic disease. The China Health Survey has tracked 6,500 Chinese undergoing the nutrition transition since 1983, and found strong correlations between high intake of fat and protein, particularly from animal sources, and the incidence of heart disease, stroke, and colorectal and breast cancer. Meanwhile, the Framingham Heart Study tracked more than 5,000 residents of Framingham, Massachusetts, since the 1950s and found that chronic illness is not a normal or inevitable consequence of aging but is closely tied to modifiable dietary and exercise habits. The long-term nature of these studies, and their broad coverage, make them reliable chronicles of the effect of poor eating on health.

Diets high in calories and fat encourage obesity, which raises the risk of heart disease, stroke, diabetes, and various cancers. These four sets of disease are responsible for more than half of all deaths in the industrial world. High-calorie, high-fat diets also promote high blood pressure and clogged arteries, which are additional risk factors for a variety of degenerative diseases. Dr. Graham Colditz at the Harvard School of Public Health has estimated that among obese American adults, slimming to a healthy weight and maintaining it could prevent 96 percent of diabetes cases, 74 percent of hyperten-ion,72 percent of coronary heart disease, 32 percent of colon cancers, and 23 percent of breast cancers. Indeed, researchers at the World Cancer Research Fund and the American Institute for Cancer Research (WCRF/AICR) report that changes in diet alone could prevent 30–40 percent of all cancers worldwide—at least as many cases as could be prevented by a cessation of smoking, a more familiar cause of cancer.

People who are overweight also suffer disproportionately from a range of nonlethal but debilitating conditions, including osteoarthritis, hormonal disorders, asthma, sleep apnea, back pain, and infertility. And like underweight, obesity raises the susceptibility to infection by impairing immune function.

The most dramatic health effect of the surge in global obesity is the parallel rise in diabetes. The global population with adult-onset diabetes jumped nearly fivefold between1985 and 1998, from 30 million to an estimated 143 million. And the age range of the affected population is broadening rapidly as well. Adult-onset diabetes—the type that is usually associated with being overweight—was once rare in people under 40. But up to 20 percent of new pediatric patients at Columbia University's Naomi Berrie Diabetes Center had adult-onset diabetes in 1998, compared with less than 4 percent in the early 1990s—a trend confirmed at clinics around the United States. As obesity spreads to younger populations, it is likely that other "adult" diseases—from heart disease to stroke and cancer—will also strike young people more frequently.

Reading 7:

Poor nutrition undermines a nation's health care system as well. Unlike the diseases of undernutrition, which often kill the young or inflict permanent and untreatable damage such as stunting or blindness, treatment of chronic illness often involves frequent use of the health care system. The overweight and obese in the Netherlands visit their physi-cians20 percent and 40 percent more, respectively, than people of healthy weight. And obese people there were 2.5 times more likely to require drugs prescribed for cardiovascular and circulation disorders.

The economic cost of these burdens to health care appears to be enormous. Comparing the prevalence of hypertension, heart disease, cancer, diabetes, gallstones, obesity, and food-borne illness among vegetarians and meat eaters in the United States, the Physicians Committee for Responsible Medicine estimated total annual medical costs in 1995 related to meat consumption of between $29 billion and $61 billion. The costs would likely have been higher if stroke and other arterial diseases had been studied as well.

Meanwhile, Dr. Colditz at Harvard has calculated the direct costs (hospital stays, medicine, treatment, and visits to the doctor) and indirect costs (reduced productivity, missed workdays, disability pensions) of obesity in the United States to be $118 billion annually, or nearly 12 percent of the nation's health care expenditures. (This is more than double the $47 billion in costs attributable to cigarette smoking in the United States.) Add to this sum the $33 billion spent on diet drugs and weight loss programs, together with the unmeasurable psychological costs from the social exclusion associated with being overweight, and the full cost of overeating begins to emerge.

Similarly, governments may need to regulate harmful nutritional information, especially the advertising of nutritionally poor foods. Sweden and Norway, for instance, do not allow any advertising aimed at children under 12,while the Flemish region of Belgium prohibits advertising five minutes before or after children's programs. And more than a dozen European countries have voluntary, self-regulating codes of conduct for advertising aimed at children.

Some nutrition advocates, including Yale professor Kelly Brownell, have argued that regulating advertising of junk foods is similar to curbing the promotion of cigarettes: both industries target children in an effort to win lifelong customers, both make products that

kill in great numbers, and both drive up health care costs substantially. Does it make sense to allow nutrition-poor foods to be promoted and sold freely while tobacco is increasingly regulated? (Are comic characters designed to sell fast food to children) really so different from Joe Camel?

Name _____ Class _____ Date _____

The Jungle Reading

By Upton Sinclair

They climbed a long series of stairways outside of the building, to the top of the five or six stories, here was the chute, with its river of hogs, all patiently toiling upward; there was a place for them to rest to cool off, then through another passageway they went into a room from which there is no returning for hogs.

It was a long narrow room with a gallery along it for visitors. At the head there was a great iron wheel, about 20feet in circumference, with rings here and there along its edge. Upon both sides of this wheel there was a narrow space, into which came the hogs at the end of their journey; in the midst of them stood a great burly negro, bare armed and bare-chested. He was resting for the moment, for the wheel had stopped while the men where cleaning up. In a minute or two, however, it began slowly to revolve, and then the men upon each side of it sprang to work. They had chains, which they fastened about the leg of the nearest hog, and the other end they hooked into one of the rings upon the wheel. So, as the wheel turned a hog was suddenly jerked off its feet and borne aloft.

At the same instant the ear was assailed by a most terrifying shriek; the visitors started in alarm, the women turned pale and shrank back. The shriek was followed by a louder and yet more agonizing--for once started upon that journey, the hog never came back; at the top of the wheel he was shunted off upon a trolley, and went sailing down the room. And meantime another was swung up, and then another, and another, until there was double line of them, each dangling by a foot and kicking in frenzy--and squealing. The uproar was appalling, perilous to the ears drums: one feared there was to much sound for the room to hold, for the walls must give way or the ceiling crack, there were high squeals and low squeals, grunts, and whales of agony; there would come a momentary lull, and then a fresh outburst, louder than ever , surging up to a deafening climax. It was too much for some of the visitors--the men would look at each other laughing nervously, and the women would stand with hands clenched, and the blood rushing to the faces, and the tears starting in there eyes.

Meantime, headless of all these things, the men upon the floor where going about there work. Neither squeals of hog nor tears of visitors made any difference to them; one by one they hooked up the hogs, and one by one with a swift stroke they slit their throats. There was a long line of hogs, with squeals and life-blood ebbing away together; until at last each started again, and vanished with a splash into a huge vat of boiling water.

It was all so very business-like that one watched it fascinated. It was pork-making by machinery, pork-making by applied mathematics. And yet somehow the most matter of fact person could not help thinking of the hogs: they were so innocent, they came so very trustingly: and they were so very human in their protests--and so perfectly within their rights! They had done nothing to deserve it: and it was adding insult to injury, as the thing was done here, swinging them up in this cold-blooded, impersonal way, without a pretence at apology, without the homage of a tear. Now and then a visitor wept, to be sure: but this slaughtering machine ran on, visitors or no visitors. K It was like some horrible crime committed in a dungeon, all unseen and unheeded, buried out of sight and of memory.

One could not stand and watch very long without becoming philosophical, without beginning to deal in symbols and similes, and to hear the hog-squeal of the universe. Was it permitted to believe that there was nowhere upon the earth, or above the earth, a heaven for hogs, where they were requited for all this suffering? Each one of these hogs was a separate creature. Some were white hogs, some were black: some were brown, some were spotted: and some were old, some were young: some were long and lean, some were monstrous. And each of them had an individuality of his own, a will of his own, a hope and a heart's desire: each was full of self-confidence, of self-importance, and a sense of dignity. And trusting and strong in faith he had gone about his business, the while

black shadow hung over him and a horrid fate waited in his pathway. Now suddenly it had swooped upon him and had seized him by the leg. Relentless, remorseless, it was: all his protests, his screams were nothing to it—it did its cruel will with him, as if his wishes, his feelings, had simply no existence at all: it cut his throat and watched him gasp out his life. And now was one to believe that there was nowhere a God of hogs, to whom this hog personality was precious, to whom these hog squeals and agonies had a meaning? Who would take this hog into his arms and comfort him, reward him for all his work well done, and show him the meaning of his sacrifice?

Eat Your Sprouts! Part I: Nutrition and Cancer Prevention

Time Commitment: Two 50 Minute Periods
Grade Levels: 6-8

Table of Contents

Overview

Cooperative structure of the lesson:
Students will work in pairs, individually and as a whole group throughout this lesson.

Expected products from lesson:
Students will conduct a lab on the oxidation of an apple. The students will learn that the oxidation process can be halted when lemon juice is applied to the flesh of an apple because the lemon juice contains vitamin C, an antioxidant. Students will learn about other antioxidants and will learn about free radicals. In addition, the students will learn how they can get the necessary antioxidants through the foods that they eat.

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Instructional Technology Resources

Internet Sites:

BioHealth Link Website
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html
A hot list of cancer sites.

Dole 5 A Day http://www.dole5aday.com/
This educational Web site offers resources to students and teachers. The site is supporting the program "5 A Day," which was created by the National Cancer Institute and the Produce for Better Health Foundation in an effort to encourage children to eat at least 5 servings of fruits and vegetables a day. The site offers nutrition-based songs and activities. Elementary teachers can access information on how to receive a free nutrition CD and teachers can find useful lesson plans covering a variety of disciplines.

West Virginia Dietetic Association http://www.wvda.org/pyramid/
This investigation/research site offers a wealth of nutrition information. This site also offers an online quiz testing your knowledge of the USDA food guide pyramid.

Oldways Preservation and Exchange Trust
http://www.oldwayspt.org/html/pyramid.htm
This research/publication site includes pictures and information about alternative "healthy eating pyramids," a set of unique dietary guides based on worldwide dietary traditions closely associated with good health. Individual pyramids have been based on Asian, Latin American, Mediterranean and Vegetarian diets.

About Cancer http://cyberdiet.com/modules/ca/outline.html
This fantastic research/publication site offers a wealth of information about cancer healthy lifestyles. For example, the site offers practical information about what antioxidants are and how they work and provides anticancer recipes.

Food Guide Pyramid http://www.nal.usda.gov:8001/py/pmap.htm
This interactive publication/research site displays the USDA Food Guide Pyramid along with information about what constitutes a serving size and tips on how to prepare foods in healthy ways.

Other Technology:

- Overhead Projector

OTHER INSTRUCTIONAL RESOURCES
Books:

The American Institute for Cancer Research. Stopping Cancer before it Starts. New

York: Golden Books.

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Teacher/Student Background Information

Through the regular metabolism of food, free radicals are formed. Free radicals are missing an electron from their chemical structure and are thus highly unstable. Because of their unstable nature, they can go through the process called oxidation. Oxidation is damaging to the body's cells and will continue unchecked unless an enzyme or antioxidant stops the process. Over time, free-radical damage to cells may lower the body's normal defenses and increase susceptibility to certain diseases,

including cancer. Antioxidants can be found in many of the foods that we eat. Dozens of antioxidants have been discovered by scientists, some of which are more powerful than others and some of which have specific abilities. Many experts consider four antioxidants to be the most powerful and they are often referred to by the acronym ACES. ACES stands for vitamins A, C and E and the mineral selenium. The antioxidant

nutrients detoxify the oxygen-induced chemicals and thus protect body

tissues from damage and lower the risk of cancer.

Oxidation also occurs when a cut apple is exposed to oxygen. One can stop, or dramatically slow the oxidation process by applying lemon juice to the cut apple. The lemon juice contains vitamin C, which is an antioxidant.

Also of note, is that while headlines read that more and more people are eating unhealthily, this includes today's youth. The National Cancer Institute recommends that children eat a minimum of 5 servings of fruits and vegetables daily; however, recent studies have shown that the average child eats about 2.5 servings of fruits and vegetables daily.

Prior to this lesson, the students should understand how to make an observation. If this is not a skill they possess, review observation techniques with your students.

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Vocabulary

Oxidation - the process whereby free radicals take electrons and transfer them, leaving a new free radical.
Free Radical - by-product of normal metabolism which are missing an electron from their chemical structure and are therefore highly unstable.

Antioxidant - any vitamin, mineral or other nutrients that fight and disarm the harmful effects of damaging atoms in the body called free radicals.

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Learning Objectives

Content:
- **Make observations** and **record** them.
- **Predict** what will happen to an apple, which is cut open and exposed to the air.
- **Discuss** the observations made during the apple lab.
- **Maintain** a food journal.
- **Compute** the average number of fruits and vegetables consumed by the class per day.

Technology:
- Use technology to locate, evaluate, and collect information from a variety of sources.
- Use technology tools to enhance learning, increase productivity, and promote creativity.

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Lesson Assessment

The teacher will be able to use thevariety of activities in the lesson to assess the students' understanding.

Content:
Rubrics are provided to assess the "What's Happening to My Apple?" worksheet and the "Alternative Food Pyramids" worksheet.

Technology:
Rubrics are provided to assess the "Food Guide Pyramid" WebQuest and the "Cancer and Your Diet" WebQuest.

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Materials Needed

(Per student)
- "What's Happening to My Apple?" worksheet
- "Fruit and Vegetable Log" worksheet
- "Family Five a Day" homework worksheet

(Per student team/group of 2)
- 1 apple
- 2 note cards
- 1 plastic knife
- 1/2 lemon
- 1 paper plate
- Computer with Internet access
- "Food Guide Pyramid" WebQuest worksheet
- "Cancer and Your Diet" WebQuest
- "Alternative Food Pyramids" WebQuest

(per class)
- Computer with Internet access
- VCR and monitor
- Timer or clock with seconds hand

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Procedures

Students will work collaboratively in pairs for part of the lesson, and individually for part of the lesson.

The students will need access to a computer lab with enough computers so that each pair of students has a computer. The computers must be connected to the Internet.

Since the students will primarily be working in pairs, few accommodations need to be made for students. However, a student who receives special math services may require the use of a calculator to calculate the average of a set of numbers.

Day 1: Exploring Apples and Pyramids

Set-up Directions:
The teacher will set up the room in pairs. At each set of desks, there will be an apple on a paper plate, a 1/2 lemon, 1 apple, 1 note card and a plastic knife. The "What's Happening to My Apple?" worksheet, the "Food and Vegetable Log" worksheet, and the "Fruit Guide Pyramid" WebQuest should be photocopied so each student pair has a copy.

Teacher Presentation & Motivation:
Teacher will ask each student to pick up their copy of "What's Happening to My Apple." The teacher will select one student to read the instructions aloud as the others follow along. The teacher will ask the students if they have any questions before they begin.

Activities:
Students will follow the instructions on the "What's Happening to My Apple?" worksheet. The students will be instructed to make observations at the one minute mark and the five minute mark. They will then push the apple halves out of the way, as they will make no further observations until the last few minutes of class.

Next, the students will receive the "Food Guide Pyramid"WebQuest handout. Student pairs will be asked to move to the computers. Students will be given about 20 minutes to complete the WebQuest. The teacher will circulate around the room to offer assistance to students in need.

After the students have explored the USDA ***Food Guide Pyramid***, the class will discuss some of the major points that were covered. Students will discuss several examples of what constitutes a serving size as well as if they feel their diet resembles the food guide pyramid.

Next, the students will find out if their daily intake of fruits and vegetables is living up to the recommendations set forth by the Food Pyramid. The teacher will distribute the food log and will go through the instructions with the students placing special emphasis on what makes up a serving size.

On the chalkboard, the teacher will make a table to record the results of the total servings of fruit and vegetables each of the students in the class ate based on the information they just recorded in the food log. From the data on the board, the students will compute the class average on the back of the worksheet. The class will discuss the class average and compare it to the goal of eating 5 servings of fruits and vegetables per day and to the national average of around 2.5 servings per day. The teacher will challenge the students to increase their fruit and vegetable intake if they are not reaching the goal of eating 5 servings.

The last thing that the students will do at the end of the class period is write another observation of what is happening to the halves of the apples.

Lastly, the teacher will handout the "Family Five a Day" homework worksheet. The students will use this handout to track the fruit and vegetable intake of each of the members of their household. The teacher will make enough copies of the handout to track the fruit and vegetable intake of the family for a day, week or whatever duration of time the teacher desires.

Day 2: Antioxidants and Cancer Prevention

Set-up Directions:
Today the students will again be working on the computers. The students should be paired with the same partner as yesterday. The handouts "Cancer and your Diet" and "Alternative Food Pyramids" should be photocopied. The teacher will need to check off the alternative food pyramid that each group will be exploring and

comparing to the USDA food pyramid. Each group will explore one alternative food pyramid and will therefore have one alternative food pyramid checked on the handout.

Teacher Presentation & Motivation:
The teacher will bring the students attention to the apple lab that was started yesterday. The students will retrieve their apples from wherever they have been stored to make their final observations and draw conclusions about the results.

Activities:
After the students have made their final observation about the apple half with lemon juice and the apple half without, the class will engage in a discussion of what they believed happened. A student will probably offer that the air made the apple turn brown but that the apple with lemon juice did not brown nearly as much. The teacher will tell the students that what took place with the lemon juiceless apple was oxidation. The other apple half was protected from the oxidation by the lemon juice, which has vitamin C in it and is an antioxidant. The students will then pair up at the computers to learn more about antioxidants and their relationship to cancer. Pass out the "Cancer and Your Diet" WebQuest. The students should be able to complete the WebQuest in approximately 25 minutes. During this time the teacher will circulate around the room offering assistance when necessary.

As students finish the WebQuest, they will receive the final worksheet entitled "Alternative Food Pyramids." Through this activity, the students will learn that the USDA food pyramid was not based on the actual diet of a culture but was designed to be an ideal diet. Several alternative food pyramids have been designed; however, they were based on the actual eating habits of several healthy cultures.

During the last 10 minutes of class, various pairs will volunteer to present the information that they collected on their assigned alternative food pyramid. After pairs have presented information about each of the alternative food webs, general comments will be made about the similarities and differences between the pyramids.

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Enrichment Options

- **Language Arts**

Students will write a poem about eating the recommended 5 fruits and vegetables a day.

- **Fine Arts**

Students can paint a mural in the cafeteria depicting the importance of eating fruits and vegetables everyday.

- **Mathematics**

Teachers can assign basic math problems from the **Dole 5 a Day** Web site. The problems can be found in the educator's section under lessons. (http://www.Dole5aday.com)

- **Social Studies**

Students can study fruits and vegetables that are grown in a variety of geographic regions. In addition, the students can study the climates of each region and also the length of the growing seasons.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Felicity Ross & Doug Fireside

Name _____ **Class** _____ **Date** _____

What's Happening to My Apple?

Materials: plastic knife, apple, 1/2 lemon, 1 apple, 2 note cards.

Directions:

- Take the note cards and write **plain apple** on one card and **apple with lemon juice** on the other card.
- Take the plastic knife and cut the apple in half.
- Take one half of the apple and squeeze lemon juice all over the flesh of the apple.
- Leave the other half of the apple alone, making sure that no lemon juice touches this half of the apple.

Predict what will happen to each half of the apple over time.

_____
_____
_____

- Record your observations in the chart below.

Observations

Time	Plain Apple	Apple with Lemon Juice
After 1 minute		
After 5 minutes		
After 40 minutes		
After 24 hours		

Name _____ **Class** _____ **Date** _____

Fruit and Vegetable Log

Directions: Think back to all of the food that you ate yesterday. Think about the breakfast, lunch, dinner and snacks that you had. Now, using this information fill out the questions below. Now, think specifically about the fruits and vegetables that you ate yesterday.

Serving Information:

One Serving is equivalent to:
1 piece of fruit
6 ounces of 100% fruit juice
1/2 cup of cooked vegetable
1 cup of leafy greens like lettuce
1/4 cup dried fruit, like raisins

List the fruits and vegetables, and the amount of each, you ate with breakfast. Don't forget the juices you drank.

_____

_____

List the fruits and vegetables, and the amount of each, you ate with lunch. Don't forget the juices you drank.

_____

_____

List the fruits and vegetables, and the amount of each, you ate with dinner. Don't forget the juices you drank.

_____

_____

List the fruits and vegetables, and the amount of each, you ate as a snack. Don't forget the juices you drank.

_____

_____

Now, add up the total number of servings of fruits and vegetables that you ate yesterday.

TOTAL _____

Did you reach the "5 a Day" goal?

Names _____
Class _____ **Date** _____

Food Guide Pyramid WebQuest

Log onto http://www.nal.usda.gov:8001/py/pmap.htm

List the 6 general food groups that make up the Food Pyramid

Which food group should you eat the most of? _____

Which food group should you eat sparingly? _____

In order to use the Food Guide Pyramid effectively, we must understand what a serving is. Give an example of a serving in each of the following categories.

1 serving of vegetables: example

1 serving of meat: example

1 serving of fruit: example

Take your mouse and click on the milk, yogurt and cheese group in the pyramid. List one recommendation that is made for consuming items in this food group.

Now, log onto http://www.wvda.org/pyramid/

Click on take quiz and answer the list quiz questions with your partner.

When you have completed the quiz, call your teacher over to your computer so that your score can be recorded.

Names _____

Class _____ Date _____

Alternative Food Pyramids WebQuest

Log on to: http://www.oldwayspt.org/html/pyramid.htm

You and your partner will be exploring an alternative Food Pyramid. Alternative Food Pyramids have been created for the Asian diet, the Latin American diet, the Vegetarian diet and the Mediterranean diet. You will be examining the diet that is checked below by your teacher.

- Asian
- Vegetarian
- Latin American
- Mediterranean

List at least 5 differences between the alternative diet you are studying and the USDA Food Guide Pyramid. You will want to click onto the food pyramid that you are assigned and may want to refer back to http://www.nal.usda.gov:8001/py/pmap.htm to review the USDA food guide pyramid.

1.

2.

3.

4.

5.

Name _____ **Class** _____ **Date** _____

Cancer and Your Diet WebQuest

Log on to http://cyberdiet.com/modules/ca/outline.html Click on Preventative Measures

Preventing the development and growth of cancer involve both limiting exposures to carcinogens **and** maintaining good physical health**.**

List the 5 carcinogen types listed on the table.

_____
_____
_____
_____
_____

List the common diet carcinogens **listed on the table.**

Go back to the main page. Click on Antioxidant Nutrients
Read the information on the page
Summarize what an antioxidant is and how they prevent diseases.

_____
_____
_____
_____
_____

List 4 antioxidants believed to help fight cancer.

_____
_____
_____
_____

Click on the Anticancer Dietary Guidelines

Diet has been linked to the development of what percent of all cancers? ____%

List two similarities and two differences between the FDA Food Pyramid Guidelines and the Anticancer Dietary Guidelines.

_____
_____
_____
_____

Name ________________________ Class __________ Date ___________________

Family 5 A Day Homework

Directions:Fill in the name of each of the members of your household. Have each family member keep track of their intake of fruits and vegetables in a day. It is your job to inform your family members of the importance of eating the recommended number of fruits and vegetables each day as well as to teach your family members what constitutes a serving of a fruit or a vegetable.

Name_____________________________
Day # _____________
___ Fruit: type ___________________
___ Fruit: type ___________________
___ Vegetable: type _______________
___ Vegetable: type _______________
___ Vegetable: type _______________

Name_____________________________
Day # _____________
___ Fruit: type ___________________
___ Fruit: type ___________________
___ Vegetable: type _______________
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___ Vegetable: type _______________

Name_____________________________
Day # _____________
___ Fruit: type ___________________
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Day # _____________
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___ Vegetable: type _______________

Eat Your Vegetables: Part I Scoring Rubrics

What's Happening to My Apple?
2 Points – Student gives complete, detailed observations noting multiple characteristics such as the color, smell and texture of the apple.
1 Point – Student gives observations that are lacking in detail.
0 Points – Observations are unclear and/or missing.

Fruit and Vegetable Log
Not Scored

Food Guide Pyramid WebQuest Worksheet
2 Points – Student successfully utilized technology resources to accurately list the six general food groups found in the food pyramid.
1 Point – Student successfully utilized technology resources to accurately list five of the six general food groups found in the food pyramid.
0 Points – All other responses.

Which food group should you eat the most of?
1 Point – Bread, cereal, rice and pasta group
0 Points – All other responses.

Which food group should you eat the least of?
1 Point – Fats, oils and sweets
0 Points – All other responses.

List one recommendation that is made for consuming items in the milk, yogurt and cheese group
1 Point – One reasonable recommendation is given.
0 Points – All other responses.

Alternative Food Guide Pyramid WebQuest
3 Points – Student successfully utilized technology resources to offer 5 differences between an alternative diet and the USDA Food Guide Pyramid.
2 Points – Student successfully utilized technology resources to offer 4 differences between an alternative diet and the USDA Food Guide Pyramid.
1 Point – Student successfully utilized technology resources to offer 3 differences between an alternative diet and the USDA Food Guide Pyramid.
0 Points – Student successfully utilized technology resources to offer 2 or fewer differences between an alternative diet and the USDA Food Guide Pyramid.

Cancer and Your Diet WebQuest
List 5 carcinogen types
2 Points – Student successfully utilized technology resources to list 5 carcinogen types.
1 Point – Student successfully utilized technology resources to list 4 carcinogen types.
0 Points – All other responses.

List 4 antioxidants believed to help fight cancer.
2 Points – Student successfully utilized technology resources to list 4 antioxidants.
1 Point – Student successfully utilized technology resources to list 3 antioxidants.
0 Points – All other responses.

Diet has been linked to the development of what percent of all cancers? _____%
1 Point – 30%
0 Points – All other responses.

List two similarities and two differences between the FDA Food Pyramid Guidelines and the Anticancer Dietary Guidelines.
2 Points – Student successfully utilized technology resources to list 2 similarities and 2 differences.
1 Point – Student successfully utilized technology resources to list 3 of the 4 similarities and differences.
0 Points – All other responses.

Eat Your Sprouts! Part II: Cancer-Fighting Foods and Health

Time Commitment: Four 50 Minute Periods
Grade Levels: 6 – 8

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Overview

Cooperative structure of the lesson:
Students will work in groups, individually and as a whole class throughout this lesson.

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Instructional Technology Resources

Internet Sites:
BioHealth Link Website
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html

A hot list of cancer sites.

Broccoli Sprouts.Com http://www.broccolisprouts.com
This communication Web site seeks to disseminate interesting news about broccoli sprouts. In addition to providing links to several online articles about broccoli sprouts, there is also information about cancer fighting literature as well as information about ordering broccoli sprout seeds.

My Life Path Health and Fitness http://www.mylifepath.com
This publication site offers articles and information about health and wellness. The site also offers users to communicate with experts in health and nutrition fields.

Food.Com http://www.food.com
This commercial site allows people to browse through menus of local restaurants and order food online. For the purpose of this lesson, the site will be used to investigate several menus of local restaurants.

Multimedia Software:
Microsoft PowerPoint - This easy-to-use presentation software by Microsoft Incorporated can be purchased at any major software outlet, including CompUSA.

Other Technology:

- Digital Camera

OTHER INSTRUCTIONAL RESOURCES
Books:
Calhoun, Susan and Jane Bradley. Nutrition Cancer and You. Kansas: Addax Publishing Group. 1997.

Mitchell, Deborah. The Broccoli Sprouts Breakthrough. New York: St. Martin's Press, 1998.

Pensiero, R.D., et al. The Strang Cookbook for Cancer Prevention. New York: Penguin Group. 1998.

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Teacher/Student Background Information

In "Eat Your Sprouts: Part I," the students learned about a variety of food pyramids that advocate eating a wide variety of foods. In Part II, we are going to look at foods that are specifically related to safeguarding a person against cancer. Fortunately, there are many such anticancer foods. These anticancer foods are effective in diverse ways. For example, cruciferous vegetables, like broccoli and cauliflower, contain anticancer compounds such chlorophyll and carotenoids. Other anticancer foods, such as beans and nuts, are high in fiber and protect the body

from contact with cancer-causing agents, especially in the intestines.

Students will need to know how to create a ***PowerPoint*** presentation. If they do not, it will take a bit more time to create the presentation.

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Vocabulary

Sprouts – newborn plants, the fragile yet hardy tendrils that emerge from a seed.
Sulforanphane – a chemical that stimulates the body's natural ability to fight cancer. Broccoli is the vegetable with the highest concentration of sulforaphane.
Cruciferous Plants – plants in the Brassica family which include broccoli, cauliflower, arugula, bok choy, brussels sprouts, cabbage, Chinese cabbage, collards, cress, daikon, kale, kohlrabi, mustard, turnip, and watercress.
Chlorophyll – The green pigment that is found in all vegetables even if they are not green. Chlorophyll is an antioxidant. Chlorophyll can prevent damage to the DNA in cells, which is the first step in the process by which normal cells transform into cancerous ones.
Carotenoids – A class of nutrients. Carotenoids are the bright orange, red and yellow pigments that are found in fruits and vegetables such as carrots, grapefruit and tomatoes. The carotenoid class contains more than six hundred members. Carotenoids protect against cancers of the lung, colon, rectum, breast, uterus, and prostate.
Antioxidant – any vitamin, mineral or other nutrients that fight and disarm the harmful effects of damaging atoms in the body called free radicals.

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Learning Objectives

Content:
- **Collect** and **organize data**
- **Identify** cancer-protective foods that they have eaten and that they have at home in their refrigerator or pantry.
- **Demonstrate** how to grow broccoli sprouts using a variety of methods.

Technology:
- Use a variety of media and formats to communicate information and ideas effectively to multiple audiences.
- Use technology to locate, evaluate and collect information from a variety of sources.

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Lesson Assessment

Content:
A rubric provided to assess "Cancer Protective Foods Writing Activity" worksheet.

Technology:
A rubric is provided to assess the Broccoli Sprouts ***PowerPoint*** Presentation.

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Materials Needed

(Per student)
- "Top Cancer-Protective Foods" worksheet
- "Top Cancer-Protective Foods Family Inventory" homework worksheet
- "Cancer-Protective Foods Writing Activity" worksheet
- Name tag

(Per student team/group of 4)
- One set of the Investigator A-D worksheets.
- One ***PowerPoint*** Presentation guide

(Per class)
- Top Cancer-Protective Foods Poster
- Computer with Internet access
- A variety of unique cancer-protective foods for the class to try such as papaya, seaweed salad, guava, kiwi, figs, tofu, sushi and currants.
- 2 jars
- 4 pieces of cheese cloth
- 2 plastic flowerpots
- 2 plates
- cling wrap
- 1 Sprouting Kit
- 2 lbs. of broccoli
- 1 ounce broccoli sprouts

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Procedures

Students will work collaboratively and individually throughout the lesson.

Throughout the activities, the students will require access to an Internet-connected computer. There should be enough computers so that each group of four can have

their own.

Since the students will primarily be working in groups, few accommodations need to be made for students.

Day 1: Cancer-Preventive Foods

Set-up Directions:
For today's activities the teacher will need to duplicate the "Top Cancer-Protective Foods" worksheet, the "Top Cancer-Protective Foods Family Inventory" homework worksheet and the "Cancer-Protective Foods Writing Activity" worksheet for each student. In addition, the teacher will need to have a variety of interesting cancer-protective foods on hand for the activity. The teacher will also need to make a large poster of each of the top cancer-preventive foods with a space after each food long enough for a name.

Teacher Presentation & Motivation:
Teacher will say, "In the first part of the 'Eat Your Sprouts' lesson we learned about general healthy eating practices. During 'Eat Your Sprouts Part II' we will learn about eating specifically to protect ourselves from cancer. Remember, about 30% of all cancers are said to be related to your diet."

Activities:
The teacher will hand out the "Top Cancer-Protective Foods" worksheet and will discuss the instructions. The teacher will explain that these foods on the list are the considered to be the most effective cancer protective foods. Students are to circle any foods that they have ever eaten and to place a star next to any foods that they eat regularly, at least 2 times per month. Give students about 5 minutes to complete their personal inventory foods.

Next, we will see how many of these foods, as a class, we have eaten. Our goal as a class will be to have all of the foods tried by at least one member of the class. The teacher will take out the "Cancer-Preventive Foods" poster. The students will go through each food and will raise one hand if they have ever tried the food and will raise two hands if it is a food that they eat regularly. After each food item, the name of one student who has at least tried the food will be listed. The teacher must make sure to select a variety of students so each student has their name on the poster at least once. Most likely, some of the more unique foods will not have been tried by any students or by many. The teacher will next have a food tasting of some unique cancer-protective foods that the students may not have been exposed to. The teacher will have a variety of these foods for the students to test such as, sushi (seaweed), figs, papaya, tofu, seaweed salad and currants.

Next, the students will complete the "Cancer-Protective Foods Writing Activity," a short writing activity about their cancer-preventive foods tasting.

Undoubtedly, the different students will have exposure to different foods because

they are probably not in charge of grocery shopping and cooking for the family.

Day 2: Broccoli Sprouts

Set-up Directions:
The teacher will need to have set up two plates, one with one ounce of broccoli sprouts and another with two pounds of broccoli. (Broccoli sprouts can be purchased at most grocery stores or grown at home from seeds.) Students will need to be broken into groups of four and the Investigator handouts will need to be duplicated so that each group has one each of the "Investigator A-D" worksheets. The classroom will need to be equipped with at least 3 computers.

Teacher Presentation & Motivation:
Teacher will have displayed in the front of the room, where all students can see, a one-ounce pile of broccoli sprouts next to a plate of two pounds of broccoli. The teacher will ask the students, "Given a choice between the two, which would the students rather eat?" Next, she will say, "In the lesson 'Eat Your Sprouts' we will learn that the contents of both of the plates have much in common." The teacher will place the students in groups of four.

Activities:
The students will receive name tags labeled with "Investigator A," "Investigator B," "Investigator C," and "Investigator D." Each student will select a nametag, write their name on it and place it on their shirt.

Next, the teacher will distribute the "Investigation" worksheets, which are labeled A-D. The teacher will direct all of the "Investigator A's" to the correct computer station for an expert conference. If there are several "Investigator A's" two or more A stations should be set up. The B's, C's and D's will be directed to the correct station. They will each receive their specific directions, which in three cases involves a WebQuest and in the case of the fourth requires using books. The students should take about 10 minutes to complete their research.

The students will be asked to return with their research to their original groups where they will receive the "***PowerPoint*** Presentation Guide" worksheet. They will then work to plan out their presentation and when it is approved they will go to the computer and actually design the presentation. This presentation will be used during the "Community AntiCancer Foods Education Day."

Day 3: Preparing for the "Community Anticancer Foods Education Day."

Set-up Directions:
The classroom will need to have enough computers with ***PowerPoint*** software on them so that each group of four students has one.

Teacher Presentation & Motivation:

Students will work in the same groups that they were in yesterday and will spend the first half of the period completing their ***PowerPoint*** presentation.

The remainder of the class will be spent learning how to grow broccoli sprouts using the variety of methods discussed in the book, The Broccoli Sprouts Breakthrough, by Deborah Mitchell. The students need to know how to demonstrate growing sprouts so that they can have a "Sprout Growing Station" at the community event.

Day 4: Community AntiCancer Foods Education Day

Set-up Directions: Today, the students are inviting in parents and other community members in for a Cancer Education Day. The students will present all that they have learned about cancer prevention and diet.

The room will need to be equipped with several stations, which will be manned by students. The following stations will be included:

Growing Sprouts Station

Cancer-Protective Foods Tasting Station

Menu Rating Station

PowerPoint presentation station

The room will need to be equipped with a computer with the ***PowerPoint*** program. For the Tasting Station, several unique anticancer foods will need to be available for tasting as well as copies of the "Top Cancer-protective Foods" worksheet for distribution. The Menu Rating Station will require a computer with an Internet connection. The Sprout growing station will require materials to grow sprouts including seeds, jars and cheesecloth.

Teacher Presentation & Motivation:
The students will be motivated to share their research with their parents and community members.

Activities:
The teacher will welcome the present community members and parents. The visitors will be broken up into groups so that they can travel around to the various stations.

The students will guide the visitors at each station through the activities. The stations are as follows:

Tasting Station: At the tasting station, the visitors will first learn about over 50 top Cancer-fighting foods. They will then have an opportunity to try some of the more unique foods on the list, such as seaweed, tofu, guava, currants and figs. At this station, the students will encourage the adults to incorporate these foods into their

everyday meals.

PowerPoint Station: At the ***PowerPoint*** Presentation Station, the visitors will see one of the groups ***PowerPoint*** presentations. Either, the best presentation can be selected or each group of visitors can be shown a different groups presentation. Students will be on hand at this station to answer questions and to run the slide show.

Menu-Rating Station: At this station, visitors will log on to www.food.com to find the menu of a favorite local restaurant. Using the "Top Cancer-Protective Foods" list, the visitors will rate the menu of the restaurant of their choice for how cancer conscious the menu is, based on the cancer fighting foods that are available at the restaurant.

Broccoli Sprouting Station:

This station will be equipped with everything that is necessary to grow sprouts. The station should also present some sprouts that have been growing for a few days. Probably the easiest method of sprouting is the jar method, which will require jars, of course, a piece of cheesecloth and seeds

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Enrichment Options

Field Experience(s):
Take a field trip to a local supermarket and learn how many of the foods on the Top Cancer-Protect Foods list are stocked regularly. Speak to the manager in charge of ordering to find out what goes into a decision of whether to carry certain items such seaweed and guava.

Guest Speaker
Invite a chef from a local restaurant to do a cooking demonstration using some of the foods listed in the "Top Cancer-Protective Foods" list.

Interdisciplinary Extensions:

- **Language Arts**

Students can log onto***Food.com*** to view the menus of several local restaurants. Based on the anticancer food guidelines as well as the top cancer-protective foods students will critique the menus for their cancer-fighting options. The students will then write a business letter to the restaurant either commending them on the inclusion of cancer-protective foods or suggesting the addition of some.

- **Mathematics**

Students will graph the prevalence rates of the major types of cancer.

- **Social Studies**

Investigate the differences between the American diet and the Asian diet, which is held accountable for lower rates of certain types of cancers among Asians who live in Asia.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Felicity Ross & Doug Fireside

Name _____ **Class** _____ **Date** _____

Top Cancer-Protective Foods

Directions: Circle each food that you have ever eaten. Draw a star next to the foods that you eat on a fairly regular basis, at least twice a month.

Apples
Apricots
Asparagus
Avocados
Barley
Beans (all varieties)
Broccoli and its sprouts
Brussels Sprouts
Cabbage
Cantaloupe
Carrots
Cauliflower
Celery
Collard Greens
Currants
Dandelion greens
Eggplant
Figs
Flaxseed
Garlic
Grapes
Grapefruit
Guava
Kale
Kiwi
Lemons
Lentils
Mangoes
Mushrooms
Nuts (most varieties)
Oats
Onions
Oranges
Papaya
Parsley
Pasta
Peppers
Potatoes
Pumpkin
Radishes
Rice (especially brown)
Sea Vegetables (seaweed)
Seeds
Spinach
Strawberries
Tangerines
Tea
Tofu
Tomatoes
Turnips
Watercress
Watermelon
Wheat

Name _____ **Class** _____ **Date** _____

Cancer-Protective Foods Writing Activity

Today, our class took an inventory of the cancer-protective foods that we have eaten. Then, we tasted some of the unique cancer-protective foods on the list. Write your parent or guardian a letter about what you learned today and describe the foods that you tried. Describe what you thought about the foods that you tried. Explain which foods you liked and which you didn't.

Dear_____ Date_____

Sincerely,_____

Name _____ Class _____ Date _____

Top Cancer-Protective Foods Inventory Homework

Directions: With your parent or guardian, go through your pantry, cupboards and refrigerator and check off the foods that are in your home.

Apples
Apricots
Asparagus
Avocados
Barley
Beans (all varieties)
Broccoli and its sprouts
Brussels Sprouts
Cabbage
Cantaloupe
Carrots
Cauliflower
Celery
Collard Greens
Currants
Dandelion greens
Eggplant
Figs
Flaxseed
Garlic
Grapes
Grapefruit
Guava
Kale
Kiwi
Lemons
Lentils
Mangoes
Mushrooms
Nuts (most varieties)
Oats
Onions
Oranges
Papaya
Parsley
Pasta
Peppers
Potatoes
Pumpkin
Radishes
Rice (especially brown)
Sea Vegetables (seaweed)
Seeds
Spinach
Strawberries
Tangerines
Tea
Tofu
Tomatoes
Turnips
Watercress
Watermelon
Wheat

Name _____ **Class** _____ **Date** _____

Investigators

Investigator A

Go to http://www.mylifepath.com/article/iac/100200621 and answer the following questions.

1. What date was the article written? _____
2. According to the article, what is now appearing on the front of some broccoli sprouts packages? _____
3. How do broccoli sprouts compare nutritionally with full grown broccoli?

   _____
4. After reading this article, check off the best description your feelings about broccoli sprouts

- Very Positive
- Positive
- Neutral
- Somewhat Negative
- Very Negative

In the space provided below, write any additional notes you feel would be helpful for your group's ***PowerPoint*** presentation.

Investigator B

Go to http://www.broccolisprouts.com/news.htm and answer the following questions.

1. What is the title of the article? _____
2. Who is the author of the article? _____
3. Who is Dr. Paul Talalay and what university does he work for? _____

   _____
4. What is sulforaphane? _____
5. What is the main drawback to growing and marketing broccoli sprouts? _____

   _____
6. After reading this article, check off the best description your feelings about broccoli sprouts
   - Very Positive
   - Positive
   - Neutral
   - Somewhat Negative
   - Very Negative

In the space provided below, write any additional notes you feel would be helpful for your group's ***PowerPoint*** presentation.

Investigator C

Get a copy of The Broccoli Sprouts Breakthrough by Deborah Mitchell and turn to page 80.

1. List the 4 sprouting methods described. _____
   _____
2. Briefly describe each of the four methods in the space provided below. (Use the information provided on pages 80-82 _____
   _____
   _____
3. Select 3 interesting sprouting hints from page 83. _____
   _____
   _____
4. After reading this article, check off the best description your feelings about broccoli sprouts
   - Very Positive
   - Positive
   - Neutral
   - Somewhat Negative
   - Very Negative

In the space provided below, write any additional notes you feel would be helpful for your group's ***PowerPoint*** presentation.

Investigator D

Go to http://www.mylifepath.com/article/iac/100200621 and answer the following questions.

1. What date was the article written? _____
2. According to the article, what is now appearing on the front of some broccoli sprouts packages? _____
   _____
   _____
3. How do broccoli sprouts compare nutritionally with full grown broccoli?_____
   _____
   _____
4. After reading this article, check off the best description your feelings about broccoli sprouts
   - Very Positive
   - Positive
   - Neutral
   - Somewhat Negative
   - Very Negative

In the space provided below, write any additional notes you feel would be helpful for your group's ***PowerPoint*** presentation.

Name _____ Class _____ Date _____

Scoring Rubrics for Eat Your Vegetables Part II

Cancer Protective Foods Writing Activity

2 Points – The student mentions the following three things: what was learned in class, at least one food that was tasted in class, a description of which foods were liked and disliked.

1 Point – Two of the three items above are mentioned in the letter.

0 Points – All other answers

Broccoli Sprouts ***PowerPoint*** Presentation

3 Points – The presentation includes 8 slides. Each slide contains relevant clip art with complete and accurate information. Each slide contains text effects (such as bold, Italics or text transitions) and transitions between each slide.

2 Points - The presentation includes 8 slides. Each slide contains clip art, which may or may not relate to the information on the slide, with complete and accurate information. Each slide contains text effects (such as bold, Italics or text transitions).

1 Point – The presentation includes 8 slides and

Either

Each slide contains complete and accurate information and most slides (at least 5) contain clip art.

Or

Each slide contains clip art and most of the information (on at least 5 slides) is complete and accurate.

THE HOLE PROBLEM WITH ULTRAVIOLET RADIATION, PART I: UV Radiation and Risk of Melanoma and Carcinoma

Lesson Time: Four 55-Minute Periods
Grades 6-8

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Overview

This lesson focuses on the connection between UV radiation and the risks of forming skin cancer. This is a topic that is of concern since we are aware of the harmful effects the sun has on our skin. Scientific research has shown the connection between sun exposure and the increased risk of forming skin cancer and other health problems. Most people are aware that too much sun is linked to skin cancer but few know the degree of risk posed by overexposure.

Students will conduct a number of activities that will review the problems of ozone depletion and where and what time of year the ozone is at risk of thinning the most. This will be related to increased UV exposure linking to the risk of skin cancer.

Students will explore what happens to the skin when melanoma is detected and will design a campaign to spark public awareness of sun exposure and risk of melanoma. The goal is to help form behavioral change about safety in the sun.

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Instructional Technology Resources

Internet Sites:

BioHealth Link: Questions of Cancer
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html
This site gives an up to date listing of cancer Internet site resources.

The Radiating Facts http://www.sunsafety.org/radiate.htm
This site gives skin cancer facts and ways for sun protection.

Ozone Depletion Data by the EPA http://www.epa.gov/ozone
This site gives up-to-date information about the current condition of the ozone hole across the globe, using real-time TOMMS data.

Skin Cancer Zone http://www.skin-cancer.com
This site gives a tour through a skin model and provides information about skin cancer and sun protective behaviors for the consumer.

The Sky is Falling http://jocky.gsfc.nasa.gov/teacher/O3fulllesson/ACT-O3fulllesson.html
This site gives the step-by-step lesson about ozone, based on latitude and longitude of a particular place in the world. This allows students to evaluate the ozone hole and its depletion.

On the Trail of the Missing Ozone
http://www.epa.gov/ozone/science/missoz/missoztx.html
This site goes through a story called *On the Trail of the Missing Ozone* that introduces ozone depletion and its relationship to the risks of skin cancer due to overexposure of UV rays.

Environmental Health Center's Sun Safety Health Effects of UV Radiation
http://www.nsc.org/ehc/sunwise/health.htm
This site gives information about overexposure to UV radiation and children. It also explores descriptions of different types of skin cancer.

InteliHealth http://www.intelihealth.com
This site will lead to areas of skin cancer and particularly melanoma or mole cancer.

SunGuard Man http://www.sunguardman.org

This site contains interactives with a character "Sunguard Man" who battles ultraviolet rays and gives protective measures against ultraviolet radiation and other links.

Video:

- ***Ozone: the HOLE story***

SC Johnson Wax
http://www.scjohnsonwax.com
800-494-4855

Other Technology:

- SafeSun Sensor UV Radiometer

Optix Tech, Inc.
Suite 1101, 1100 17th St., NW
Washington, DC 20036
Phone (202) 737- 6641, Fax (202) 737-2351,
Email - info@safesun.com,
Web site - http://www.safesun.com FREE if you register your school as a "Sunwise" school at the Web site http://www.epa.gov/sunwise.

OTHER INSTRUCTIONAL RESOURCES

Articles:

Lee, Judy and Joyce Derulle, "Field-Testing for Ozone," The Science Teacher, December 1995: 16-18.

Publications:

EPA publications

"Ultraviolet Index: What You Need to Know";
"Be Sun Wise: What is the Ultraviolet (UV) Index?";
"Ozone Depletion";
"UV Radiation";
"Sun Protection For Children";
"Action Steps For Sun Protection";
"Health Effects of Overexposure to the Sun";
"The Sun, UV, and You";
"A Guide to the UV Index and Sun-Safe Behavior"

Environmental Protection Agency, Washington, DC 20460, 800-296-2996.
http://www.epa.gov/sunwise

NASA Facts: NF-198 December 1993, **"Ozone: What is it, and why do we care about it?"**
Goddard Space Flight Center, Office of Public Affairs
Greenbelt, Maryland 20771
301-286-8955

"Be Sun Smart! Be Safe in the Sun" exposure cards.

South Seas Trading Co.
HCR2 Box 9613,
Keaau, HI 96749,
800-964-2924.
Price: $4.25 ea.

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Teacher/Student Background Information

The teacher will want to review information about part of the electromagnetic spectrum: ultraviolet radiation. The Earth has different levels of the atmosphere, the troposphere and the stratosphere. The ozone layer forms a thin shield in the stratosphere that protects the Earth from Ultraviolet Radiation. Ozone is a naturally occurring gas in the Earth's atmosphere that absorbs certain wavelengths of the sun's UV radiation. Ozone is formed when oxygen (O) molecules in the atmosphere absorb UV radiation and split into two oxygen (O_2) atoms, which combine with oxygen gas molecules to form ozone (O_3) molecules. Ozone is broken apart as it absorbs UV radiation. This helps sustain the natural balance of ozone in the stratosphere that protects life on Earth from harmful radiation. Ozone levels vary in different parts of the world as well at different times of year. Ozone is monitored by NASA's Total Ozone Mapping Spectrometer (TOMS) instrument. When the ozone level is depleted, increased levels of UV radiation reach the Earth's surface. The higher levels of UV radiation that hit the Earth can lead to a greater risk of overexposure and lead to skin cancer.

The incidence of skin cancer in the United States has reached epidemic proportions. There are many health and education groups working to prevent the predicted one million cases of skin cancer. Melanoma is the most serious form of skin cancer. Many dermatologists believe that there is a link between childhood sunburns and tanning and malignant melanoma later on in life. There are other skin cancers that are most commonly diagnosed. The most common is basal cell carcinoma, that appears in overexposed skin on the face, ears, lips and the nose. The other is squamous cell carcinoma which is more aggressive and can spread to other parts of the body.

If people have information that may tell them when UV radiation is strong, they will be able to limit exposure to the sun. But if exposure is necessary, people should know how to protect themselves by wearing sunscreen and wearing protective clothing.

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Vocabulary

Atmosphere: The protective blanket of gases that surrounds our planet that provides us with the air we breath, makes our weather and protects us from the full blast of the sun's radiation.
Basal cell: Small, round cells found in the lower part, or base, of the epidermis, the outer layer of the skin; these cells divide to produce new skin cells, replacing those that die and slough off the surface of the skin.
Carcinoma: Cancer; uncontrolled increase of abnormal new cells that form tumors that can destroy surrounding tissue and spread throughout the body.
Dermis: The lower or inner layer of tissue that makes up the skin.
Epidermis: The upper or outer layer of tissue that makes up the skin.
Malignant: Cancerous; cells that can invade and destroy nearby tissue and spread to other parts of the body.
Melanin: A dark-brown to black pigment found in the skin, hair, and parts of the eyes.
Melanoma: A type of malignant skin cancer that arises in melanocytes, the cells that produce pigment usually beginning in a mole.
Ozone: A layer of gas composed of 3 oxygen molecules that filters out the sun's damaging ultraviolet rays.
Squamous cell: Flat cells that make up most of the epidermis, the outer layer of skin; they look like fish scales.
Stratosphere: The good ozone sustains in the area from 6 to 30 miles above the Earth; depletion of this area of the atmosphere causes UV radiation to get to the Earth at a quicker pace.
TOMMS: NASA's Total Ozone Mapping Spectrometer measures the amount of sulfur dioxide emitted into the atmosphere and monitors the depletion of the ozone globally.
Troposphere: Part of the atmosphere that ranges from the Earth's surface to approximately 6 miles above the Earth's surface; ozone here is considered to be smog or bad ozone.
Ultraviolet Radiation-A: The most abundant radiation on the Earth's surface penetrating beyond the top layer of human skin allowing vitamin D synthesis and plant photosynthesis.
Ultraviolet Radiation-B: This is partially absorbed by the ozone layer but does damage to the skin and eyes and contributes to development of skin cancers and other health effects.

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Learning Objectives

The students will:
- **Define** vocabulary related to ozone depletion, ultraviolet radiation and the basic structure of the skin.
- **Measure** the amount of ozone in the air by using student made Schoenbein paper and an UV Radiometer.

- **Identify** parts of the skin**.**
- **Explain the connection** between exposure to UV radiation and the risk of skin cancer.
- **Differentiate** between the different types of skin cancers.
- **Design** a method to spread information about the need for protection from the sun's damaging effects.

- **Goal 1: Skills and Processes:** Students will explain how the nature of science has affected inquiry, technology, and the history of science **Scientific Inquiry 1.8.1, 1.8.2, Technology 1.8.10, 1.8.11, 1.8.13, 1.8.14, History of Science 1.8.16**
- **Goal 2: Earth/Space Science:** Students will use scientific skills and processes to explain the chemical and physical interactions of the environment, Earth, and universe that occur over time. **Interactions of Hydrosphere and Atmosphere 2.8.11, 2.8.12**
- **Goal 3: Life Science:** Students will use scientific skills and processes to explain the dynamic nature of living things, their interactions, and the results from the interactions that occur over time. **Cellular 3.8.1, 3.8.2, 3.8.3**
- **Goal 6: Environmental Science:** Students will use scientific skills and processes to explain the interactions of environmental factors (living and non-living) and analyze their impact from a local to a global perspective. **Environmental Issues 6.8.5, 6.8.6**

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Lesson Assessment

These activities have a number of built- in assessments: "The Sky is Falling," "How Good is My Ozone?," and "The Sun and Me: What is the Problem?"

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Materials Needed

(Per Class)
- Computer lab with modem and Internet access so students can work in teams of two for Internet activities
- Materials to make Schoenbein Paper: recipe, Potassium iodide, Filter paper, Corn starch, Glass stirring rod, Small paint brush, 250 mL beaker, Heat source (hot plate), Distilled water, Heat-safe glass plate, 5 gallon bucket, single hole paper puncher
- Safety goggles for the teacher
- Apron
- Wet-dry bulb psychrometer that uses two non-mercury-filled thermometers or local weather data

- Fishing line or thin rope
- ***SafeSun Sensor*** UV Radiometer from the Optix
- UV Exposure Cards from South Seas Trading Company

(Per Student Group of 2)
- Computer with Internet access
- "The Sky is Falling?" activity sheet downloaded from the Web site http://jwocky.gsfc.nasa.gov/teacher/O3fulllesson/ACT-O3fulllesson.html
- "How Good is My Ozone?" activity sheet

Per Student
- ***InteliHealth*** article "Destruction of Ozone Layer Heightens Concerns About Skin Cancer," from the following web site: http://www.intelihealth.com/IH/inUh/EMIHC000/333/333/283916.html
- The Science Teacher, "Field-Testing for Ozone" article
- EPA publications "Ultraviolet Index: What You Need to Know", "Be Sun Wise: What is the Ultraviolet (UV) Index?", "Ozone Depletion", "UV Radiation", "Sun Protection For Children", "Action Steps For Sun Protection", "Health Effects of Overexposure to the Sun", "The Sun, UV, and You"; "A Guide to the UV Index and Sun-Safe Behavior"
- Internet Search: "The Sun and Me: What's the Problem?"
- "SkinGuard Your Skin Survey" from ***SunGuard Man*** Web site http://www.sunguardman.org
- "Use the ABC's to Make a Guide for Fun in the Sun" Activity Sheet

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Procedures

Day 1: What is Ozone?

Set-up Directions:
You will need a computer lab set up for each pair of students to work. They will need Internet access to the ***NASA*** site: http://jwocky.gsfc.nasa.gov/teacher/O3fulllesson/ACT-O3fulllesson.html and the activity sheet titled "The Sky is Falling?" that can be downloaded from this Web site.

You need to prepare the students with vocabulary: ozone, latitude, longitude, atmosphere, stratosphere, and troposphere. Each student should have a copy of the ***InteliHealth*** article titled "Destruction of Ozone Layer Heightens Concerns About Skin Cancer" (or another up-to-date article) to spark an interest for the week's activities.

Teacher Presentation & Motivation:
In this activity, students will get a chance to familiarize themselves with definitions concerning ozone. The students will compare the ozone level at their present

location compared to locations around the world. They will identify where ozone levels are the worst around the globe.

Activity 1:
Reading to be Informed: After setting up the students in the computer lab they will read to be informed the article from the ***InteliHealth News*** "Destruction of Ozone Layer Heightens Concerns about Skin Cancer."

Activity 2:
The students will conduct an Internet activity, "The Sky is Falling?" from the ***NASA*** site http://jwocky.gsfc.nasa.gov/teacher/O3fulllesson/ACT-O3fulllesson.html.

Each student should work with a partner for the entire activity. Hard copies of the activity sheet can be downloaded for the activity from the previous Web site, if needed. By the end of this activity, students should have an understanding of what ozone is and its purpose. They should know where the ozone is thinning and what time of year it thins the most not only in the area they live but also around the globe. You will then want to collect the activity or answer sheets from the students for assessment.

At the end of the activity, you should prepare them for the next day's activity of field testing ozone in their schoolyard by giving a take home article "Field Testing for Ozone" from the The Science Teacher December 1995 issue. Students should be instructed to highlight or underline the "key" points in the article. This will give background for testing the ozone around the school.

Day 2: Field Testing Our Ozone

Set-up Directions:
You need to have all of the materials needed for the Schoenbein paper. You will need to make up the Schoenbein Papers before the students arrive using the included recipe. Provide a 5 gallon bucket of distilled water so the students can dip their paper and hang in direct sunlight for at least 8 hours. These will be used for the students to hang in various areas of the schoolyard to test for ozone levels. The paper will have to hang for at least 8 hours, so either you can retrieve the paper at the end of the day or have the students retrieve the paper the following day.

Provide a SafeSun Sensor UV Radiometer from Optix and UV Exposure Cards from South Seas Trading Company for Activity 2.

Teacher Presentation & Motivation:
You will need to review with the students the home assignment reading, "Field-Testing for Ozone." You will want the students to review the research and results that led to the issue to study ozone in the community. You will need to review the Schoenbein Color Scale and the Relative Humidity Number Chart from the article.

Activity 1:

Have the students brainstorm where around the schoolyard they think ozone levels may be high or low. Ask students to give explanations for their predictions.

Tell the students they will conduct an investigation using Schoenbein paper to field test their hypothesis which they read about in the article.

Hand out the laboratory investigation "How Good is My Ozone?" The students will work in pairs. They should retrieve the hole-punched Schoenbein filter paper and place a number or name at the bottom of the paper in pencil. Have students place approximately 18 inches of fishing line or string through the hole that has been punched so they may hang up their papers in their designated areas.

Have students choose a place outside (not in direct sunlight) where they will hang their test paper. Tell students when they get to their location to dip the paper in distilled water and allow it to hang undisturbed. The students then need to return to the classroom for further activities.

Activity 2:
After the students have returned to the classroom, have them write a description of the location they chose to hang their test paper. Have them make a prediction whether they believe the paper will test high or low for ozone on their lab papers.

After that is complete, hand out the three EPA Sun Wise publications: "Ozone Depletion", "UV Radiation", and "What is the Ultraviolet Index?"

After reading the publications, lead students in correlating the idea that when there is less ozone in the atmosphere, more bad UV radiation hits the Earth that can be damaging to life. Have students define the types of UV radiation and UV index.

Show students the UV Radiometer and how it works. Show the UV sensor cards as well. Allow students to practice taking UV radiation readings with the sensor and identifying if the UV radiation outside is safe at the time. (Instructions are in the box with the sensor.) Tell students to bring the lab reports and "Field-Testing for Ozone" articles with them the next day.

Day 3: Field Testing Ozone Results

Set-up Directions:
Before going on the school tour to collect the papers for testing, determine the relative humidity of the data collection site by using a bulb psychrometer or local weather data or if online, the Automated Weather Service site data. Round off the relative humidity reading to the nearest 10 percent. (Higher relative humidity makes the paper more sensitive to ozone, and a higher Schoenbein Number is observed.) The correction to be made is determined and figured into the calculation of ozone concentration. Refer to the "Relative Humidity Schoenbein Number Chart" in the Science Teacher article, "Field-Testing for Ozone."

Teacher Presentation & Motivation:
The students will retrieve the papers and collect and analyze the data concerning the ozone levels and UV Radiometer readings and UV Exposure cards for the specific areas around the school. They will share their findings with the class and in writing. This illustrates the prevalence of skin cancer and the increase of UV-B exposure due to ozone depletion.

Activity:
This is where students will retrieve their Schoenbein papers and take the UV index reading with the UV radiometer at their particular site. The students should record their data on their data charts.

You will need to assist the students in receiving the relative humidity reading for the day.

The students will continue with the data collection and analysis. About 2 gallons of distilled water in a bucket will be needed for the students to observe any changes in their Schoenbein papers.

At the end of the analysis, you need to collect the laboratory investigation for assessment. By the end of the day's activity, students should have an understanding that the depletion of the ozone layer causes damaging rays of UV-A and UV-B to penetrate to the Earth's surface.

The laboratory investigation and analysis questions should be collected and evaluated based on the student's research and findings.

Day 4: How Does UV Radiation Get to the Skin?

Set-up Directions:
This activity is Internet based, therefore, if possible, to have a computer lab set up for each student to be at a station or in pairs. Each student will need a copy of the "SunGuard Your Skin Survey" from the ***SunGuard Man*** website, http://www.sunguardman.org

Teacher Presentation & Motivation
This activity will involve an Internet search encompassing the broad idea that UV radiation effects the skin's layers. The skin then can change and form types of cancer due to those damaging rays. Students will be lead on a search to find out about the different types of skin cancers. You will need to review the vocabulary dealing with the skin, carcinomas and melanomas.

Each student will need the activity, Internet Search "The Sun and Me: What's the Problem?" This will havethe students go through text version.

- **Differentiation**: For lower level students, there is an illustrated panel version if you go to the home page of the EPA/ozone site.

- **Differentiation:** For the higher achieving readers, there is a site that can be added to the search. <http://www.ciesin.org/TG/HH> then go to ozskin1.html, ozskin2.html, ozskin3.html. These three items are very high level reading but show the correlation between Ozone Depletion, UV-B Exposure, and Skin Cancer and its prevention.

Activity:
This activity will allow the students to conduct a search that is guided to allow them to explore the effects of UV radiation on the skin. The students will diagram a skin model and identify cancers that are associated with different layers of the skin. They will see the different cancers and understand the need to protect oneself from the sun's harmful rays.

Conclude the activity with the "SunGuard Your Skin Survey" to prepare the students for the next few days.

They will need to be told they will participate in an informative multimedia presentation about safety in the sun and the root causes of the sun's damaging rays. Home assignments may be to brainstorm ideas for this presentation.

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Enrichment Options

- **Science**

Have a dermatologist or oncologist visit the classroom for a demonstration to discuss the skin and cancer.

- **Health**

Have students evaluate different brands of sunscreens for SPF and longevity. A lesson plan centered on this topic titled "Sunscreen Smokescreen," can be found on the EviroHealth Link Web site at: http://www.mpt.org/learningworks/teachers/ehl/

- **Math**

Students could observe photos of moles that have developed carcinomas in lapse photography and analyze the growth rate by measurement using the ABCD's of moles.

- **Physical Education**

Students could take the UV Radiometer outside during physical education or recess and observe the UV index as they are participating in outdoor activities.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, how could this lesson be adjusted after its initial implementation? What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Jennifer Petering and Kevin Feeney

Name _____ Class _____ Date _____

Schoenbein Paper Recipe

Materials:

Potassium iodide

Filter paper

Corn starch

Glass stirring rod

Small paint brush

Heat source (hot plate)

81/2" x 11" paper for drying filter paper or 9" microwave-safe plate

Scissors

Distilled water

Heat-safe glass plate

Safety goggles

250 mL beaker

Apron

Hot pad for removing beaker from heat source

Zipper-lock bags or glass jar for storing paper

Preparation:

1. Place 100 mL of distilled water in a 250 mL beaker and add 5 g of corn starch.

2. Heat and stir mixture until it gels. The mixture is gelled when it thickens and becomes somewhat translucent.

3. Remove the beaker from the heat and add 1 g of potassium iodid and stir well. Cool the solution.

4. Lay a piece of filter paper on a glass plate and carefully brush the paste onto the filter paper. Turn the filter paper over and repeat the process to the opposite side. Apply the paste as uniformly as possible. The paper can be exposed for immediate testing at this point or may be allowed to dry. If you are to let it dry, follow the rest of the procedures.

5. Allow the paper to dry on the 8 1/2" x 11" paper. Do not set in direct sunlight. A low-temperature drying oven works best. To save time, place the paper on a microwave-safe plate and microwave for one minute.

6. Cut the filter paper into 1 inch-wide strips. To store the strips, place them in a zipper-lock plastic bag or a glass jar out of direct sunlight.

7. Wash hands thoroughly with soap, and scrub under fingernails with a brush after working with the potassium iodide mixture.

Name _____ Class _____ Date _____

How Good is My Ozone?

This activity will test the oxidation capability of ozone. Ozone in the air will oxidize the potassium iodide on the Schoenbein paper to produce iodine. The iodine reacts with starch and produces a purple color. The exact shade of purple correlates to the amount of ozone present in the air.

This activity will also discover the relative humidity in the atmosphere and how this interrelates with the ozone level and the amount of Ultraviolet radiation that is reaching the Earth at that particular time of the day.

Pre-lab question: Which areas around your school do you think have the highest levels of ozone? Which areas around your school have the lowest amounts of ozone? Why?

_____

_____

_____

_____

_____

Day 1

1. Think-pair-share with your partner an area in your schoolyard to be your data collection site to test for ozone concentration. Write that location in the space that follows:

_____

2. When you receive your Schoenbein paper, write a code word or your name at the bottom of the paper in pencil. Make sure you have a hole at the top of the paper for fishing line to go through so you may hang up your paper in your specified location. Place fishing line through the hole so that you may hang your paper at the data collection site.

3. When told to do so, go to your data collection site and dip the dry Schoenbein paper in distilled water and hang the paper OUT OF DIRECT SUNLIGHT. Leave in that location for at least 8 hours.

4. Review the process to use an Ultraviolet Radiation Radiometer with your instructor. Most meters will indicate an Ultraviolet Index number on a scale of 0-10+. The sensors calculate the dose of UV the user has absorbed in the course of a day. The index number corresponds with an Intensity Level in the following way:

INDEX NUMBER	INTENSITY LEVEL
0 to 2	Minimal
3 to 4	Low
5 to 6	Moderate
7 to 9	High
10+	Very High

Special Note: Based on the index numbers, you should take special care to adopt special safeguards to sun overexposure such as wearing sunscreen, hats, sunglasses, and protective clothing if the index value is moderate or higher.

DAY 2

TESTING PROCEDURE

5. Go to data collection site and retrieve your Schoenbein paper.

6. Take the Ultraviolet Radiation reading with the SafeSun Sensor UV Radiometer or other ultraviolet radiation radiometer.

Indicate the index number _____ Indicate the Intensity Level _____

7. Dip a strip of the test paper in distilled water. Observe the color and determine the Schoenbein Number using the Schoenbein color scale as follows:

Schoenbein Color Scale

0-3	Little or no change
4-6	Lavender hue
7-10	Blue or Purple

____

Schoenbein number

8. Determine the relative humidity of the data collection site by using a bulb psychrometer or local weather data. Round off to the nearest 10 percent.

Relative Humidity _____

9. Refer to the Relative Humidity Schoenbein Number Chart. Along the bottom of the chart, find the point that corresponds to the Schoenbein number that you recorded. From that point, draw a line upward until it intersects with the curve that corresponds to your relative humidity reading. To find the ozone concentration in parts per billion, draw a perpendicular line from the Schoenbein number/relative humidity point of intersection tot the left side of the chart.

My ozone reading _____ ppb

Observations and Questions:

1. What change in the test paper did you observe? (The color of the paper may not be uniform.) Determine the Schoenbein Number by the color in an area with the most noticeable change.

_____

_____

_____

_____

_____

2. Compare your test to those of other students. Do all the test papers appear the same? (Individual test papers will vary depending on the amount of oxidants at that site. Be aware that false positive results can occur from nitrous oxides in heavy traffic areas.)

_____

_____

_____

_____

_____

3. Was the relative humidity for your test day high or low? _____

How does that effect your ozone results?

_____

_____

_____

_____

_____

4. Why do you think the test papers did not all appear the same?

_____

_____

_____

_____

_____

5. Would the parts per billion of ozone be the same for a Schoenbein Number of 4 at a relative humidity of 30 percent and 70 percent? Explain.

_____

_____

_____

_____

_____

6. Based on the data you collected, do you think this method is a good way to measure tropospheric ozone? Why or why not?

_____

_____

_____

_____

_____

7. How does this data compare with the local monitoring station?

_____

_____

_____

_____

_____

8. What connection can you make with the ozone level and UV index level?

_____

_____

_____

_____

_____

Name _____ Class _____ Date _____

The Sun and Me: What's the Problem?

Introduction: This activity is designed to give you some background information on UV radiation and its link to skin cancer. When you complete this activity you should be able to:

- Identify the different UV rays
- Differentiate between the good and bad effects of sunlight
- Label the parts of the skin
- Differentiate between the different types of skin cancer
- Generate ideas to prevent skin cancer due to harmful effects of UV radiation

1. Make sure the Internet connection is set to your particular starting point or home page.

   Go to the site http://www.epa.gov/ozone/science.missoz/missoztx.html
   This will bring up the EPA site "On the Trail of the Missing Ozone" text version.

   a. Read the text through the **In the Newsroom of the Daily Requirement...**
   Go back and click on *huge hole* and give the title of the site. _____

   Read until you get to *size of the ozone hole* and click on it.

   b. Scroll to the **Ozone Hole Area Over Time** and read through **Ozone Hole Area During the Year**. What area and what time of year do you observe the ozone hole the largest? _____

   When does the hole seem to disappear? _____

   Why do you think the hole is larger that time of year? _____
   _____

   c. Click on previous page or go back two times. Click on *stratosphere*. Read through the definition of *troposphere*. What is the difference between the two parts of the atmosphere? _____
   _____
   _____
   _____
   _____

2. Click *Return to previous page*. Read the first paragraph in the section **Farley Meets with a Scientist**. When you get to the part about the *ultraviolet, or UV*, rays, click on it.

   a. Scroll up to **UV: Ultraviolet radiation** and read through the definition.

   b. Click on *ozone*. What is it and where is it found? _____

   c. Click the Return to Previous Page Bar. Click on *UVA*. Describe this type of radiation. _____
   _____
   _____

   d. Scroll down to *UVB.* Describe this type of radiation._____
   _____

   e. Scroll down to *UVC.* Describe this type of radiation._____
   _____

3. Click the *Return to Previous Page Bar* twice. Keep reading until you get to *wherethe trouble starts.* and click on this and read through the "Ozone Depleting Process." Click on **go back** and keep reading until you get to *North America*. Read through this site and answer the following questions.

   a. Where will ozone depletion be greater in the United States, Seattle or Los Angeles? Why? _____
   _____

   b. When will ultraviolet radiation double in the Antarctic? _____

   c. Even though the ozone hole increases in size, does the sun reduce its UVB production? _____
   _____

   d. Explain how ozone depletion and UVB radiation interconnect. _____
   _____
   _____

4. Go back to previous page. Keep reading Farley's conversation. Let's see if we can answer Farley's question *Why is it so important that the ozone layer filter out the UV rays?* Click on this and answer his question. _____
   _____
   _____
   _____

5. Go back and keep reading Farley's conversation. After **Farley goes to a doctor** go back and click on *what too much UV radiation*. Scroll down to the bottom of this page and click on *Health Effects of Ozone Depletion*.
   a. List the major health problems linked to overexposure to UV radiation:
      - _____
      - _____
      - _____
      - _____

   b. Which type of skin cancer is the most serious and why? _____
   _____
   _____
   _____

   c. There are two other types of skin cancers in the category Nonmalignant Carcinoma.

   Describe **basal cell carcinoma**.
   _____
   _____
   _____

   Describe **squamous cell carcinoma**.
   _____
   _____
   _____

6. Go back two times to previous page and finish reading Farley's adventure on "The Trail of the Missing Ozone."

   Explain briefly what Farley found out in his adventure._____
   _____
   _____
   _____

The focus now is on Skin Cancer.

You now have a background of how the ozone hole is directly related in allowing UV radiation to get through the atmosphere and to the Earth. We have seen that too much UV radiation can cause major problems for plants and animals. We are going to focus on the harmful effect of overexposure of UV radiation and the risk of several types of skin cancer and one in particular, melanoma.

We have previously identified the major types of skin cancer. Now let's see how bad they really are and what they look like. We need to do this so we may be able to diagnose our own if it occurs.

1. Go to the site http://www.sunsafety.org/radiate.htm

   This site will give you some *Radiating Facts.*

   What is skin cancer?_____

   Where is skin cancer the most commonly diagnosed? _____

   In what age group do most malignant melanomas occur? _____

   What percentage of skin cancer can be attributed to overexposure to the sun? _____

2. It states in these facts that "a person born today is twice as likely to develop malignant melanoma as someone born only a decade ago and 12 times as likely as someone born 50 years ago." Based on your knowledge and research, why would this statement be true?
   _____
   _____
   _____
   _____

3. Go to site http://www.nsc.org/ehc/sunwise/health.htm
   Scan through the *Sun Safety: Health Effects of UV Radiation* site.

   a. Why are children most at risk to overexposure to UV radiation?
   _____
   _____
   _____

   b. Describe in detail what basal cell carcinomas look like and where they occur.
   _____
   _____
   _____
   _____

c. Describe in detail what squamous cell carcinomas look like and where they occur.

_____
_____
_____
_____

d. We know malignant melanoma is the most deadly of the three skin cancers. How do melanomas start out?

_____
_____
_____

4. Go to the Web site www.skin-cancer.com

   a. Describe where melanomas commonly show up in males.

   b. Describe where melanomas commonly show up in females.

   c. You will need to diagram the structure of the skin and define the parts of the skin. Click on the word *skin* at the bottom of the page for the diagram the structure and function of the skin. Label your diagram and describe the parts of the skin.

Epidermis _____
Dermis _____
Melanin _____
Melanocyte _____

5. When you get to the end of each page click the red arrow and continue.

   a. Describe the difference between benign and malignant tumors.

b. Describe what you see in the pictures of the different skin cancers.

c. Can melanomas be curable?_____

d. Describe some causes of melanoma

e. How can melanoma be prevented? _____
_____
_____
_____

Let's now focus on sun safety. Keep scrolling through the section on sun safety and safety for kids.

1. When and where is UV exposure the greatest? _____
   _____
2. When can someone get a sunburn, even if they may not think they can?
   _____
   _____
3. List some general safety rules for children.
   - _____
   - _____
   - _____
   - _____
4. . List 5 ways you can protect yourself from the sun's bad rays.
   1. _____
   2. _____
   3. _____
   4. _____
   5. _____

5. Since part of prevention of melanoma can be early detection, people with moles need to be particularly careful. They need to watch their moles to see if they look different. The warning signs of melanoma can correspond to the first four letters of the alphabet. Go to the site http://www.intellihealth.com the click on cancer and in the **cancer info finder scroll** down to *skin cancer* and click GO. In the **search intellihealth** box, type in *melanoma and* click GO. Scroll down to *Mole Cancer* and click. Click on *prevention*. This will lead you to the ABCD's of examining a mole.

   A _____

   B _____

   C _____

   D _____

6. Scroll down a little farther and list the types of treatments that are used when melanomas are diagnosed.

7. Now that you have concluded your Internet activity, write a paragraph explaining the effects and prevention of overexposure to the sun.

Name _____ Class _____ Date _____

Use the ABC's to Make a Guide for Fun in the Sun

Some examples to get you started are the following:

A* = *Away. Stay out of the sun in the middle of the day from 11am to 3pm

B* = *Block. Use a sunscreen with a SPF of 15 and reapply regularly.

C* = *Cover up. Wear a t-shirt and a hat.

D* = *Discuss it. Talk to your family and friends about sun protection.

Some other questions that might be useful to consider are the following:

- What age might sun damage begin?
- Why should the public be aware of the issue and why they should be concerned?
- What are the most effective sun protection measures?

Name _____ Class _____ Date _____

GRADING RUBRICS

Task 1 - UV Radiation Background

I. What Is UV Radiation?

3- Includes a discussion of all 3 types of UV radiation AND how they are affected by the ozone layer. Includes how each type affects living things such as animals, plants, and humans.

2- Includes a discussion of at least 2 types of UV radiation AND how they are affected by the ozone layer.

1- Lists 2 of the 3 types of UV radiation but no relationship established between exposure to radiation and damage to the human body.

0- Less than two types of UV radiation identified.

II. What Affects The Amount Of Radiation Exposure?3- Extensive discussion of all 7 conditions with a reference to what UV index represents.

2- Discussion of most (5 of the 7) conditions with no reference to what UV

index represents.

1- Limited discussion of the conditions (3 of the 7) with no reference to what

UV index represents.

0- No construction of meaning.

Task 2 - Health Effects of Exposure to UV Radiation

I. What Effect Does UV Radiation Have On Your Health?

3- Extensive discussion of both positive and negative effects of UV radiation exposure including risk factors.

2- Discussion of only few positive and negative effects of UV radiation exposure with some risk factors.

1- Limited discussion of only positive or only negative effects of UV radiation exposure with limited discussion of risk factors.

0- No construction of meaning.

II. How High Is Your Risk Factor For Skin Cancer?

3- Clear connection between prediction and risk factors with an extended discussion about specific risk factors.

2- Clear connection between prediction and risk factors with no discussion about specific risk factors.

1- No attempt to support prediction with additional information about risk factors.

0- No construction of meaning.

III. What You Can Do To Lower Your Risk Factor?

3- Extensive discussion of individual risk factors and how to decrease exposure. Include direct information about how each method decreases the risk.

2- Lists 3 ways to decrease risk and limited discussion of which risk factors are affected.

1- Lists 3 ways to decrease risk with no discussion of how the method affects risk.

0- No construction of meaning.

Task 3 - The Commercial/Brochure/Presentation

The Information Presented

5- Information about the effects of UV radiation exposure, the risk factors, and ways to prevent overexposure is accurate. There are clear connections between risk factors and ALL prevention methods.

4- Information about the effects of UV radiation exposure, the risk factors, and ways to prevent overexposure is accurate. There are clear connections between risk factors and SOME prevention methods.

3- Information about the effects of UV radiation exposure, the risk factors, and ways to prevent overexposure is accurate. There are clear connections between risk factors and a FEW prevention methods.

2- Information about the effects of UV radiation exposure, the risk factors, and ways to prevent overexposure is accurate. There are clear connections between risk factors and at least ONE prevention method.

1- Information about 2 of the 3 topics (UV radiation exposure, the risk factors, and ways to prevent overexposure) is mostly accurate.

0- Only one topic is addressed and/or the information is grossly inaccurate.

The Hole Problem with Ultraviolet Radiation, Part II: Promoting Sun Safety

Lesson Time: Three 55-Minute Periods
Grades 6-8

Table of Contents

Overview

After students have a background about ozone depletion and how that relates to UV penetration through the atmosphere (see "The Hole Problem with Ultraviolet Radiation Part I), they will be ready to present their knowledge about the subject. The foundation allows students to communicate the harmful effects of extensive UV radiation and sun damage that leads to various types of skin cancer. Students who have this background then can express to the public how to prevent this type of damage from occurring.

This lesson will help the students learn the necessity of getting across the important message for EVERYONE to protect themselves from the harmful rays of the sun.

Students will demonstrate ways to practice effective sun protection. Different formats of demonstration that involves different aspects of the school community are the following:

1. audio announcement to the school population
2. video commercial to express the ABCD's for fun in the sun
3. ***PowerPoint*** presentation to the PTSA
4. poster and banners displayed at school and at the local elementary school

This can be achieved with all academic levels of students. Programs to use to achieve the goals are software packages such as ***Inspiration*** to help graphically organize the students' thoughts.

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Instructional Technology Resources

Internet Sites:

BioHealth Link: Questions of Cancer
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html
This site gives an up to date listing of cancer Internet site resources.

Power Point Presentations
http://www.crpc.rice.edu/CRPC/GT/lee/powerpoint.html
This site shows how to make *PowerPoint* presentations easy to illustrate and deliver ideas.

Multimedia Software:

- **Microsoft *PowerPoint*** for the presentation of the multimedia skin cancer prevention project
- ***Inspiration*** for students to construct webs to link information for presentation

Inspiration Software, Inc.
7412 SW Beaverton Hillsdale Hwy., Suite 102,
Portland. OR 97225-2167
800-877-4292,
http://www.inspiration.com

Video:

- ***Ozone: the HOLE Story***

SC Johnson Wax
http://www.scjohnsonwax.com
800-494-4855

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Materials Needed

(Per Class)

- Computer with ***PowerPoint*** and ***Inspiration*** software downloaded
- EPA Publications, "Sun Protection For Children", "Action Steps for Sun Protection" and "Health Effects of Overexposure to the Sun."
- Video Camera (usually can be borrowed from your school's media specialist)
- Blank video tape
- Props needed for taping of commercial
- Colored paper and poster board
- Art supplies for posters
- VCR and television monitor
- Blank audio cassette tape and player

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Learning Objectives

The students will:

- **Define** vocabulary related to ozone depletion, ultraviolet radiation and the basic structure of the skin
- **Explain the connection** between exposure to UV radiation and the risk of skin cancer
- **Differentiate** between the different types of skin cancers
- **Design** a method to spread information about the need for protection from the sun's damaging effects.

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Procedures

Day 1: Multimedia Presentations

Set-up Directions:
Have a VCR and monitor ready to show the 4:25 minutes of the *Ozone: the HOLE story* video.

Have students bring all information they have used in Part I Lesson activities. They will need to return all investigations and Internet activities to help plan for their presentations. Have plenty of paper for students to generate ideas for their presentations.

EPA Publications which will be helpful for the students to use in their presentation preparation are the following: "Sun Protection For Children", "Action Steps for Sun

Protection" and "Health Effects of Overexposure to the Sun."

You will need a computer in the classroom loaded with ***Microsoft PowerPoint*** and ***Inspiration*** software, so the students involved with this presentation can work as a team.

The ***Inspiration*** software can be used to make a web for the campaign story board starting with "Sun Exposure." Students can brain storm ideas studied in the previous lessons.

You will need to have art supplies such as markers, construction paper, poster board, glue sticks, scissors and anything else the students may need. You will need a cassette recorder with a tape and a video recorder with a blank tape for the video commercial. You may need to prep the video group on the use of the video camera.

Teacher Presentation & Motivation:
Begin by initiating a discussion with the students on their experiences with the sun such as sunburns, tans, use of sunscreens, and their knowledge of the damage that can be done when excessive UV radiation contacts the skin.

Show the video clip from ***Ozone: the HOLE Story***. This will give the students an idea of how to set up their multimedia presentations.

FOCUS FOR VIEWING
The focus for viewing is a specific responsibility or task(s) students are responsible for during or after watching the video, to focus and engage the students' viewing attention. Use only 4:25 minutes of the ***Ozone: the HOLE story*** video. A tie in to the problem of the UV radiation penetration due to ozone depletion and the cancer that is a risk. There is also a sample cartoon commercial for safety in the sun.

FAST FORWARD from the beginning to 11:00 and **PLAY. STOP** after the "Slip, Slop, Slap" commercial at 15:25.

Instruct students to sign up on chart paper to produce one of the multimedia presentations for safety in the sun. Hand out the checklist of items that must be included in all presentations.

Have chart paper to allow students to sign up for the various presentations:
- Information Brochures
- Information Posters
- Audio Infomercial
- Video Infomercial/Commercial
- ***PowerPoint*** presentation
- ***Inspiration*** presentation

Have students bring in all props and costumes or miscellaneous items they will need to practice and polish their presentations.

Students should include in their presentations facts about the ozone depletion

allowing UV rays to penetrate through the atmosphere, facts about overexposure to UV radiation being a root cause of skin cancer, and preventative measures from overexposure so that people can have fun in the sun.

Examples are given in the "Alphabet to Fun in the Sun" information sheet where students take each letter from the alphabet and relate it to some part of sun education and protection.

Days 2 and 3: Practice and Presentation

Activity
A sample rubric is given for teachers to use for the presentations by going to the site ***Student Multimedia Project Rubric*** sample.
http://www.ncsu.edu/midlink/rub.mm.st.htm

Sample rubrics are also included for the presentations.

Community Connection:
Students present their infomercials and ***PowerPoint*** presentations to the PTSA or other parent groups. They can present the commercials and posters and brochures to the school community, the local elementary schools. As an extension, some students could develop a puppet show or a skit for the younger children.

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Enrichment Options

- **Language Arts**

Students can write letters to their parents explaining the campaign "Slip, Slop, Slap!"

Have students create a crossword or a word find on sun protection.

- **Social Studies**

Students can present ideas about the sun safety to students who travel to tropical places for spring break or in the summer during a student council or town council meeting.

- **Fine Arts**

Students can compose a song or a jingle for the morning announcements to go along with the public service announcement.

Students can design sun safety t-shirts and have a contest with the craziest sun safety T-shirt design.

- **Science**

Have a cosmetologist speak about the sun protection factor found in make-up and hair products and lotions.

- **Technology**

Have students put their campaigns on a web site that is linked to the school web site.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, how could this lesson be adjusted after its initial implementation? What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Jennifer Petering and Kevin Feeney

Bittersweet Sweeteners: Artificial Sweeteners and Cancer, Part I

Time Commitment: Four 50 Minute Periods
Grades Levels: 6-8

Table of Contents

Overview

Cooperative structure of the lesson:
Students will be working for most of the lesson in groups of four.

Expected products from lesson:
Students will be conducting experiments to observe the physical and chemical properties of natural and artificial sugars. They will also construct a timeline of the history of artificial sweeteners by using a WebQuest. Students will view a ***60 Minutes*** segment to examine the controversy surrounding the artificial sweetener aspartame. Students will discuss bias in research as a result of viewing the segment. On the last day, students will create an educational display that will synthesize

what they have learned about artificial sweeteners.

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Instructional Technology Resources

Internet Sites:
Filimentality BioHealth Link
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html
This site contains a hot list of Internet cancer sites.

Filimentality Internet Project Site
http://www.kn.pacbell.com/wired/fil/pages/listinternetcy1.html
This site contains a hot list of Internet sites that aid in using the Internet.

FDA Consumer—Sugar Substitutes: Americans Opt for Sweetness and Lite
http://www.fda.gov/fdac/features/1999/699_sugar.html
This publication of the FDA gives an overview of the history of artificial sweeteners.

Computer Software:
Microsoft PowerPoint

Video(s):
CBS Video
327 Holly Court
Williston, VT 05495
1-800-542-5621

Other Technology:

- Television
- VCR

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Teacher/Student Background Information

The artificial sweetener/cancer debate has been sounding for years. There is a wealth of knowledge in print and on the Internet. One important aspect that the students must be aware of is the bias in the research. The teacher must point out that when researchers are paid by a corporation to conduct tests, there is an inherent bias in the results. This can be looked at and discussed as the students view the ***60 Minutes*** segment.

Prerequisite skills the students need in order to successfully complete this lesson

include the ability to graph, employ lab safety, and create a timeline. Students should have some background knowledge of cancer and environmental factors that cause cancer. Students can get this background information through various Web sites such as the American Cancer Society and National Cancer Institute sites. They should also have an understanding of physical and chemical properties.

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Vocabulary

Aspartame– artificial sweetener used in many diet products. Chemical composition is C14-H18-N2-O5

Saccharin– artificial sweetener used in many diet products

Volatility– ability for a substance to turn into a gas

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Learning Objectives

Content:

- **Observe** and **record** physical and chemical properties of sugar, saccharin, and aspartame.
- **Compare** the properties of sugar, saccharin, and aspartame.
- **Gather** information on the history of artificial sweeteners.
- **Create** a timeline of the history of artificial sweeteners.
- **Synthesize** information on artificial sweeteners in order to **create** a public awareness presentation.

Technology:

- Use technologies in a safe and effective manner.
- Use appropriate technologies for research, creativity, and problem solving.
- Use appropriate technologies to access, store, manage, analyze, and communicate information.

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Lesson Assessment

Content and Technology:

Use the "Comparing Natural and Artificial Sweeteners Scoring Rubric" to evaluate students' understanding of the content.

Use the "Timeline WebQuest Scoring Rubric" to evaluate students' understanding of

the content and successful use of technology.

Use the "Educating the Public Scoring Key" to assess students' synthesis of information learned on artificial sweeteners.

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Materials Needed

(per student)
- worksheet, "Comparing Natural and Artificial Sweeteners"
- worksheet, "History of Artificial Sweeteners"
- worksheet, "How Sweet Is It?"
- worksheet, "Educating the Public"

(per student team/group of 2)
- scissors
- register tape
- meter stick
- metric ruler

(per student team/group of 4)
- 100 mL beaker with sugar
- 100 mL beaker with aspartame
- 100 mL beaker with saccharin
- microscope
- 3 microscope slides
- 3 cover slips
- wire mesh
- ring stand
- ring
- evaporating dish
- Bunsen burner or butane burner
- matches
- scoopula
- teaspoon
- computer with Internet access
- crayons or markers
- poster board

(per class)
- computer with Internet access
- VCR and monitor

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Procedures

Students will be working in cooperative groups through much of this lesson. On day one they will work in lab groups of four. On day two they will be paired together.

On day one students will need to use computers with Internet access. The ideal set-up would be in a computer lab in which students could pair up at the computers.

No special accommodations are required as students will be working in cooperative groups.

Day 1: Properties of Sweeteners

Set-up Directions:
The teacher will need the following materials for each group of four students: three 100 mL beakers, a sample of sugar, aspartame, and saccharine, microscope, 3 slides, 3 cover slips, ring stand, ring, wire mesh, evaporating dish, butane burner, and matches. Each student will need a copy of the worksheet, "Comparing Artificial and Natural Sweeteners".

Teacher Presentation & Motivation:
The teacher will ask the students if they, or anyone they know, uses artificial sweeteners. Call on students to name various sweeteners. List these on the board. Ask students if they know the name of the chemicals that are used in the artificial sweeteners. The teacher will then show an example of sugar, aspartame, and saccharin. The students will look at these three examples and write down their observations. Teacher explains, "Today we will be looking at the physical and chemical properties of these three substances in order to make comparisons between natural and artificial sweeteners. One observation I will tell you is that aspartame is 180 times sweeter than sugar and saccharin is 300 times sweeter than sugar. As always in science class, you will not be tasting these samples."

Activities:
The teacher will divide the class into groups of four. The groups of students will complete the activity, "Comparing Artificial and Natural Sweeteners." After the students have completed the activity, have them discuss their comparisons by reading aloud their paragraphs.

Day 2: The History of Artificial Sweeteners

Set-up Directions: The teacher will need the following materials per group of two students: register tape, metric ruler, scissors, and a meter stick. Each student will need a copy of the worksheet, "History of Artificial Sweeteners WebQuest." Students should be grouped in pairs to create their timelines.

Teacher Presentation & Motivation:
The teacher states, "Yesterday we looked at the physical and chemical properties of two types of artificial sweeteners. Today we are going to look at the history of artificial sweeteners." The teacher asks the students if they know any history about artificial sweeteners. If so, list these comments on the board. If not, tell the students that they will be completing a WebQuest to gain an understanding about the history of artificial sweeteners.

Activities:
Divide the class into groups of two to complete the "History of Artificial Sweeteners WebQuest" and the timeline. After completion, use the timeline scoring rubric to assess students' understanding.

Day 3: The Aspartame Controversy

Set-up Directions: The teacher will need the following materials for the class: a television and VCR, and video, *60 Minutes: How Sweet is it?*. Each student will need a copy of the worksheet, "How Sweet Is It?"

Teacher Presentation & Motivation: The teacher says, "Over the past couple of days we have examined the properties and history of artificial sweeteners. Today we will begin to examine the controversy surrounding artificial sweeteners."

PRE-VIEWING ACTIVITIES
The teacher hands out the worksheet, "How Sweet Is It?." Have students think-pair-share about the validity of scientific experimentation. Give students an example in which two different researchers came up with opposite results. How should these results be interpreted? What other information would you need to draw a better conclusion?

FOCUS FOR VIEWING
The focus for viewing is a specific responsibility or task(s) that the students are responsible for during or after the video, to focus and engage students' viewing attention.

VIEWING ACTIVITIES
The teacher says, "Your focus for viewing will be to listen for statements that support aspartame and statements against aspartame. For each statement you hear that supports aspartame you will put a '+' sign on the T-chart. For each statement you hear that is against aspartame, you will write a '-' sign on the T-chart." **PLAY** entire video segment.

POST-VIEWING ACTIVITIES
On the overhead or chalkboard, the teacher will make a T-chart. The teacher asks students to tally their pluses and minuses. The teacher will ask a few students to share their totals with the class. The teacher will then lead the class in a discussion

about specific evidence that both supported and was against aspartame. The teacher will add statements to the T-chart and students will add these to their chart on the worksheet. This discussion should lead into bias in research.

As homework, have the students go through their refrigerator and cupboards. They should look at the labels on the food products and list all of the products they find that contain an artificial sweetener.

Day 4: Educating the Public

Set-up Directions:
The teacher will need the following materials for each group of four students: paper, crayons or markers, a computer with ***PowerPoint***, and poster board. Other materials may be needed as groups decide how best to educate the public about artificial sweeteners. Students will also need a copy of the worksheet, "Educating the Public."

Teacher Presentation and Motivation:
The teachers will lead the class in a discussion of products that contains artificial sweeteners. Students should have made a list from last night's home assignment. After listing these on the board and having a brief discussion, the teacher states, "Today we will take all of the information we have learned about artificial sweeteners and use it to educate the public. You and your group will create a Web site, pamphlet, poster, or a ***PowerPoint*** presentation in order to educate the public about artificial sweeteners. Be sure your educational tool contains the necessary information as detailed in the "Educating the Public" worksheet.

Activities:
Divide the class into groups of four to complete the "Educating the Public" assignment. After completion use the corresponding scoring rubric to assess students' understanding.

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Enrichment Options

Interdisciplinary Extensions:

- **Science**

One of the reasons many people use an artificial sweetener is due to the low solubility of natural sugar and the high solubility of artificial sweeteners. Students can design a lab to test and compare the solubility of artificial sweeteners and sugar.

- **Social Studies**

Students can extend their timeline by adding important social and political events.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Kevin Feeney & Jennifer Petering

Name _____ Class _____ Date _____

Comparing Natural and Artificial Sweeteners

You and your group will be observing the physical and chemical properties of sugar, aspartame, and saccharin.

Materials Needed:

100 mL beaker with sugar ring stand
100 mL beaker with aspartame ring
100 mL beaker with saccharin evaporating dish
microscope Bunsen or butane burner
microscope slides (3) matches
cover slips (3) scoopula
wire mesh teaspoon

Procedure:

Part A: Observing the Physical Appearance

1. Using the scoopula, place a small amount of each sweetener on separate microscope slides.
2. Place a cover slip on top of each slide.
3. Observe each sweetener under 100 x magnification and draw your observations in the circles below. Be sure to label your drawing and write the magnification.

Part B: Chemical Volatility Test

Volatility refers to a chemicals ability to vaporize, or turn into a gas.

1. A chemical has a high volatility if it emits a strong odor. Smell each sample and describe its volatility in the table below as either high, medium, or low.

Volatility of Sweetener

Sweetener	Volatility
Sugar	
Aspartame	
Saccharine	

Part C: Ease of Melting

By timing how long it takes for a substance to melt, you can infer its bond strength. A short melting time would infer a covalent bond and a long melting time would infer an ionic bond.

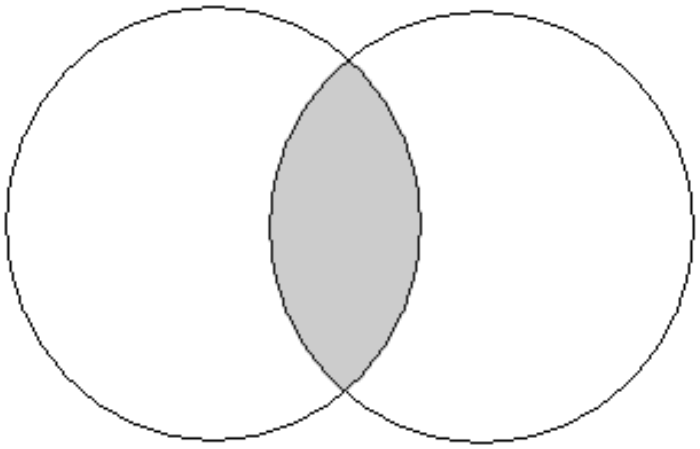
1. Place the ring on the ring stand and place the wire mesh on top of the ring.
2. Using the spoon, place a teaspoon of sugar into the evaporating dish.
3. Place the evaporating dish onto the wire mesh.
4. Light the burner and place under the ring.
5. Time how long it takes for the sugar to melt. Record the time in the table below.
6. Repeat this procedure for the aspartame and saccharine. Be sure to use the same amount of each sample.

Melting Time of Sweeteners

Sweetener	Melting Time	Type of Bond
Sugar		
Aspartame		
Saccharin		

Analysis:

1. Fill in the Venn diagram to compare the physical and chemical properties of natural sweeteners and artificial sweeteners.



2. Using the Venn diagram as an aid, write a paragraph comparing the physical and chemical properties of the natural sweetener with the artificial sweeteners.

_____

_____

Adapted from Prentice Hall, Physical Science Lab Manual

Name _____ **Class** _____ **Date** _____

History of Artificial Sweeteners WebQuest

Directions: Go to the following Web site: *http://www.fda.gov/fdac/features/1999/699 sugar.html*

Read the article which describes the history of artificial sweeteners. Fill in the information for each of the dates below. Also, record three additional dates that you and your partner feel are important enough to place on your time line.

1879 -

1911 -

1958 -

1977 -

1981 -

1988 -

1996 -

1998 -

____ -

____ -

____ -

You and your partner are now ready to create your timeline. Be sure you have the following materials: meter stick, metric ruler, register tape, and scissors. The scale that you will use is one meter equals one hundred years. Be sure to include all components of a timeline (title, equidistant lines, scale, events, line with arrows at the ends).

Name _____ **Class** _____ **Date** _____

History of Artificial Sweeteners WebQuest
Answer Key

Directions: Go to the following Web site: *http://www.fda.gov/fdac/features/1999/699 sugar.html* Read the article which describes the history of artificial sweeteners. Fill in the information for each of the dates below. Also, record three additional dates that you and your partner feel are important enough to place on your time line.

1879 - discovery of saccharin

1911 - early attempt to ban usage of saccharin

1958 - creation of the Food Additives Amendment. Saccharin was exempt from testing because it was thought to be GRAS (generally recognized as safe)

1977 - Canadian study which found that saccharin causes bladder cancer in rats.

1981 - FDA approved aspartame for public use.

1988 - FDA approves acesulfame potassium as an artificial sweetener.

1996 - Study that linked aspartame to brain tumors.

1998 - FDA approves sucralose as an artificial sweetener.

____ -

____ -

____ -

You and your partner are now ready to create your timeline. Be sure you have the following materials: meter stick, metric ruler, register tape, and scissors. The scale that you will use is one meter equals one hundred years. Be sure to include all components of a timeline (title, equidistant lines, scale, events, line with arrows at the ends).

Name _____ Class _____ Date _____

Timeline WebQuest Scoring Rubric

The following rubric will be used to evaluate your comprehension of the history of artificial sweeteners and your use of technology to gather information:

3 - Student successfully utilized technology resources to accurately create a timeline with all major components.

2 - Student successfully utilized technology resources to accurately create a timeline with one major component missing or incorrect.

1 - Student successfully utilized technology resources to accurately create a timeline with two major components missing or incorrect.

0 - All other responses.

Student's Name _____

Partner's Name _____

Score _____

Comments:

Name _____ Class _____ Date _____

How Sweet Is It?

Viewing Activity:

As you view the 60 Minutes segment, listen for statements supporting the safety of aspartame. For each supporting statement you hear, write a plus (+) sign in the chart below. Also listen for any statements refuting the safety of aspartame. For each of these statements you hear, write a minus (-) sign in the chart below.

Supporting Statements (+)	Refuting Statements (-)

Name _____ Class _____ Date _____

How Sweet Is It?
Answer Key

Viewing Activity:

As you view the 60 Minutes segment, listen for statements supporting the safety of aspartame. For each supporting statement you hear, write a plus (+) sign in the chart below. Also listen for any statements refuting the safety of aspartame. For each of these statements you hear, write a minus (-) sign in the chart below.

Supporting Statements (+)	Refuting Statements (-)
(Answers will vary but studentsshould have at least five plus signs and five minus signs.)	

Name _____ Class _____ Date _____

Educating the Public

Now that you have gained some background knowledge on artificial sweeteners, you and your group will need to educate the public. Your group will first need to decide on the best method to do this. You may decide to create a pamphlet, make a poster, create a Web page, or create a ***PowerPoint*** presentation. You and your group must include the following information in your educational display: the properties of artificial sweeteners versus natural sweeteners, the history of artificial sweeteners, some products that contain artificial sweeteners, and the controversy surrounding artificial sweeteners. You and your group will be assessed based on the scoring key below.

Your group's educational presentation includes the following:

		Points Earned	Points Possible
properties of artificial & natural sweeteners		____	10
history of artificial sweeteners		____	10
products that include artificial sweeteners		____	10
artificial sweetener controversy		____	10
presentation is neat an organized		____	10
	TOTAL	____	50

Comparing Natural and Artificial Sweeteners
Scoring Rubric

The following scoring rubric will be used to evaluate your understanding of the physical and chemical properties of natural and artificial sweeteners:

3 – Student has all three drawings and completed data tables. Analysis paragraph describes at least two similarities and two differences for both the physical and chemical properties.

2 – Student has all three drawings and completed data tables. Analysis paragraph describes at least one similarity and one difference for both the physical and chemical properties.

1 – Student has incomplete drawings or incomplete data tables. Analysis paragraph describes at least one similarity and one difference for both the physical and chemical properties.

0 – All other responses.

Student's Name _____

Partner's Name _____

Score _____

Comments:

Bittersweet Sweeteners
Artificial Sweeteners and Cancer, Part II

Time Commitment: Four 50 Minute Periods
Grades Levels: 6-8

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Overview

Cooperative structure of the lesson:
Students will be working for most of the lesson in groups of four.

Expected products from lesson:
Students will use real data to analyze and look for a correlation between artificial sweeteners and cancer incidents. Students will also conduct guided research in order to present one side of a debate on whether or not artificial sweeteners cause cancer.

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Instructional Technology Resources

Internet Sites:
Filimentality BioHealth Link
http://www.kn.pacbell.com/wired/fil/pages/listbiohealtbi.html
This site provides a hot list of Internet sites related to cancer.

http://www.hoptechno.com/book2htm
This publication discusses the various types of artificial sweeteners and the controversy surrounding them.

RoC: Saccharin http://ntp-server.niehs.nih.gov/ htdocs/8_RoC/RAC/Saccharin.html
This document is an excerpt form the National Institute of Health's "Report on Carcinogens."

Sweet 'N Low http://www.sweetnlow.com
This is the homepage for the Sweet 'N Low corporation.

Saccharine does not promote urinary tract cancer, scientists say
http://www.nando.com/newsroom/ntn/health/011298/health11_28937_noframes.html
This publication describes research done with saccharin and its effect on monkeys.

Calorie Control Council | Low-Calorie Sweeteners: Saccharin
http://www.caloriecontrol.org/sacchar.html
This document shows evidence supporting saccharin and its safe usage.

NSFD: Saccharin http://www.foodsafety.org/il/il096.htm
This document also supports saccharin and its safe usage.

Bid to Absolve Saccharin is Rebuffed by U.S. Panel
http://www.junkscience.com/news/sac2.html
This article was originally printed in the New York Times. It describes research done to try to de-list saccharin as a carcinogen.

Toluene http://www.mssm.edu/molbio/hoxpro/hazard/Saccharin.html
This document describes the health, biological, and ecological hazards of saccharin.

SACCHARIN—Hazard Rankings http://www.scorecard.org/chemical-profiles/hazard-indicators.tcl?edf_substace_id=81%2d07%2d2
This document graphically depicts the hazards of saccharin.

Saccharin Still Poses Cancer Risk, Scientists Tell Federal Agency
http://www.cspinet.org/new/saccharn.htm
This is a copy of a press release from the Center for Science in the Public Interest.

Comments on Saccharin http://www.cspinet.org/reports/saccomnt.htm
This document is a copy of a letter from the Center for Science in the Public Interest to the National Toxicology Program Board of Scientific Counselors' Report on Carcinogens Subcommittee.

CSPI's comments to the Health Protection Branch (HPB)
http://www.cspinet.org/reports/sacanada.htm
This document is a copy of a letter from CSPI to the Health Protection Branch of the Bureau of Chemical Safety.

Calorie Control Council | Low-Calorie Sweeteners: Aspartame
http://www.caloriecontrol.org/aspartam.html
This document describes the benefits of aspartame.

Nutrasweet http://nutrasweetkelco.com
This is the homepage for nutrasweet. This site provides copies of numerous articles describing the safety of aspartame.

Untitled http://ificinfo.health.org
Document that describes the safety of using aspartame.

Home http://www.PRESIDIOTEX.COM/barcelona/
This report describes how aspartame converts to formaldehyde in lab rats.

SUMMARY http://www.PRESIDIOTEX.COM/barcelona/SUMMARY/summary.html
This research report describes the methods used to conclude that aspartame converts to formaldehyde.

April 1997: 6th Grader, Jennifer Cohen proves aspartame is an uns...A
http://www.dorway.com/jcohen.html
This article describes a sixth grader's science fair project which found that aspartame converts to formaldehyde.

Spreadsheet Software:

- ***Microsoft Excel***

Other Technology:
- Graphing calculator

OTHER INSTRUCTIONAL RESOURCES
Articles:
Andrea Brockman, "Side effects of sweetener may outweigh benefits," University Wire, 3 Feb 1999.

Rita Carter, "The truth about sugar substitutes," Independent, 19 Nov 1996, pp. 11.

Marlene Cimons, "Life is sweet for dieters as FDA OKs new substitute," Home, Los Angeles Times, 2 Apr 1998, pp. A-16.

Christine Gorman, "A web of deceit the latest e-mail scare campaign attack an artificial sweetener. Here's how to find the truth," Febr Ed., Time, 8 Feb 1999, pp. 76.

Greg Gordon, "Aspartame is a suspect in rise of brain tumors," Minneapolis Star Tribune, 5 Nov 1996, pp. 01A.

Greg Gordon, "Consumer groups demand new FDA study of aspartame's safety," Minneapolis Star Tribune, 19 Nov 1996, pp 05A.

Greg Gordon, "The artificial-sweetener debate," Minneapolis Star Tribune, 22 Nov 1996, pp. 01A.

Maura Lerner; Ann Merrill, "Study taps into fears surrounding aspartame," Minneapolis Star Tribune, 10 Nov 1996.

Sheldon Margen and Dale A Ogar, "Eating smart, most faux sugars sweeten foods safely," Home Edition, Los Angeles Times, 6 Dec 1999, pp. S-3.

Robert Steyer, "Monsanto substitute for sugar said safe FDA disputes report by Washington U. professor," Five Ed., St. Louis Post-Dispatch, 5 Nov 1996, pp. 06C.

Diane Toomey, Bob Edwards, "Saccharine," Morning Edition (NPR), 30 Oct 1997.

Kimberly Watson, "Chemical warfare: Christians battling aspartame which 'damages the temple'," The Dallas Morning News, 20 Mar 1999, pp. 05A.

"Mosanto: Dr. Virginia Weldon 'top candidate' to become Commissioner of the FDA," M2 PressWIRE, 27 May 1997.

"Save the rats", 2 Ed., The Washington Times, 27 Dec 1998, pp.B2.

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Teacher/Student Background Information

The artificial sweetener/cancer debate has been sounding for years. There is a wealth of knowledge in print and on the Internet. One important aspect that the students must be aware of is the bias in the research. The teacher must point out that when researchers are paid by a corporation to conduct tests, there is an inherent bias in the results. This can be looked at and discussed as the students conduct their research on days two and three. All of the cited articles (newspaper, magazine, and radio transcripts) are available on the ***Electric Library***. The ***Electric Library*** is a subscription-based Internet catalogue of newspaper, magazine, and television articles. The *Electric Library* Web site is http://www.elibrary.com. The subscription rate is $9.95 a month or $59.95 a year. All of the data on cancer incidence rates is found in the Cancer Incidence in Five Continents, Volumes I to VII. Six of the seven volumes can be found at the Johns Hopkins School of Public Health library.

A prerequisite skill the students need in order to successfully complete this lesson include the ability to graph. Students should have some background knowledge of cancer and environmental factors that cause cancer.

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Vocabulary

Aspartame – artificial sweetener used many diet products. Chemical composition is

C14-H18-N2-O5

Saccharin – artificial sweetener used in many diet products

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Learning Objectives

Content:
- **Organize** and **analyze** data graphically.
- **Infer** correlation from graphs.
- **Research** a position in the artificial sweetener debate.
- **Present** information found to the class regarding the artificial sweetener debate.
- **Synthesize** information learned in order to write a letter of persuasion.

Technology:
- Use technologies in a safe and effective manner.
- Use appropriate technologies for research, creativity, and problem solving.
- Use appropriate technologies to access, store, manage, analyze, and communicate information.

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Lesson Assessment

Content:
Use the "Graphing Cancer Incidence Rates Scoring Key" to assess students' ability to graph data and make a correlation from the graphs. Use the "Presentation Scoring Key" to evaluate each groups' presentation. Use the "Letter Scoring Rubric" to assess students' letter to the editor.

Technology:
Use the following scoring key to evaluate students' use of technology during their research on days three and four:

3 - Student successfully utilized technology resources to accurately gather all information needed for their presentation topic.

2 - Student successfully utilized technology resources to accurately gather most information needed for their presentation topic.

1 - Student successfully utilized technology resources to accurately gather some information needed for their presentation topic.

0 - Student did not successfully utilize technology resources to accurately gather information for their presentation topic.

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Materials Needed

(per student)
- worksheet and rubric, "Cancer Incidence Rates"
- worksheet and rubric, "Group Presentations"
- worksheet and rubric, "Putting It All Together - Writing a Letter to the Editor"
- graph paper
- ruler

(per student team/group of 4)
- computer with Internet access and ***Microsoft Excel***

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Procedures

Students will be working in cooperative groups throughout the lesson. They will work in groups of four.

On days two and three students will need to use computers with Internet access. The ideal set-up would be in a computer lab in which students could pair up a the computers.

No special accommodations are required as students will be working in cooperative groups.

Day 1: Graphing Cancer Incidence Rates

Set-up Directions:
The teacher will need the following materials for each student: graph paper, ruler, and "Cancer Incidence Rates" worksheets.

Teacher Presentation & Motivation:
Referring back to Part I, the teacher asks the students to look at their timelines and to recall the ***60 Minutes*** video they viewed. The teacher asks the students to identify any controversies that have developed due to artificial sweeteners. The students should identify that some researchers have found that saccharin and aspartame cause cancer. The teacher explains, "Today we are going to look at actual data of cancer cases in the United States and two other countries. We will graph this data to see if there is any correlation between when the artificial sweetener aspartame was approved and an increase in cancer cases."

Activities:
Students will work in groups of four to complete their graphs. Each student in the group will graph a different cancer for all three countries. Each cancer type for all three countries should be displayed on one graph for easy comparison. Graphs can be

done on graph paper, with a graphing calculator or using a spreadsheet (***Excel***). After the students have completed their graphs, they should draw a line down 1983. This is when aspartame was given full approval from the FDA. When all four graphs are completed, the groups should look for trends and write a paragraph discussing any correlation between the introduction of aspartame and cancer incidences.

Day 2 & 3: Research a Position

Set-up Directions:
The teacher will need to divide the class into groups of four. Using the same groups as in Part I would be best. The teacher will need copies of the four "Presenting Your Case" worksheets for the class. It would be best if the class was in the computer lab or library where they can access resources for their research.

Teacher Presentation & Motivation:
The teacher will explain, "Now that we have gathered information about saccharin and aspartame, we will now take a closer look at the controversy surrounding the link between artificial sweeteners and cancer. Each group of four will be taking a stand on one side of the issue. You will research your position and then present it to the class." Write the four positions on the board: saccharin is safe, saccharin causes cancer, aspartame is safe, and aspartame causes cancer. Allow groups a minute or two to decide which position they would like to research. It would be best if all positions are being researched.

Activities:
Groups will research for the remainder of the period and the next day.

Day 4: Group Presentations

Set-up Directions
The teacher will need a copy of the "Presentation Scoring Key" for each group. A copy of the "Group Presentations" and "Putting It All Together" worksheets are needed for each student.

Teacher Presentation & Motivation:
The teacher will explain that each group will be presenting its case either for or against artificial sweeteners.

Activities:
As the groups present their case, the other students should be filling out their graphic organizer, "Group Presentations." At the end of the presentations, students should be given, "Putting It All Together" to work on their writing prompt.

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Enrichment Options

Interdisciplinary Extensions:

- **Fine Arts**

Students can create a newspaper or magazine ad that persuades to public to limit or halt their use of artificial sweeteners. The ads should include facts learned about the dangers of artificial sweetener consumption.

- **Mathematics**

Students can do further statistical analysis of cancer incidence data. An example would be to find the percent increase before introduction of the artificial sweetener and percent increase after the sweetener was introduced to the public.

- **Language Arts**

Students can write letters to various food corporations to persuade them not to use artificial sweeteners in their products.

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Teacher Reflections For Future Use of This Lesson Plan

As a reflective practitioner, note how this lesson could be adjusted after its initial implementation. What strategies worked? What might work better? What direction do I need to take to guide my students in mastering these outcomes?

2000 BioHealth Link: Questions of Cancer Mentor Teacher Team:

Kevin Feeney & Jennifer Petering

Name _____ **Class** _____ **Date** _____

Cancer Incidence Rates

Breast Cancer

Miyagi, Japan		Bombay, India	
Year	**Rate per 100,000**	**Year**	**Rate per 100,000**
1964	10.8	1964	10.9
1971	14.1	1972	11.3
1977	17.5	1975	21.2
1982	15.2	1982	19.3
1992	31.1	1992	28.2

Source: "Cancer Incidence in Five Continents"

United States	
Year	**Rate per 100,000**
1964	77.4
1973	82.6
1977	84.1
1982	89.3
1989	106.7
1992	111.1

Source: SEER

Name _____ **Class** _____ **Date** _____

Cancer Incidence Rates

Prostate Cancer

Miyagi, Japan		Bombay, India	
Year	**Rate per 100,000**	**Year**	**Rate per 100,000**
1964	2.3	1966	1.9
1971	2.4	1972	1.8
1977	4.9	1975	1.7
1981	6.8	1982	1.8
1992	13.4	1992	2.9

Source: "Cancer Incidence in Five Continents"

United States	
Year	**Rate per 100,000**
1962	40.5
1965	40.3
1972	45.6
1977	42.7
1982	46.8
1992	84.3

Source: "Cancer Incidence in Five Continents"

Name _____ **Class** _____ **Date** _____

Cancer Incidence Rates

Brain Cancer

Miyagi, Japan		Bombay, India	
Year	**Rate per 100,000**	**Year**	**Rate per 100,000**
1964	2.7	1966	0.9
1971	0.9	1972	1.0
1977	0.8	1975	1.1
1981	1.0	1982	1.3
1992	1.3	1992	2.7

Source: "Cancer Incidence in Five Continents"

United States	
Year	**Rate per 100,000**
1962	5.1
1965	5.7
1972	5.5
1977	5.6
1982	2.0
1992	2.6

Source: "Cancer Incidence in Five Continents

Name _____ **Class** _____ **Date** _____

Cancer Incidence Rates

Bladder Cancer

Miyagi, Japan		Bombay, India	
Year	**Rate per 100,000**	**Year**	**Rate per 100,000**
1964	2.6	1966	0.6
1971	2.3	1972	0.8
1977	3.4	1975	0.8
1981	2.1	1982	1.9
1992	11.5	1992	3.0

Source: "Cancer Incidence in Five Continents"

United States	
Year	**Rate per 100,000**
1962	13.3
1965	15.8
1972	16.4
1977	14.1
1982	5.3
1992	8.5

Source: "Cancer Incidence in Five Continents"

Graphing Cancer Incident Rates

Scoring Rubric

	Points Earned	Possible Points
Appropriate title	____	**5**
X and Y-axes are labeled	____	**10**
Data for all three countries is graphed correctly	____	**30**
Key included to distinguish data	____	**10**
Line drawn at 1983 point	____	**5**
Paragraph discussing any correlation	____	**20**

Total		**80**

Name _____ **Class** _____ **Date** _____

Presenting Your Case:
Saccharin, No Harm to Your Health

You and your group are a team of corporate attorneys hired by the various corporations that use saccharin in their products. You have been asked to present your case to the Food and Drug Administration in order to convince them that saccharin is not a health threat. Your presentation should be between 5 - 7 minutes in length and include the following: a brief history of saccharin, a description of the physical and chemical properties, a statement of your position, and evidence to support your team's position. Use the following Web sites and reference articles to aid in your research.

Web Sites:

http://www.hoptechno.com/book2htm

http://ntp-server.niehs.nih.gov/htdocs/8_RoC/RAC/Saccharin.html

http://www.sweetnlow.com

http://www.nando.com/newsroom/ntn/health/011298/health11_28937_noframes.html

http://www.caloriecontrol.org/sacchar.html

http://www.foodsafety.org/il/il096.htm

http://www.junkscience.com/news/sac2.html

Other References:

Diane Toomey, Bob Ewards, Saccharine, Morning Edition (NPR), 30 Oct 1997.

Save the rats, 2 Ed., The Washington Times, 27 Dec 1998, pp. B2.

Rita Carter, The truth about sugar substitutes, Independent, 19 Nov 1996, pp. 11.

Sheldon Margen and Dale A. Ogar, Eating smart; most faux sugars sweeten foods safely; Home Edition, Los Angeles Times, 6 Dec 1999, pp. S-3

Name _____ **Class** _____ **Date** _____

Presenting Your Case:
Saccharin, the Bittersweet Reality

You and your group are a team of attorneys hired by public advocacy groups. You have been asked to present your case to the Food and Drug Administration in order to convince them that saccharin is a health threat. Your presentation should be between 5 - 7 minutes in length and include the following: a brief history of saccharin, a description of the physical and chemical properties, a statement of your position, and evidence to support your team's position. Use the following Web sites and reference articles to aid in your research.

Web Sites:

http://www.hoptechno.com/book2.htm

http://ntp-server.niehs.nih.gov/htdocs/8_RoC/RAC/Saccharin.html

http://www.mssm.edu/molbio/hoxpro/hazard/Saccharin.html

http://www.scorecard.org/chemical-profiles/hazard-indicators.tcl?edf_substance_id=81%2d07%2d2

http://www.cspinet.org/new/saccharn.htm

http://www.cspinet.org/reports/saccomnt.htm

http://www.cspinet.org/reports/sacanada.htm

Other References:

Marlene Cimons, Life is sweet for dieters as FDA OKs new substitute; Home, Los Angeles Times, 2 Apr 1998, pp. A-16.

Rita Carter, The truth about sugar substitutes, Independent, 19 Nov 1996, pp. 11.

Saccharin studies have shown the dangers for over 20 years, 2 Ed., The Washington Times, 7 Jan 1999, pp. A16.

Sheldon Margen and Dale A. Ogar, Eating smart; most faux sugars sweeten foods safely; Home Edition, Los Angeles Times, 6 Dec 1999, pp. S-3.

Name _____ **Class** _____ **Date** _____

Presenting Your Case:
Aspartame, No Harm to Your Health

You and your group are a team of corporate attorneys hired by the various corporations that use aspartame in their products. You have been asked to present your case to the Food and Drug Administration in order to convince them that saccharin is not a health threat. Your presentation should be between 5 - 7 minutes in length and include the following: a brief history of aspartame, a description of the physical and chemical properties, a statement of your position, and evidence to support your team's position. Use the following Web sites and reference articles to aid in your research.

Web Sites:

http://www.hoptechno.com/book2.htm

http://www.caloriecontrol.org/aspartam.html

http://ificinfo.health.org

http://nutrasweetkelco.com

Other references:

Christine Gorman, A web of deceit the latest e-mail scare campaign attacks an artificial sweetener. Here's how to find the truth, Febr. Ed., Time, 8 Feb 1999, pp. 76.

Sheldon Margen and Dale A Ogar, Eating smart; most faux sugars sweeten foods safely; Home Edition, Los Angeles Times, 6 Dec 1999, pp. S-3

Robert Steyer, Monsanto substitute for sugar said safe FDA disputes report by Washinton U. professor, Five Ed., St. Louis Post-Dispatch, 5 Nov 1996, pp. 06C.

Maura Lerner; Ann Merrill, Study taps into fears surrounding aspartame, Minneapolis Star Tribune, 10 Nov 1996.

Greg Gordon, Aspartame is a suspect in rise of brain tumors, Minneapolis Star Tribune, 5 Nov 1996, pp. 01A.

Name _____ **Class** _____ **Date** _____

Presenting Your Case:
Aspartame, the Bittersweet Reality

You and your group are a team of attorneys hired by public advocacy groups. You have been asked to present your case to the Food and Drug Administration in order to convince them that aspartame is a health threat. Your presentation should be between 5 - 7 minutes in length and include the following: a brief history of aspartame, a description of the physical and chemical properties, a statement of your position, and evidence to support your team's position. Use the following Web sites and reference articles to aid in your research.

Web Sites:

http://www.PRESIDIOTEX.COM/barcelona/

http://www.PRESIDIOTEX.COM/barcelona/SUMMARY/summary.html

http://www.dorway.com/jwnoasp.txt

http://www.dorway.com/jcohen.html

http://www.hoptechno.com/book2.htm

Other references:

Greg Gordon, The artificial-sweetener debate, Minneapolis Star Tribune, 22 Nov 1996, 01A.

Mosanto: Dr. Virginia Weldon "top candidate" to become Commissioner of the FDA, M2 PressWIRE, 27 may 1997.

Greg Gordon, Consumer groups demand new FDA study of aspartame's safety, Minneapolis Star Tribune, 19 Nov 1996, pp. 05A.

Kimberly Winston, Chemical warfare: Christians battling aspartame which 'damages the temple', The Dallas Morning News, 20 Mar 1999, pp. 1G.

Greg Gordon, Aspartame is a suspect in the rise of brain tumors, Minneapolis Star Tribune, 5 Nov 1996, pp. 01A. Andrea Brockman, Side effects of sweetener may outweigh benefits, University Wire, 3 Feb.1999

Name _____ Class _____ Date _____

Group Presentations

As you listen to each group present their case for or against artificial sweeteners, summarize their key points on the graphic organizer below.

For Aspartame	Against Aspartame
For Saccharin	Against Saccharin

Presentation Scoring Key

Group Members:

_____

_____

_____

_____

Your grade will be based on the successful inclusion of the following criteria in your presentation:

Criteria	Your Points	Possible Points
History of Artificial Sweetener	_____	15
Description of Artificial Sweetener	_____	15
Position Statement	_____	5
Evidence to Support Group's Position	_____	25
Meets 5 - 7 Minute Time Frame	_____	5
Information is Presented in a Professional Manner	_____	15
Total	_____	80

Name _____ Class _____ Date _____

Putting It All Together –
Writing a Letter to the Editor

Based upon the information you have learned about artificial sweeteners, write a letter to the editor of your local newspaper persuading them to conduct further research on the safety of artificial sweetener consumption. As you write your letter think about the physical and chemical properties of aspartame and saccharin. Think about their history. Think about any correlation you found with regards to cancer incidence rates. Also think about the group presentations.

To begin your letter be sure to complete the pre-writing activities below.

FAT-P

Form=

Audience=

Topic=

Purpose=

Critical Squares

Think About #1

Think About #2

Think About #3

Think About #4

Letter Scoring Rubric

Student's Name _____

3 points	The writing clearly states the author's point of view in a persuasive argument and addresses each component of the prompt.
2 points	The writing clearly states the author's point of view in a persuasive argument and addresses three components of the prompt.
1 point	The writing clearly states the author's point of view in a persuasive argument and addresses two components of the prompt.
0 points	All others.

INTERNET RESOURCES

BIOHEALTH LINK: QUESTIONS OF CANCER INTERNET RESOURCES

BioHealth Link: Questions of Cancer Filimentality Site
http://biohealthlink.cjb.net

Maryland Public Television
www.mpt.org

Johns Hopkins School of Hygiene and Public Health
http://phweb.sph.jhu.edu/default.htm

Johns Hopkins Oncology Center
http://www.hopkinscancercenter.org/

Johns Hopkins InteliHealth
http://www.intelihealth.com/

Internet Projects Filimentality Site
http://inetprojects.cjb.net

OTHER RESOURCES

Door Prizes and Giveaways
2000 BioHealth Link: Questions of Cancer Summer Institute

Door Prizes and Giveaways
2000 BioHealth Link: Questions of Cancer Summer Institute

Giveaways: UV-Detecting Beads and Bracelets
Door Prizes: UV Tee Shirt, UV Nail Polish, and Bead Kit

Educational Innovations, Inc.
151 River Road
Cos Cob, CT 06807-2514
(888) 912-7474
www.teachersource.com
Contact: Ron Perkins

Door Prizes: ***The Human Body*** – Multimedia CD-ROM

Sunburst Technology
101 Castleton Street
P.O. Box 100
Pleasantville, NY 10570-0100
(800) 321-7511
www.SUNBURST.com
Contact: Claire Kubasik (PR Manager)

Door Prizes: Videos: ***Radon Risks and Remedies*** (4), ***The Polygon"(Nuclear testing in Kazakhstan)*** (2), ***and The International Chernobyl Project*** (2)

International Atomic Energy Agency
www.iaea.org
Contact: Brenda Blann
B.Blann@iaea.org

Door Prizes: 5 Videos: ***The Long Long Race***
Giveaways: Pamphlets and One-sheets:

Promise and Progress – The Johns Hopkins Oncology Center – Spring/Summer 1999 issue

"The Bunting – Blaustein Cancer Research Building"

Do New Buildings Truly Make a Difference? A Special supplement commemorating the openings at Johns Hopkins of The Harry and Jeanette Weinberg Building and The Bunting-Blaustein Cancer Research Building

"About the Johns Hopkins Oncology Center"

Johns Hopkins Oncology Center Scientific Report, 1999

Johns Hopkins Oncology Center
600 North Wolfe Street
Baltimore, MD 21287-8943
Oncology Public Affairs: (410) 955-1287
http://www.hopkinscancercenter.org/
Discounted Video Price: $22.50
To order, please utilize "*The Long, Long Race* Video Order Form" in the registration folders.

Giveaways: ***Inspiration*** software demo disks
Door Prizes: 2 Tee Shirts, and ***Inspiration*** software

Inspiration Software, Inc.
7412 SW Beaverton
Hillsdale Hwy, Suite 102
Portland, OR 97225-2167
(503) 297-3004
(800) 877-4292
www.inspiration.com
Contact: Stephanie Brandt
Sbrandt@inspiration.com

Door Prize: Book: ***Exploring the Biomedical Revolution***

Johns Hopkins University Press
(800) 537-5487
(410) 516-6956
Contact: Jack Holmes (41) 516-6928

Door Prizes: Video and charts

Carolina Biological Supply Company
1834 Fendall Ave.
Charlottesville, VA 22903
www.carolina.com
Contact: Clyde White
(336) 222-6443

Door Prizes: ***Newton's Apple*** *"Antibiotics/ Cancer"* video, CD ROM and Teacher's Guide

GPN
18001 North 33rd Street
P. O. Box 80669
Lincoln, NE 68501-0669
(800) 228-4630
Contact: Stephen Lenzen

Door Prizes: Books: ***Cancer Clinical Trials*** and ***Childhood Cancer***

O'Reilly & Associates, Inc.
101 Morris Street
Sebastopol, CA 95472
(800) 998-9938
order @oreilly.com
http://www.oreilly.com
Contact: Shawnde Paull (ext. 363)
Fax: (707) 829-0104

Giveaway: ***PERIL*** CD-ROM

Canadian Network of Toxicology
Contact: Donna Warner
dwarner@tox.uoguelph.ca

Giveaways: ***The Human Genome Project*** Video and ***From Maps to Medicine Teacher's Guide***

National Human Genome Research Institute
Contact: Jeff Spencer
(301) 402-0911

Giveaways: Various booklets and brochures

National Cancer Institute
Publications Ordering Service
P.O. Box 24128
Baltimore, MD 21227
www.publications.nci.nih.gov/
1-800-4-CANCER

and

American Cancer Society
http://www3.cancer.org/cancerinfo/pub_list.asp?ct=
1-800-ACS-2345

Giveaways: Books

Understanding Cancer, by C. Norman Coleman, M.D., The Johns Hopkins University Press

The Broccoli Sprouts Breakthrough, by Deborah Mitchell, St. Martins Mass Market Paper

Guns, Germs & Steel, by Jared Diamond, W.W. Norton & Co.

Stopping Cancer Before it Starts, American Institute for Cancer Research

Available from:
The Book Rack (Gives 25% discount to teachers)
55 E. Padonia Road
Timonium, MD 21093
(410) 667-6897
(800) 933-1023

Door Prize: ***CellServ*** Lab Kit

R.M. Nardone Associates, Inc.
3317 Richwood Lane
Brookeville, MD 20833
Contact: Mark S. Nardone (Vice President)

Giveaway: Magnets & pens
Door Prizes: 3 ***SunGuard Man*** Teacher Kits & T-Shirts

MedChi
The Maryland State Medical Society
1211 Cathedral Street
Baltimore, MD 21201-5516
(410) 539-0872 x 340
(800) 492-1056
Contact: Roberta M. Herbst, M.S.
Roberta@mail.medchi.org

Giveaway: **Poster:** "The Genetic Code…"
Door Prize: $100.00 Gift Certificate

Science Kit & Boreal Laboratories
P.O. Box 5003
777 East Park Drive
Tonawanda, NY 14151-5003
(800) 828-7777
Contact: Chris Sweeny
sk@sciencekit.com
http://sciencekit.com

Giveaways: NIH Curriculum Supplement Series: ***Human Genetic Variation & Cell Biology and Cancer***

Dr. Bruce Fuchs, Director
Office of Science Education
National Institutes of Health
6100 Executive Blvd.
Bethesda, MD 20852
http://science-education.nih.gov/nihHTML/homepage/Popup/popup.htm

Door Prize: HIP Biology Biotechnologist materials

Center for Image Processing in Education
4500 E. Speedway Blvd., Suite 58
Tucson, AZ 85712
http://www.evisual.org
Contact: Steven Moore, Ph.D., Executive Director
SteveM@cipe.com
(800) 322-9884, ext. 205

Giveaways: Posters: "Understanding Cancer" and "Keys to Healthy Eating"
Door Prize: $100.00 Gift Certificate

Fisher Science Education
12807 Folly Quarter Road
Ellicott City, MD 21042
Contact: Dr. Thomas Custer
(800) 806-5889
tcuster@fisheredu.com

Giveaways: Display Posters, etc.
Doorprizes: "Right Choices" Teaching Kit for Grades 9-12 and Cookbook

American Cancer Society
8219 Town Center Drive
P.O. Box 43026
Baltimore, MD 21236
Contact: Sherry Livich
(410) 933-5146

Giveaways: EPA publications "Ultraviolet Index: What You Need to Know"; "Be Sun Wise: What is the Ultraviolet (UV) Index?"; "Ozone Depletion"; "UV Radiation"; "Sun Protection For Children"; "Action Steps For Sun Protection"; "Health Effects of Overexposure to the Sun"; "The Sun, UV, and You"; "A Guide to the UV Index and Sun-Safe Behavior"

Environmental Protection Agency
Washington, DC 20460,
(800) 296-2996
http://www.epa.gov/sunwise