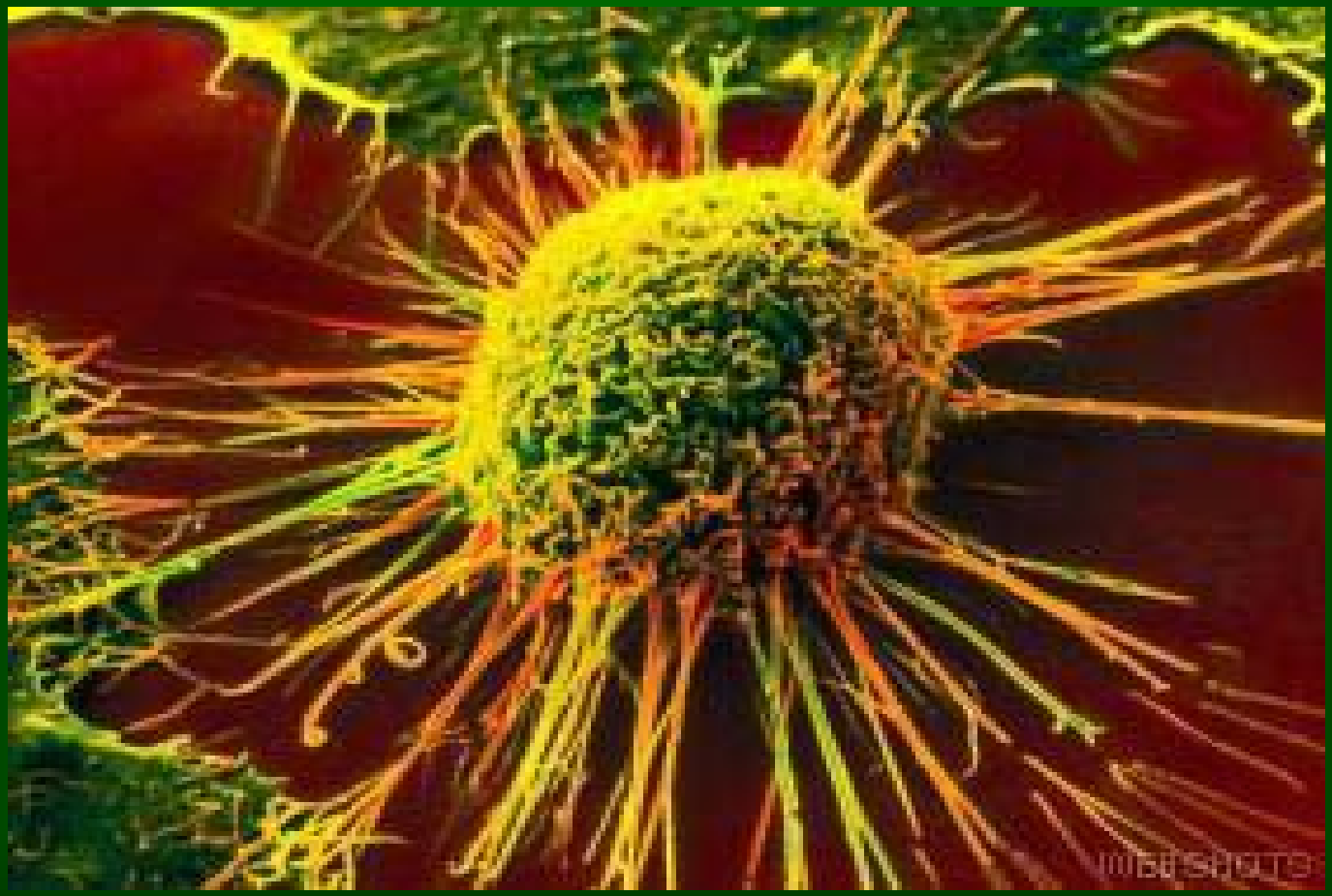
100 Years of Advances Against Cancer

The National Institutes of Health and the National Cancer Institute in partnership and cooperation with the scientific research community.



Created by the National Cancer Institute's
Grants Administration Branch.

1900s-1920's

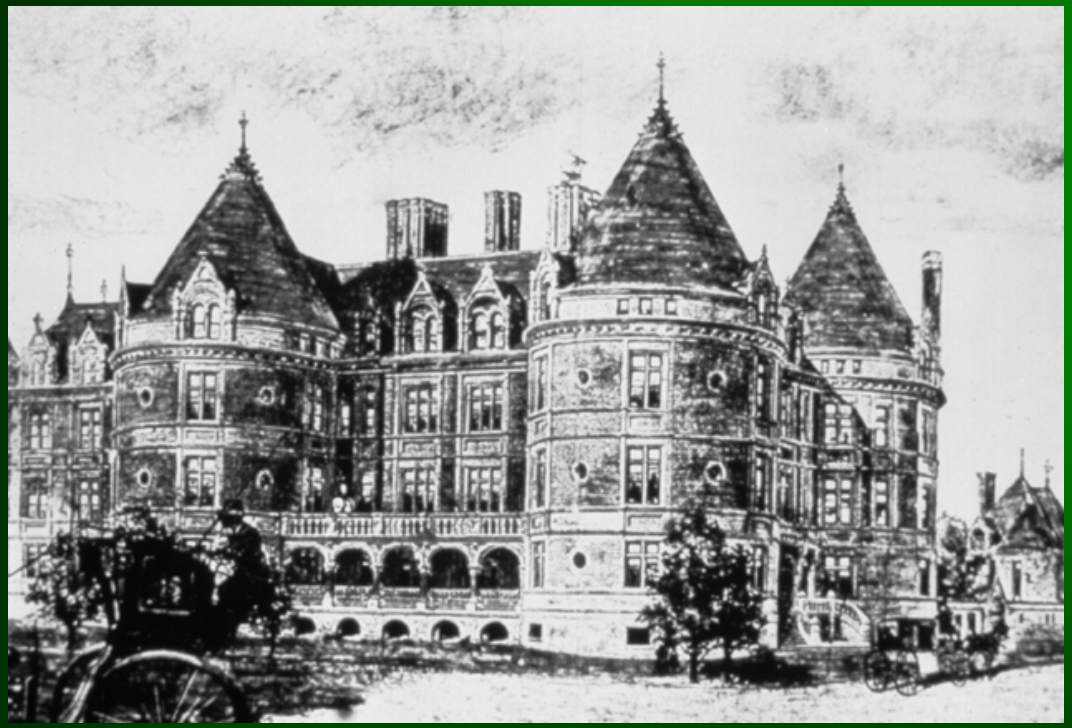
Gratwick Laboratories (Roswell Park Memorial Institute). First cancer research laboratories established in 1898, moved in 1901.

1903 Radium found effective in treatment of tumors.

1911 P. Rous discovered a virus that causes cancer in chickens.

Black and white drawing of N.Y. Cancer Hospital, Memorial Sloan Kettering

(Est. 1884)



1912 Cancer cells are grown in the laboratory, the first long-term "tissue culture."

1913 Publication of first known article on cancer's warning signs: *Ladies' Home Journal*

1915 Coal tar gives rabbits cancer in experimental proof of carcinogenesis.

1904: View of American Oncologic Hospital, the first precursor of Fox Chase Cancer Center.

1927: View of Institute for Cancer Research founded in 1927 at Lankenau Research Hospital. The two organizations joined in 1966 to become Fox Chase Cancer Center.

'Conquer Cancer' Adopted as Battle Cry of the Public Health Service

FatalitiesFromDisease AreIncreasingRapidly

Surgeon General Parran Believes 25,000 Lives Can Be Saved Yearly by Application of Information Already Available.

By Christine Sadler.

In the natural order of advancement cancer should have disappeared along with medieval armor and the belief in three-headed giants. That it is today the second greatest killer in the United States and the Nation's fastest growing medical problem possibly is the major anachronism of our streamlined age.

Despite surgery, radium and X-ray—the three accepted means of treatment—cancer takes a toll of nearly 150,000 American lives annually. Its origin remains as much of a mystery as it was 4,000 years ago.

In 1900 it stood last among the ten leading causes of death in this country. Today it stands second only to heart disease. From 1900 until 1910 there was a 37 per cent increase in our number of cancer deaths. The next decade witnessed another 39 per cent increase, and by 1930 an additional 41 per cent was noted.

With no increase in actual prevalence, the increased age of the population would result in still another 30 per cent increase in the number of cancer deaths by 1960.

These figures were among many startling ones revealed to Congress at the recent hearing on proposed cancer bills. Never before had so many medical leaders appeared to plead in behalf of any legislative measure. With almost single accord they stressed the need for co-ordinated effort and the necessity for a Nation-wide program such as they said only the Government can give.

"Conquer Cancer," New Health Cry.

The bills were whipped into one that followed closely the advice given in the expert testimony. The revised version sped through Congress and last week was signed by the President. With its passage, "Conquer Cancer" becomes the Nation's newest health cry.

A new division of the Public Health Service is created, to be known as the National Cancer Research Institute, and it is proposed that the fight be extended over two fronts. Cancer's origin will be hunted and the known methods of treatment will be extended into areas where cancer knowledge and treatment facilities are woefully limited.

Even if the Institute's laboratories fail to yield the complete answer to the cancer mystery, which is the big hope of the medical profession, results of efforts on the second front will more than repay the Nation.

For in its early stages cancer is one of the most curable of diseases. The experts do not doubt at all that the increase in cancer deaths can be stopped and the tide turned back in the other direction. This can be done, they declare, by dissemination of the knowledge already available and by taking the expensive cancer treatment facilities into the areas which can not now afford them.

But the whole answer is the goal. That will come, they declare, only from research laboratories. These laboratories, in which old leads will be checked and new ones followed, will be housed in buildings erected near Bethesda, Md., on land donated to the Public Health Service by the late Luke Wilson, Washington business man who was a cancer victim.

Architects Drawing Plans for Laboratory.

An expenditure of $750,000 for their erection has been authorized by Congress and architects are now drawing the plans. There will be laboratories for biochemists, physicists, biologists, pathologists, radiologists, as well as for cancer students and technicians already at work under PHS supervision.

From which laboratory the answer will come no one knows. Most medical men agree it probably will come from the coordinated efforts of several. They doubt that it will be the result of solitary effort in some obscure laboratory—as so many of the great scientific discoveries have been. Cancer is too big a job for any one man, the men at the hearing declared.

Dr. C. C. Little, director of the American Society for the Control of Cancer, said that while some of the beginners might prefer to work alone in the hope of making an important finding, men in the age group from 40 to 50, would welcome the chance for more co-ordination and the chance to exchange and check views informally.

"Those of us who are biologists do not know enough chemistry or enough physics. The younger chemists and physicists recognize that they do not know enough biology. No one man knows enough to do research work in all branches of cancer research," he said.

The Institute will make it possible for the findings in one field to be checked against and with those in another. Duplication of effort will be prevented and concentration made when needed.

In addition to providing $750,000 for establishment of a research institute, Congress authorized a $700,000 appropriation for laboratory upkeep and for the purchase of radium.

According to present plans, $1,000,000 will be spent for radium over a period of five years. The Government will purchase ten grams a year at $20,000 a gram until the supply is increased to 50 grams. This will be loaned to States and institutions having an inadequate supply of the expensive element.

Dr. Thomas Parran, surgeon general of the Public Health Service, estimates that approximately 25,000 lives can be saved annually by application of "the information already available."

Radium is part of this information, since only surgery, radium and X-ray are recognized methods of cancer treatment. In the United States and available for medical use, according to estimates, there are 113 radium grams. It is estimated that 125 grams more are needed. Most of the available supply is now concentrated in the larger cities and cancer centers. Many States have only a few milligrams, and some of them have none.

The supply for industrial use is twice as great. The estimated total of 250 grams. This is divided among 287 hospitals, 414 physicians, 9 laboratories and numerous private industrial concerns.

The Washington supply totals between 750 and 800 milligrams, which is considered more than adequate for a city of this size.

The cancer bill recognizes the fact that not just any practicing physician can use radium and X-ray successfully and provides for the training and instruction in technical matters relating to the diagnosis and treatment of cancer."

Although it is recognized that cancer is essentially a research problem and that research moves slowly, the new cancer bill calls for speed wherever possible. "Development and prompt widespread use of the most effective methods of prevention, diagnosis and treatment" are stipulated.

A Nation-wide program of cancer education probably will be undertaken, although the difficulties inherent in this are many. Cancer diagnosis is a problem for an expert. Scattered attempts at cancer education often have resulted in "cancer phobia." There is no other subject about which fear is so prevalent.

One of the most dangerous peculiarities of cancer is that in its early stages it does not cause pain. Only when it approaches some tissue that has nerves is the victim aware of his attack. "If each cancer had the pain of a jumping toothache, no one would die of it, for the patient would see the doctor at once, when the disease is surgically curable," declares Dr. R. T. Simpson, noted New York expert.

Dr. Parran says that early recognition, followed by treatment before migration of cancer cells has occurred, is "the first and great desideratum, the one on which all campaigns against cancer are based."

A major task undertaken by the institute will be the checking of announced "cancer cures." Thousands of Americans are duped annually by doctors whose purported cures are not recognized by the medical profession. Cancer has been one of the richest fields for quacks.

The need for standardizing equipment by which to test high-voltage X-ray machines and compare the strength of radiation received from X-ray and radium has long been apparent to cancer workers. The Bureau of Standards recently acquired one large testing machine, but has room for no more until it secures a new laboratory. Scientists interested in the subject believe the cancer bill will call attention to the necessity for adequate standardizing facilities.

Until testing equipment is made available, they point out, much of the work will lack co-ordination because the relative value of radiation treatments will remain unknown.

Recognizing the lack of trained workers in the cancer field, the new cancer bill authorizes the Institute "to provide training and instruction in technical matters relating to the diagnosis and treatment of cancer; to provide fellowships in the Institute from funds appropriated or donated for such purposes; to secure for the Institute consultation services and advice of cancer experts from the United States and abroad; and to cooperate with State health agencies in the prevention, control, and eradication of cancer."

A National Advisory Cancer Council will review and assist in directing work of the Institute. The council will consist of six members "selected from leading medical or scientific authorities who are outstanding in the study, diagnosis, or treatment of cancer in the United States." Dr. Parran, who will be ex-officio chairman of the council, will select the other members.

Dr. L. R. Thompson, head of the National Institute of Health, a division of the Public Health Service, is expected to get one of the appointments. Other experts, from whom appointments might be made, include: Dr. James Ewing, head of the Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York; Dr. Charles Mayo and his brother, Dr. William Mayo, of the Mayo Clinic; Dr. Francis Carter Wood, head of the Institute of Cancer Research, Columbia University; Dr. Max Cutler, Michael Reese Hospital, Chicago; Dr. Ludvig Hekoen, of the University of Chicago; Dr. Temple Fay, director of the Temple University unit of the International Cancer Research Foundation Fund; Dr. G. Failla, Memorial Hospital, New York; Dr. Warren H. Lewis, Johns Hopkins University; Dr. M. A. Tuve, of Carnegie Institution; Dr. Dudley Jackson, of San Antonio; Dr. Little, and Dr. Simpson.

With the exception of the Mayo brothers and Dr. Lewis, these men appeared before the Congressional committee and at that time were declared to be "perhaps 50 per cent of the individuals in the United States who are thoroughly qualified to carry on and to conduct research in the field of cancer."

Vogtlin Mentioned to Head Institute.

Dr. Carl Voegtlin, of the National Institute of Health, has been pointed to as the logical man to head the new institute. Dr. Voegtlin has been directing research for the Public Health Service in the cancer field and is now in Europe visiting various cancer clinics.

To prevent the idea that the Government is entering the cancer field with such impetus that no more private cancer donations are needed, the bill provides that donations shall be received and recognized by suitable markers to the donors in the institute buildings.

Dr. Lewis, recognized by many as the world's No. 1 cancer authority, has declared for a decade that with six $10,000,000 institutes scientists soon could control cancer. The only gift that has equalled this estimate for one institute was made in June to Yale University. The nearest approach before that date was the gift of $2,000,000 which William H. Donner of Philadelphia, gave in 1932 for an International Cancer Research Foundation. The George Crocker Institute which Dr. Wood manages at Columbia University was given $1,400,000, while the largest cancer gift before that made by Mr. Donner.

Much of the money given for cancer has gone into buildings and endowment funds. The income from these funds was last year given as $300,000. Senator Homer T. Bone, of Washington, who introduced the cancer bill in the Senate, said that on all cancer research in the United States $700,000 was spent in 1937 "and this without any central direction."

Still Room for Private Initiative.

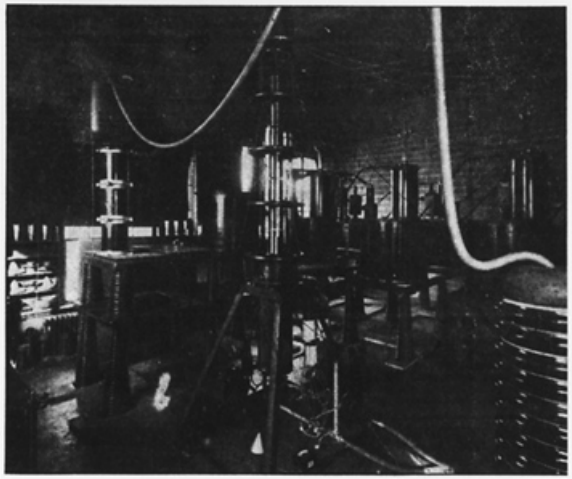
It has been estimated that altogether the country had cancer research equipment equal to two $10,000,000 institutes. The Yale donation makes a third. The $500,000 that will be allotted to the institute for annual upkeep is "almost the equal of two more." So there will still be room for private initiative in the cancer field.

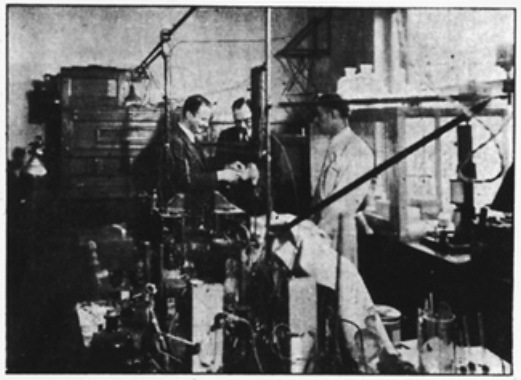
Fighting with Senator Bone for passage of the cancer bill was Representative Maury Maverick, of Texas, who urged that $1,000,000 additional be included for establishment of a hospital in which the Government would treat cancer patients. He pointed out that the Government spends $646,500 a year on cotton research, $507,000 a year on forest research, $381,000 on dairy cattle.

"It's time we did something about cancer, and especially it is time we got after the common, ordinary, crooked quacks in the cancer field and ran them out of business."

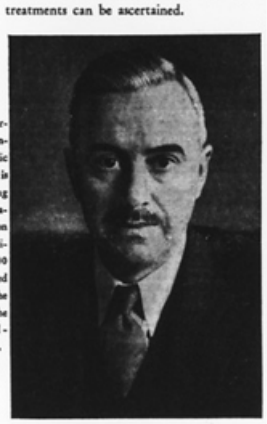
Cancer, the second greatest killer in the United States, has become the country's No. 1 medical problem. And the Public Health Service is now engaged in a Nation-wide campaign to wipe out this ancient scourge. Last week President Roosevelt signed a bill authorizing the erection of a $750,000 National Cancer Institute to be built on a site near Bethesda, Md. The land was donated by the late Luke Wilson, a trustee of Woodward & Lothrop, who was a victim of cancer.

A famous cancer expert, Dr. Carl Voegtlin, of the National Institute of Health, has been suggested as head of the new foundation. He is shown below with Dr. R. H. Fitch (left) and Dr. Herbert Kaher (right) at work on a phase of their studies of malignant growths.





The super voltage X-ray tube above was designed to test high-voltage X-ray machines and compare the strength of radiation received from X-ray and radium. The Bureau of Standards recently acquired this machine, and experts hope that more may soon be made available, so that the relative value of radiation treatments can be ascertained.



Dr. Thomas Parran, Surgeon General of the Public Health Service, is taking a leading part in the Nation's war on cancer. He estimates that 25,000 lives can be saved annually by the application of the information already available.

U. S. Creates New Division For Research

Bills Rushed by Congress Are Signed by President.

Victim of Dreaded Malady Donated Land for Laboratories.

National Cancer Institute Act, July 23, 1937

1930's

1930 The National Institute of Health is established by the Ransdell Act.

1938 NCI Budget: $400,000

June 6 , 1938
Members of the first National Advisory Cancer Council at the groundbreaking ceremonies at the NCI's building 6.

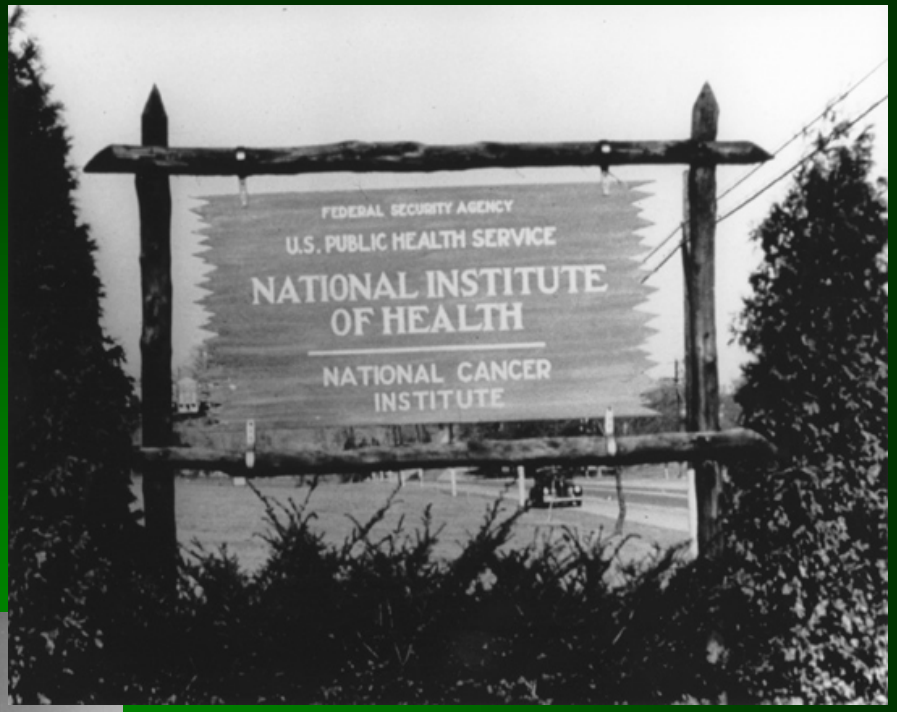
June 24, 1939
Cornerstone laying for NCI's building

Shown: Mrs. Luke Wilson, whose husband, a cancer victim, donated the land

Dr. Thomas Parton, Surgeon General of the U.S. Public Health Service &

Henry Morgenthau, Secretary of the Treasury (Holding trowel)

Welcome to the National Cancer Institute



1939 The National Cancer Institute's first home, "Building 6".

1937 The first NCI staff was comprised of Harvard personnel.

November 27,1937: First NCI grant was awarded for $27,550 to Louis F. Fieser to investigate chemical structure and carcinogenic activity.

1940's

1940 First issue of the Journal of the National Cancer Institute is published.

1943 Pap smear is introduced into medical practice.

1944 DNA found by O. Avery, C. MacLeod, and M. McCarty to be the basic cell material.

NCI's First Scientific Staff
Source: *Life Magazine*, June 17, 1940

1940-1949 NCI appropriations $42 million!

October 31, 1940 **Pres. Franklin Roosevelt dedicates the first 6 buildings of NIH.**

National Institutes of Health Campus - 1940

1947 S. Farber finds that a folic acid derivative inhibits acute leukemia.

S. Farber also founds Children's Hospital Cancer Research Foundation in the next decade.

1948 G. Hitchings synthesizes 6-mercaptopurine (6-MP) to combat childhood leukemia.

1949 FDA approves nitrogen mustard (methclorethanine), a drug that interacts with DNA chemically to kill cancer cells.

1950's

1950 E. Wynder, E. Graham, and Sir R. Doll confirm cigarette smoking-cancer link.

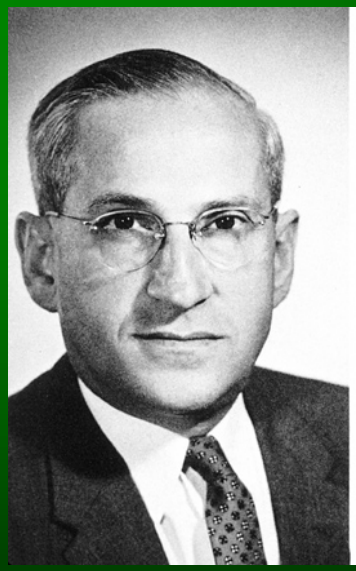
1952 DNA found to be genetic material in some viruses.

1953 FDA approves methotrexate as anti-cancer drug.

1953 J. Watson and F. Crick discover the structure of DNA.

1955 National Chemotherapy Program begins.

1955 R. Hertz and M. Chiu Li achieve total cure of a human solid tumor, choriocarcinoma.



1950-1959 NCI appropriations $330 million!

1960's

1960 Chromosome abnormality associated with leukemias.

1961 M. Nirenberg and others prove triplet code governs DNA action.

1962 Royal College of Physicians issues report on smoking and health.

1964

- **U.S. Surgeon General issues Report on Smoking and Health**
- A virus (Epstein-Barr virus) is linked to human cancer for the first time.
- American Society of Clinical Oncology established.

Dr. Emil Freireich working with a blood cell separator centrifuge at M.D. Anderson Hospital.

1960-1969 NCI appropriations $1.8 billion!

FDA Approvals:

- **1961** Vinblastine: a drug that binds to tubulin. Derived from the ornamental shrub, vinca rosea.
- **1962** 5-FU
- **1963** Vincristine: a sister drug to Vinblastine.
- **1964** Melphalan (L-PAM) approved for marketing.

1966 NCI standardizes testing of cancer-causing chemicals.

1969 R. Heubner & G. Todaro propose the oncogene hypothesis.

1970's

1970-1979 NCI appropriations $6.1 billion.

1970 H. Temin & D. Baltimore discover reverse transcriptase enzyme: a key to gene engineering.

1971 President Richard M. Nixon converted Army's former biological warfare facilities at Ft. Detrick, MD, to house research activities on the causes, treatment, and prevention of cancer.

1973

- Computed tomography (CT) introduced in the United States
- Recombinant DNA techniques developed for cloning genes
- Surveillance, Epidemiology, and End Results (SEER) Program established.

December 23, 1971

President Nixon signs the National Cancer Act of 1971.

1974

•CANCERLINE, a national database of published cancer research established.

•FDA approves doxorubicin, an anti-tumor antibiotic from Streptomyces bacteria.

1975 Methods developed to identify and sequence DNA fragments.

1976

•Cancer Information Service (1-800-4-CANCER) opened.

•Interleukin-2 discovered.

•First human proto-oncogenes discovered.

1977 First national cancer patient education program founded (I Can Cope).

1978

- First human testing of a biological therapy (alpha-interferon).
- Tamoxifen approved by FDA for marketing as a treatment drug.
- FDA approves cisplatin, a powerful anti-cancer drug.
- Metastic cells shown to arise from pre-existing subpopulations in primary tumors.

1979

- P53 discovered, most frequently mutated gene in human cancer.
- Modified radical mastectomy replaces radical mastectomy for breast cancer.

1970's

- Studies in human populations link cancer risk to infectious agents, such as human papillomavirus (cervical cancer) and hepatitis B (liver cancer).

- Statistical methods developed to control simultaneously for several factors in the analysis of studies and to quantify cancer risks.

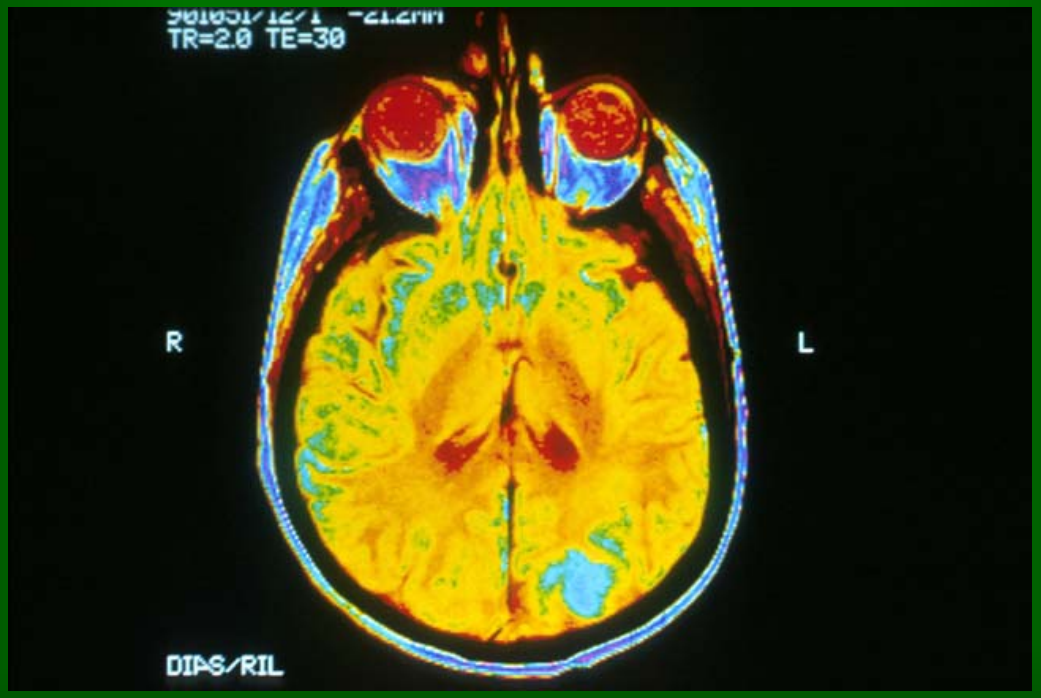
- Studies clarify the patterns of cancer risk following exposure to ionizing radiation.

- Studies link cancer risks to hormonal drugs, such as diethylstilbestrol (DES) taken during pregnancy and hormonal replacement therapy.

1980-1989 NCI appropriations $12 billion!

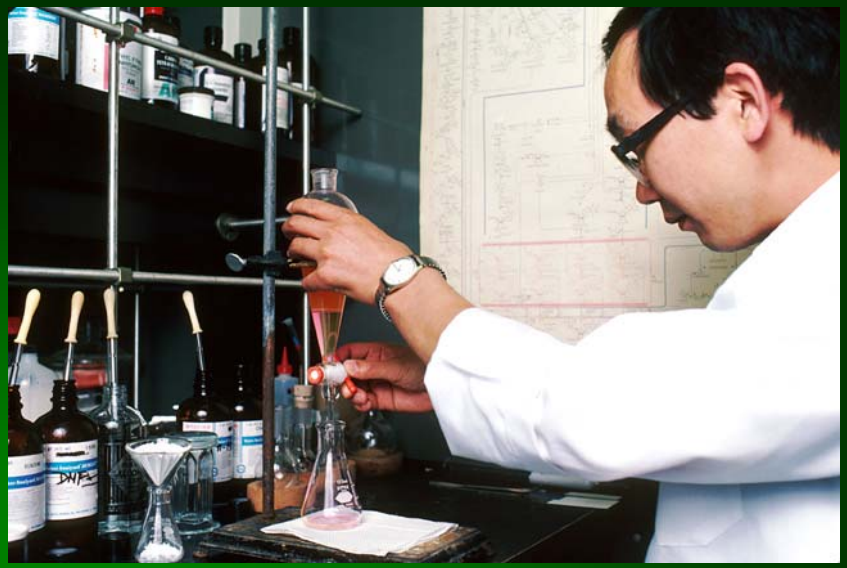
1980's

- Magnetic resonance imaging (MRI) introduced.



- Flexible sigmoidoscopy and colonoscopy developed to help find and remove precancerous growths.

•Continuous pain medication infusion pumps developed.



•First highly effective anti-nausea drugs developed to alleviate side effects of chemotherapy.

•Biochemical and genetic assays integrated into epidemiologic studies (molecular epidemiology).

1981 Introduction of first human viral vaccine that can prevent cancer (hepatitis B virus vaccine for liver cancer).

1985 Lumpectomy plus radiation found equivalent to mastectomy for breast cancer.

1986 First tumor suppressor gene cloned (Rb).

Adjuvant chemotherapy:

- **1988** Proven to increase disease-free survival in early breast cancer
- **1989** Proven to increase survival in colon cancer

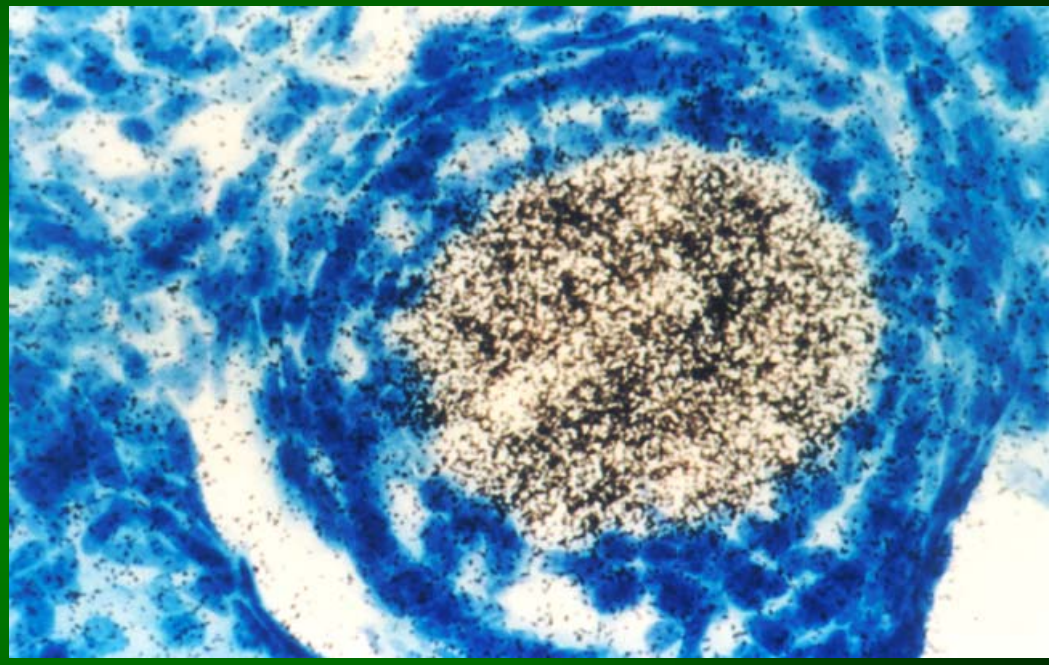
1990's

Breast cancer death rates began to decline!

- **Multi-step nature of carcinogenesis proven.**

- **Transition from film-based radiology to digital computer-assisted medical imaging.**

- **Several common genetic variants linked to the risk of lung and other cancers.**

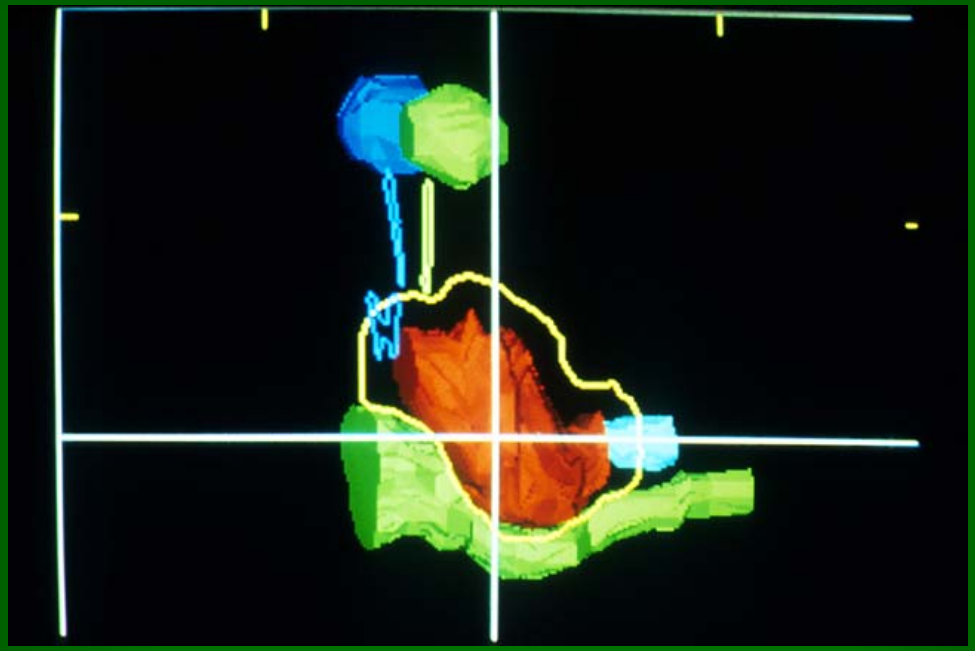


- **Fluorescence in situ hybridization technique developed (FISH).**

1990-1999 NCI appropriations $21.8 billion!

1990 First chemoprevention trial to show efficacy – vitamin A analogue against mouth and throat tumors.

1991 Adjuvant radiation and chemotherapy found to improve survival in rectal cancer.



Cloning Advances:

- **1993** First of the hereditary nonpolyposis colon cancer genes
- **1994** BRCA1, the first inherited breast cancer gene
- **1995** BRCA2

FDA Approvals:

- **1995** Tretinoin, the first successful differentiating agent
- **1995** Porfimer sodium, a drug that sensitizes tumors to light, permitting photodynamic therapy in the U.S.
- **1996** Topecan, first of a class of drugs that interferes with the enzyme topoisomerase
- **1997** Rituximab, first biotechnology product approved by FDA to treat patients with cancer
- **1998** Trastuzumab (Herceptin), targets cancer cells that produce a protein found in high number of women with metastic breast cancer

1990's Studies and Trials

1992 Breast Cancer Prevention Trial begins, testing tamoxifen as a preventive agent in women at increased risk of the disease (1998: Results found that tamoxifen reduced the chances of women at risk of developing breast cancer by half.)

1993

- NCI-sponsored studies in China show importance of nutrition in preventing cancer.
- Prostate Cancer Prevention Trial begins, testing finasteride, a drug used to reduce symptoms of prostate enlargement.
- The Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial begins recruiting 148,000 volunteers (the largest early detection study).

1997 Cancer Genome Anatomy Project is launched, a multi-year project to assemble the first index of genes involved in cancer.

A New Century...

NIH-Funded Centers to Seek Early Environmental Exposures that May Lead to Breast Cancer

10/14/2003 -- National Institutes of Health announced the funding of four new Breast Cancer and the Environment Research Centers to study the prenatal-to-adult environmental exposures that may predispose a woman to breast cancer.

NIH Funds Eight New Grants Focused on Aging and Cancer

10/10/2003 – Seventy-seven percent of all cancers are diagnosed at 55 and older. With cancer death rates highest among people 65 years and older, the National Cancer Institute (NCI) and the National Institute on Aging (NIA) are launching a new initiative to accelerate research into th relationship between aging and cancer.

New Advances

New Treatment Significantly Improves Long-Term Outlook for Breast Cancer Survivors

10/9/2003 International clinical trial concludes women should consider taking letrozole after five years of tamoxifen treatment to continue to reduce risk of recurrence.

Decline Shown in Death Rates from Four Leading Cancers :

09/02/2003 - Death rates from the four most common cancers - lung, breast, prostate, and colorectal - continued to decline in the late 1990s according to new data from the "Annual Report to the Nation on the Status of Cancer, 1975-2000."

1938 – 2003 NCI appropriations total $57.5 billion!

Making a Difference…

Clinicians **Scientists**

Researchers **Administrators**

Volunteers **Patients**

American Public

In 2001, there were 9,600,000 cancer survivors in the U.S.

We…are Changing the World.

Timeline information and Pictures extracted from the following website: http://cancer.gov

Our Challenge Goal to the Nation

Eliminate the suffering and death due to cancer by 2015.

Andrew C. von Eschenbach, M.D.

Director National Cancer Institute

October 2003