

**The Small Business Innovation Research (SBIR) &  
Small Business Technology Transfer (STTR)  
Program Interagency Policy Committee  
Report to Congress**

**Office of Science and Technology  
Small Business Administration**

**Participating Agencies**

**Department of Defense  
Department of Health & Human  
Services  
Department of Energy  
National Aeronautics & Space  
Administration  
National Science Foundation  
Department of Agriculture  
Department of Homeland Security  
Department of Education  
Department of Commerce  
Environmental Protection Agency  
Department of Transportation**

**SBIR/STTR  
Award Size Flexibility**

***September 15, 2014***

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## Table of Contents

A. Introduction .....	4
B. Context.....	7
1. <i>SBIR/NIH Awards</i> .....	9
2. <i>Small Business Administration Role</i> .....	11
3. <i>NIH's SBIR Peer-Review Process</i> .....	11
C. Methodology .....	11
D. The Biomedical Research Environment .....	12
1. <i>Role of NIH</i> .....	12
2. <i>Cost of Conducting Biomedical Research Is High and Increasing</i> .....	12
3. <i>VC Landscape Is Changing and Looking for Less Risky Investments</i> .....	13
E. Ramifications of the Award Size Caps.....	15
1. <i>Using Non-SBIR Funding to Augment SBIR Awards</i> .....	15
2. <i>Increasing the Number of Funded Applications</i> .....	15
F. Findings .....	16
G. Recommendation .....	16

## **A. Introduction**

The Small Business Innovation Research (SBIR) / Small Business Technology Transfer (STTR) Reauthorization Act of 2011 (Reauthorization Act), a division of the National Defense Authorization Act for Fiscal Year 2012<sup>1</sup>, created the SBIR/STTR Interagency Policy Committee (IPC). The IPC is co-chaired by the White House Office of Science and Technology Policy (OSTP) and the U.S. Small Business Administration (SBA) and includes representatives from Federal agencies that participate in the SBIR or STTR programs. As part of the Reauthorization Act, the IPC is required to review certain issues and make policy recommendations to Congress on ways to improve program effectiveness and efficiency.

This report reviews issues regarding the impact of award sizes on the effectiveness the SBIR and STTR programs from primarily a NIH and life-science perspective. The report was prepared for the OSTP and SBA interagency policy committee by the Institute for Defense Analyses-Science and Technology Policy Institute.

Congress established the SBIR program in 1982 and the STTR program ten years later to assist small business concerns (SBCs) in obtaining Federal research and development (R&D) funds to build a strong economy and support technological innovation as discussed below:

- **SBIR:** Requires Federal agencies with extramural budgets for Federally-funded research or research and development (R/R&D) over \$100 million to set aside a percentage of their annual extramural R/R&D budget for awards to small businesses. This percentage was 2.5% prior to FY 2012, and increased to 2.6% in FY 2012 and will continue to increase by 0.1% each year until it reaches a base requirement of 3.2% in FY 2017.
- **STTR:** Modeled after the SBIR program, STTR requires Federal agencies with extramural budgets for R/R&D exceeding \$1 billion to set aside a percentage of their annual extramural R/R&D budget for SBCs that work in cooperation with universities, federally funded research and development centers, and other non-profit scientific and educational institutions. This percentage was 0.3% in FYs 2004-2011, and legislation increased this minimum to 0.35% for FYs 2012 and 2013, with continued increases through 2016. The goal is to facilitate transfer of technology and research from these institutions to commercial use and encourage innovation.

The Small Business Act indicates that “assistance” provided by the SBIR and STTR programs “be given to small-business concerns to enable them to undertake and to obtain the benefits of research and development in order to maintain and strengthen the competitive free enterprise system and the national economy.”<sup>2</sup>

The Policy Directive identifies the following primary objectives:

- Stimulate technological innovation;
- Meet Federal R&D needs;
- Foster and encourage participation in innovation and entrepreneurship by socially and economically disadvantaged persons;

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<sup>1</sup> <http://www.gpo.gov/fdsys/pkg/PLAW-112publ81/pdf/PLAW-112publ81.pdf>

<sup>2</sup> 15 U.S.C. § 638(a).

- Facilitate better partnering of ideas and technologies between innovative small business concerns and research institutions through federally-funded research and development; and,
- Increase private-sector commercialization of innovations derived from Federal research and development funding.

In addition, the Reauthorization Act added several new initiatives including:

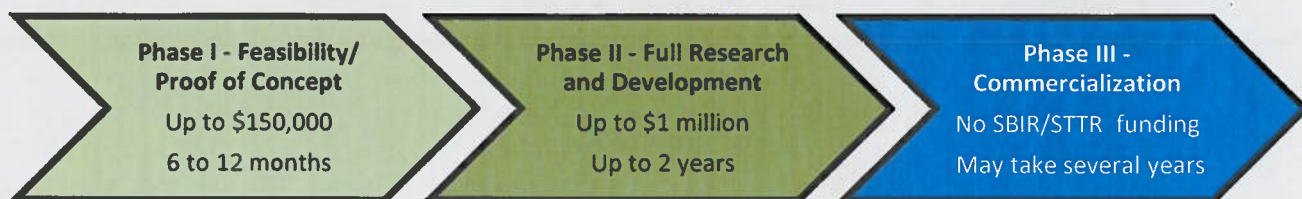
- Permitting agencies to direct some SBIR funds to firms that are owned by multiple venture capital operating companies (VCOCs), hedge funds, and/or private equity firms;
- Allowing agencies to provide one additional Phase II award to small businesses to extend a study;
- Commercialization readiness program at DOD and pilot programs at civilian agencies;
- Reducing processing times;
- Pilot program to allow agencies to use 3% of program budgets for administration and oversight;
- Reducing vulnerability of Fraud Waste and Abuse (FWA);
- Provisions for improved program evaluation; and,
- Other initiatives to increase commercialization and outreach.

In general, the SBIR/STTR reauthorization legislation underscored the need for improved commercialization, outreach, and program evaluation. In December 2013 the lead SBIR/STTR Program Managers in conjunction with White House Office of Science & Technology Policy (OSTP) facilitated the creation of five sub-working groups that fall under the "Fueling Small Business Innovation" component of the President's Lab to Market Commercialization Agenda. These five groups are:

- 1) Outreach & Communications
- 2) Commercialization Pathways
- 3) Awards Efficiency & Efficacy
- 4) Databases & Interagency Exchange of Information
- 5) Asset Mapping

Going forward these five groups are tasked with various short-term and long-term projects that fall within scope of various facets covered in the President's Lab to Market Commercialization Agenda. They will seek to identify issues, challenges, and provide further recommendations for consideration amongst the various SBIR/STTR program managers as well for SBA and OSTP consideration as it relates to the SBIR/STTR program.

To bring technology from ideas to commercialization, both programs utilize a three phase approach:



- **Phase I – Feasibility/Proof of Concept.** Using a competitive process, Federal agencies award up to \$150,000 to a small business to perform R/R&D for up to 6-12 months on a specific topic in order to establish its technical merit, feasibility, and commercial potential. During this phase, Federal agencies assess both the performance of the small business and the potential of the technology prior to providing further Federal support in Phase II.
- **Phase II – Full Research and Development.** Based on the results achieved in Phase I, Federal agencies will decide whether to continue R/R&D efforts into Phase II based on the scientific, technical, and commercial merit and feasibility of the idea. If the Federal agency decides to continue into Phase II, it will award up to \$1 million to the small business to continue R/R&D efforts for up to 2 years.
- **Phase III - Commercialization.** No specific SBIR or STTR funding is associated with Phase III. The objective of Phase III is for the small business to pursue commercialization objectives resulting from the Phase I/II activities. The Small Business Act<sup>3</sup> defines commercialization as:
  - the process of developing products, processes, technologies, or
  - the production and delivery (whether by the originating party or by others) of products, processes, technologies, or services for sale to or use by the Federal Government or commercial markets.

A significant advantage to Phase I/II award winners is that Federal agencies may pursue sole source contracts with Phase I or II awardees to utilize the technology developed through prior SBIR/STTR awards, which automatically qualifies as a Phase III activity.

Section 5124 of the Reauthorization Act<sup>4</sup> directs the SBIR/STTR IPC to review the issue of SBIR/STTR award size flexibility and to report its policy recommendations to Congress. The policy recommendations are to address ways to improve program effectiveness and efficiency and include appropriate criteria for exercising award size flexibility. This report represents the IPC fulfillment of the mandate with particular focus on one provision of the Act establishing award size caps on SBIR awards that previously did not exist.

To support the development of this report, OSTP and SBA requested that the Institute for Defense Analyses' (IDA) Science and Technology Policy Institute (STPI) conduct a study for the SBIR IPC on the impact of SBIR award size flexibility on the success of the program. The study focused primarily on awards issued by the U.S. Department of Health and Human Services,

<sup>3</sup> 15 U.S.C. § 638(e)(10).

<sup>4</sup> <http://www.gpo.gov/fdsys/pkg/PLAW-112publ81/pdf/PLAW-112publ81.pdf>

National Institutes of Health (NIH) due to NIH's concerns award size flexibility. Furthermore upon review of this particular issue, the IPC recommends that the Small Business Act be revised to allow greater SBIR/STTR award size flexibility for NIH and other agencies as well, given the initial findings of this report.

A team of STPI researchers utilized a variety of methods to determine the effect of limited award size flexibility with a focus on the impact experienced by the NIH SBIR program. The STPI research team consulted with IPC members, SBA, OSTP, and related non-governmental organizations. The STPI team met with several small business experts and NIH SBIR program managers and analyzed award and venture capital data. Appendix A provides a more detailed list of the entities that STPI consulted.

The STPI team determined that award size flexibility issues disproportionately affect the National Institutes of Health (NIH) because NIH frequently issued awards in excess of the award size caps established by the Act. This report is informed by the STPI study and outlines its methodology, preliminary findings, and recommendations regarding SBIR award size flexibility.

## **B. Context**

The SBIR program was established by the Small Business Innovation Development Act of 1982 (Public Law 97-219) to: "(1) stimulate technological innovation; (2) use small business to meet Federal research and development needs; (3) foster and encourage participation by minority and disadvantaged persons in technological innovation; and (4) increase private sector commercialization of innovations derived from Federal research and development."

The SBIR program consists of three phases and award levels: Phase I awards provide funding for determining the technical merit, feasibility, and commercial potential of proposed research and development efforts; and, Phase II awards provide funding to further develop a product or technology to the point of commercialization, building upon efforts initiated by Phase I funding. Phase III awards utilize private investment and/or Federal contracts to provide funding for commercialization efforts for products, processes, or services resulting from Phase I and II funding.

The Act limited SBIR Phase I awards to a maximum of \$150,000 and Phase II awards to a maximum of \$1 million; however, agencies are allowed at their discretion to exceed the monetary caps by up to 50%, so the effective limits are \$225,000 for Phase I awards and \$1.5 million for Phase II awards.

SBA addressed this flexibility in the establishment of award sizes by providing agencies with guidance in revised SBIR and STTR Policy Directives, which were issued on August 6, 2012, 77 Fed. Reg. 46806 (Aug. 6, 2012) and 77 Fed. Reg. 46855 (Aug. 6, 2012). Section 7(i)(1) of the SBIR Policy Directive and section 7(j) of the STTR Policy Directive discuss the SBIR and STTR award size thresholds, as follows:

*Generally, a Phase I award (including modifications) may not exceed \$150,000 and a Phase II award (including modifications) may not exceed \$1,000,000. Agencies may issue an award that exceeds these award guideline amounts by no more than 50%.*

Several of the participating agencies with smaller SBIR budgets have traditionally chosen to administer their awards at less than the guideline amounts. The rationale usually given is that the agency finds it more effective to issue a somewhat larger number of awards for amounts less than the threshold rather than a fewer number of awards for amounts that are close to the threshold. This is based on: (1) the criterion that to be effective, the SBIR program must try to tap a wide range of possible solutions to the technology issues in the solicitations; and (2) the judgment that the smaller size is sufficiently effective.

Similarly, some of the agencies with larger budgets have administered awards that exceed the guideline amounts. The rationale given by these agencies is that the larger award sizes are more effective when dealing with capital intensive research proposals and that, due to their large SBIR/STTR budgets, they are still able to fund a sufficiently wide range of proposals.

The Act included a provision that an agency may request from SBA a waiver to this limit for certain awards or types of awards. The SBIR Policy Directive states in Section 7(i):

*(5) Agencies must submit this request for a waiver to SBA prior to release of the solicitation, contract award, or modification to the award for the topic. The request for a waiver must explain and provide evidence that the limitations on award size will interfere with the ability of the agency to fulfill its research mission through the SBIR Program; that the agency will minimize, to the maximum extent practicable, the number of awards that exceed the guidelines by more than 50% for the topic; and that research costs for the topic area differ significantly from those in other areas. After review of the agency's justification, SBA may grant the waiver for the agency to exceed the award guidelines by more than 50% for a specific topic. SBA will issue a decision on the request within 10 business days. The waiver will be in effect for one fiscal year.*

The Act included a provision for a second, sequential, Phase II award. This doubles the amount of Phase II dollars an agency may give to a Phase II awardee for a given project. The Act also included a provision for a civilian agency Commercialization Readiness Pilot (CRP) program that allows an agency to use up to 10% of its SBIR/STTR budget for additional awards to SBIR/STTR awardees. The size of these awards may be up to three times the Phase II guideline amount. In setting the award size thresholds, Congress made the policy decision to include a provision that agencies may apply for, and SBA may grant, waivers to the award size threshold. The Policy Directive establishes that the agency request must provide SBA with the following information:

- 1) Evidence that the limitations on award size will interfere with the ability of the agency to fulfill its research mission through the SBIR or STTR programs;
- 2) Evidence that the agency will minimize, to the maximum extent practicable, the number of awards that exceed the guidelines by more than 50% for the topic; and,
- 3) Evidence that research costs for the topic area differ significantly from those in other areas.

The first two requirements are directly from the statute. SBA added the third requirement as further guidance in fulfilling the first requirement. Essentially, the first requirement is to provide evidence that larger-than-cap awards are needed to efficiently and effectively meet the goals of the program which includes meeting agency missions. The third requirement clarifies that such evidence must necessarily demonstrate higher relative costs of doing the research.



SBA must rely principally on the agency's expertise and experience regarding the relative effectiveness of larger awards for specific research areas or technologies. Therefore, when reviewing a waiver request, SBA looks to see that the agency presents a clear rationale for the larger award amount that is grounded in the agency's prior experience with the program, and that the agency shows it is working to minimize its over-cap award amounts as directed by statute and the Policy Directives.

### 1. SBIR/NIH Awards

In 2012, the United States Government awarded over \$2 billion in SBIR and STTR contracts and grants. The statistics are broken down by agency in Table 1.

**Table 1. SBIR and STTR Awards Across All Agencies in 2012**

	Phase I			Phase II			Phases I and II	
	# Awards	Total Award Amount	Mean Award	# Awards	Total Award Amount	Mean Award	# Awards	Total Award Amount
USG Total	3818	\$608,192,751	\$159,296	1717	\$1,427,090,839	\$831,154	5535	\$2,035,283,590
DOD	1974	\$228,857,182	\$115,936	988	\$691,184,809	\$699,580	2962	\$920,041,991
HHS	864	\$248,537,867	\$287,680	303	\$446,930,993	\$1,475,020	1167	\$695,468,860
DOE	257	\$38,261,210	\$148,876	110	\$111,862,987	\$1,016,936	367	\$150,124,197
NASA	298	\$36,878,346	\$123,753	98	\$72,836,274	\$743,227	396	\$109,714,620
NSF	240	\$35,860,350	\$149,418	136	\$65,386,139	\$480,780	376	\$101,246,489
USDA	63	\$6,234,159	\$98,955	25	\$10,571,668	\$422,867	88	\$16,805,827
DHS	36	\$4,390,268	\$124,727	18	\$7,835,609	\$453,094	54	\$12,225,877
ED	24	\$2,623,035	\$109,293	14	\$9,344,508	\$667,465	38	\$11,967,543
DOT	21	\$3,006,480	\$143,166	10	\$6,141,311	\$614,131	31	\$9,147,791
DOC	16	\$1,465,801	\$91,613	9	\$3,029,978	\$336,664	25	\$4,495,780
EPA	25	\$1,978,134	\$79,125	7	\$2,099,581	\$299,940	32	\$4,077,715

Source: [SBIR.gov](http://SBIR.gov).

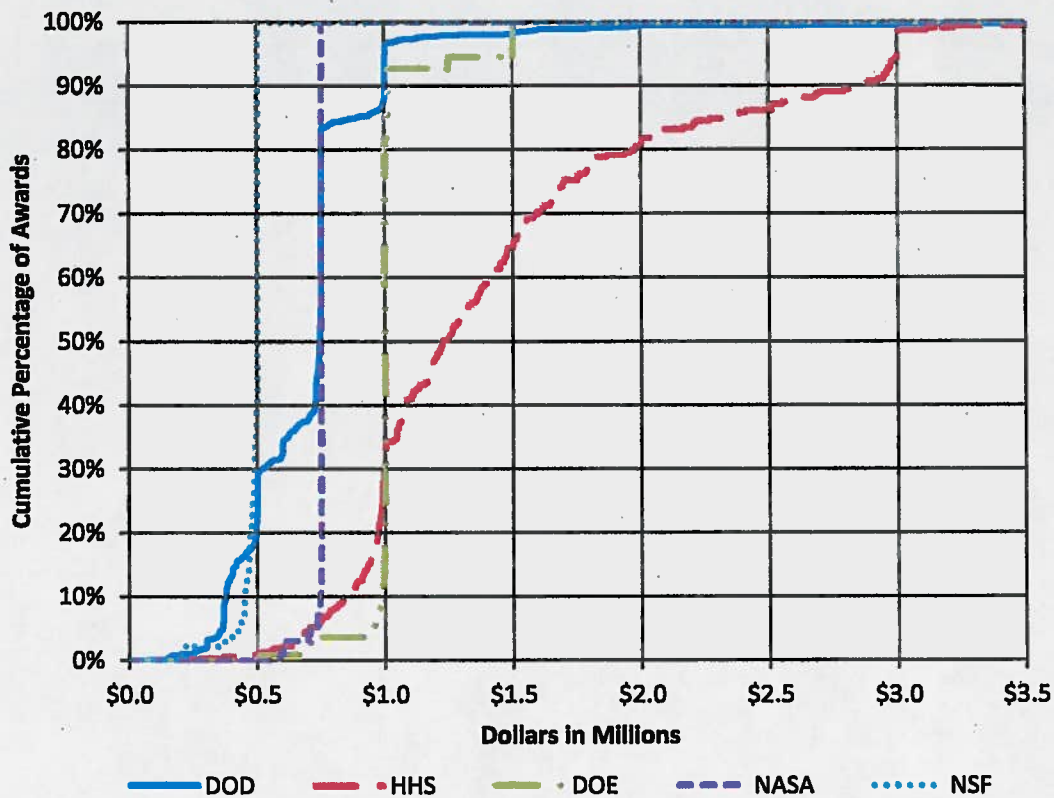
The shading of the mean award column indicates award size, with lighter shading indicating smaller mean awards and darker shading indicating larger mean awards. The HHS row (for the Department of Health and Human Services) is dominated by awards issued by NIH. A total of 96% of the awards (amounting to 98% of the total dollars awarded by HHS) are from NIH awards. The rest are from other parts of HHS, including the Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA).

The year 2012 was not an outlier. As Figure 1 below shows, NIH has a history of making SBIR awards that are significantly larger than those awarded by other government agencies. The HHS entry again predominantly reflects funds awarded by NIH. For FYs 2009–2012, 20% of HHS's Phase II awards were in excess of \$2 million. The shape of HHS's curve is striking. It is apparent that NIH tailors award amounts more than other agencies, which appear to frequently use a standard award size. Appendix B looks at the projects and companies that received large awards from NIH in FYs 2009–2012, some of which involved awards above the award size thresholds. The other agencies have long vertical lines in Figure 1 because many of their awards are

consistently made for the same amount. For example, the National Aeronautics and Space Administration (NASA) frequently issues awards of \$750,000, and National Science Foundation (NSF) frequently issues awards of \$500,000. The data support what our discussions at NIH revealed to us—program managers at NIH exercise significant care to make sure that the size of a given award matches the needs of the application.<sup>5</sup>

The National Academies released a study in 2009<sup>6</sup> that found NIH’s SBIR program to be successful in many ways, including the finding from Phase II survey data that “40 percent of SBIR-funded projects reach the marketplace.”

**Figure 1. Distribution of Phase II Awards 2009–2012<sup>7</sup>**



Source: SBIR.gov.

Appendix C provides several NIH SBIR/STTR success stories and, in the process, offers insights into the kinds of research and development activities funded by large NIH SBIR/STTR projects.

<sup>5</sup> NIH policy allows program managers to negotiate with an applicant to reduce the award size below the amount in the application but they can never award more than the initial request. All applications are in response to a solicitation written by NIH, which contains a specific limit for that solicitation. Applications requesting more than the solicitation limit are not considered.

<sup>6</sup> C. W. Wessner (editor), *An Assessment of the SBIR Program at the National Institutes of Health*, National Research Council, [http://www.nap.edu/catalog.php?record\\_id=11964](http://www.nap.edu/catalog.php?record_id=11964).

<sup>7</sup> In DOE’s Office of Energy Efficiency and Renewable Energy, for instance, while the percentage overall is fairly steady (declining from 63% in 2012 to 60%) some individual offices changed by a factor of 2, thus affecting the overall \$ number (x-axis).

## **2. Small Business Administration Role**

Under the Act, SBA has the authority to provide a waiver to an agency to exceed the award size thresholds for a specific award or solicitation. A waiver may be approved for a fiscal year if the administrator determines, based on information from the agency, that the award caps will “interfere with the ability of the agency to fulfill its research mission through the SBIR or the STTR program” and that “the agency will minimize, to the maximum extent possible” the number of awards that exceed the thresholds.

As of July 2013, NIH requested and SBA approved six solicitation waivers, including an omnibus waiver for FY 2014 that grants NIH broad authority to make large awards under the following constraint: the amount of any award exceeding a Phase I or Phase II limit is considered to be ‘over-the-cap’ and the aggregate total of ‘over-the-cap’ dollars may not exceed 5% of NIH’s total SBIR award dollars for that year. For example, if NIH issues a Phase I award for \$300,000, then the \$75,000 of that award, which exceeds the threshold amount, would be considered over-the-cap dollars. Over-the-cap dollars can also come from Phase II awards that exceed the cap.

According to SBIR.gov data, from 2009 through 2012, about 22% of NIH’s SBIR award dollars would have been counted as over-the-cap dollars under the current rules.

## **3. NIH’s SBIR Peer-Review Process**

All NIH grant applications, including SBIR and STTR applications, go through the same peer-review process and are awarded a score. This score is not definitive, but generally those applications with better scores are more likely to be awarded funding. If an application is selected for award over one or more applications with comparatively higher scores, the program manager must write a letter of justification.

### **C. Methodology**

The STPI team used a variety of methods to assess issues related to award size flexibility, including meetings with program managers and industry experts, data analysis, reviews of NIH waiver requests, and other relevant reports.

The team met with several program managers (PMs) at four institutes and centers (ICs) across NIH to gain insights into how the program is run and the need for award size flexibility. The meeting agendas were semi-structured to allow the various PMs to bring up new ideas and concerns. Team members also met with two industry experts to further understand issues facing small businesses, particularly for life science- and biomedical-related businesses.

Additionally, the team analyzed SBIR award data from SBIR.gov and NIH RePORTER at ProjectReporter.NIH.gov. These data sets were used to understand the SBIR program. Lastly, venture capital (VC) data was gathered through the PricewaterhouseCoopers and National Venture Capital Association MoneyTree report. This information was collected to understand the larger biomedical research environment outside of Federal funding. Ideally, the team would have liked to use additional microeconomic data to better understand VC and other non-Federal investments; however, data limitations and time constraints prohibited further analysis.

The STPI team reviewed NIH’s requests from FY13 to exceed award size limits. Finally, STPI reviewed previous evaluations of the SBIR program, including reports from the National Academies.

## D. The Biomedical Research Environment

NIH's SBIR program plays a role in America's biomedical research environment. Understanding the program requires understanding that environment.

### 1. Role of NIH

NIH funds innovations that fall on a spectrum between 'blockbuster' and 'orphan'. An example of a blockbuster might be a therapy for juvenile peanut allergies. Since millions of children in America suffer from peanut allergies, this therapy would, if successful, serve the greater good and yield millions of dollars in profit per year. One of the purposes of the SBIR program is, "to increase private sector commercialization of innovations derived from Federal research and development." A small chance of success for such a blockbuster therapy should attract risk takers in the private sector to consider commercialization once the risk of failure is low enough and/or mitigated through the help of initial seed investment funding from SBIR/STTR related programs.

Orphans, unlike blockbusters, have a small potential market and therefore comparatively small potential profits. Another purpose of the SBIR program is, "to use small business to meet Federal research and development needs." Not surprisingly, there may be a Federal need for something even if the potential profits are small. For example, one NIH group studies damage to the human body from ionizing radiation. They have made SBIR awards for technologies and drugs that would be useful for people exposed to a nuclear reactor meltdown or a nuclear or radiological weapon detonation. HHS might want to stockpile this technology or drug in case of an emergency, but the market for this treatment may otherwise be miniscule. NIH program managers would like to help companies find other uses for their technology, but with only modest potential profits this innovation would require a far higher probability of success before private concerns would likely consider investment. Since many "Federal research and development needs" fall near the higher risk and longer return on investment end of the spectrum and most biomedical research is expensive, NIH may need to provide larger or additional awards for such potential blockbusters to effectively address this purpose of the SBIR program.

Given NIH's mission to broadly fund biomedical research and the purposes of the SBIR program, neither of these approaches to SBIR awards—funding blockbusters and funding orphans—is right or wrong.

### 2. Cost of Conducting Biomedical Research Is High and Increasing

Any research that involves human or other animal test subjects is conducted within a rigorous regulatory environment, which substantially increases costs. Furthermore, before a drug or device can be approved by the U.S. Food and Drug Administration (FDA) for sale, it must go through expensive clinical trials.

According to the article, "Diagnosing the Decline in Pharmaceutical R&D Efficiency" over a billion dollars is spent in the United States on drug research for each drug that reaches the marketplace.<sup>8</sup> Not only is drug development expensive, but the cost is also increasing according to what the authors call "Eroom's Law," a play on Moore's Law for electronics which says that the number of transistors on a chip will double every 2 years. Eroom's Law says that the cost of

<sup>8</sup> J. W. Scannell, A. Blanckley, H. Boldon, and B. Warrington, "Diagnosing the Decline in Pharmaceutical R&D Efficiency," *Nature Reviews Drug Discovery* 11: 191–200, (March 2012).

drug development is doubling every 9 years. Since the cost of a drug is going up faster than the likely profits, private investors want to see lower risk before they will invest in a company.

NIH will not fund all of the development costs for each drug, but it does play an important role in the earliest funding of drug research.<sup>9</sup> The idea that NIH provides the ‘first money’ in developing new drugs is crucial to attracting the private investors who can carry that drug to commercialization. The academic research performed with NIH grants spawns ideas for various new products that could improve health. However, the probability of financial success for these ideas is still too low to attract private funding. NIH sees the role of SBIR awards as ‘de-risking’ the ideas to attract private investors. The ideas are inherently risky because many of them will not succeed in the marketplace, but without funding, it is impossible to know which will fall into this class. NIH helps SBCs pursue ideas to the point at which many can be set aside for lack of effectiveness or commercialization potential, but a few prove themselves to be worthy of further investment.

Not all NIH SBIR projects involve large awards. Figure 1 shows that between 2009 and 2012, more than 65% of Phase II awards were under the \$1.5 million cap, and 30% of Phase II awards were under \$1 million. NIH SBIR program managers report that some Phase I awardees, typically related to software development, start selling their products without even needing to apply for a Phase II grant. NIH program managers fund such applications, but feel that they would not be true to their mission if they did not also fund the early stages of commercializing their own research toward creating new drugs and other expensive research like developing new diagnostic methods and devices.

### **3. VC Landscape Is Changing and Looking for Less Risky Investments**

The aim of SBIR awards (as a critical source of “non-dilutive” funding) is to help high-risk, early-stage innovative research by SBCs reach commercialization. This is typically achieved either by the small business selling itself or its intellectual property to a larger firm or by the small business growing organically with the help of outside investments—including through VC.

During the course of STPI meetings, the National Venture Capital Association (NVCA) representative and others observed that venture capitalists are becoming more risk averse, especially in the life sciences sector, and are shifting investments from high-risk seed stage ventures to later stage, lower risk ventures. To independently validate this contention, STPI analyzed MoneyTree<sup>10</sup> VC data.

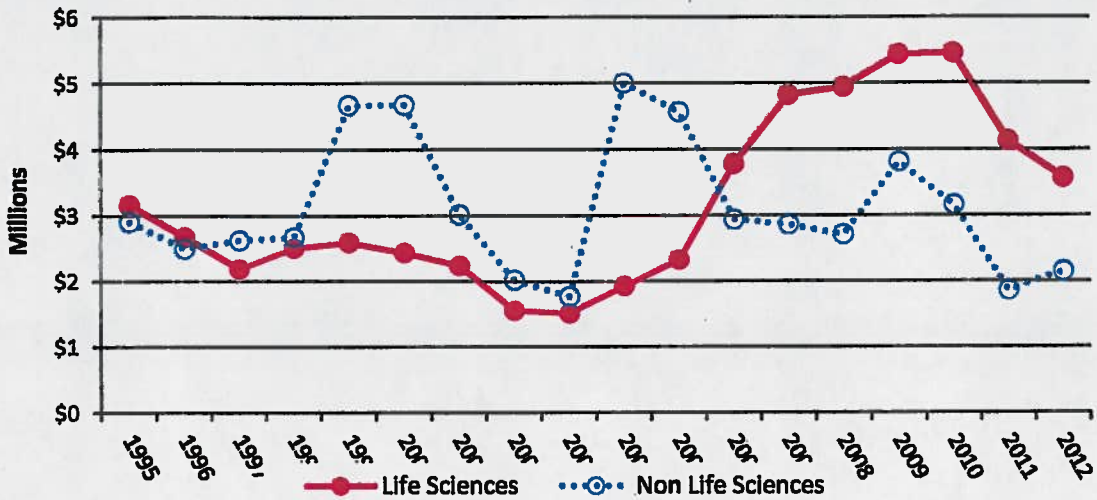
The MoneyTree data provides the number of VC deals and the amount of VC investments – broken down by industry sector (of which there are 17) and stage of funding (of which there are 4) – for each quarter since 1995. The 17 industry sectors include biotechnology and medical devices and equipment; these two sectors combine to form the aggregate sector known as the life sciences sector, which roughly aligns with biomedical research. The 4 stages of VC investment are: startup/seed stage (referred to as seed stage herein), early stage, expansion stage, and later stage.

<sup>9</sup> C. W. Wessner, “Rethinking the Small Business Innovation Program,” The Innovations in Economic Development Forum, Georgia Institute of Technology, Atlanta, Georgia, February 2012, [http://stip.gatech.edu/wp-content/uploads/2012/02/2012\\_02\\_Wessner-SBIR-GaTech.pdf](http://stip.gatech.edu/wp-content/uploads/2012/02/2012_02_Wessner-SBIR-GaTech.pdf).

<sup>10</sup> MoneyTree is available at <https://www.pwcmoneytree.com/MTPublic/ns/nav.jsp?page=historical>.

Figure 2 below compares the average seed stage funding per deal for the life sciences sector to the average for the other 15 (non-life science) sectors combined. Notably, since 2006, the amount of funding provided to life science firms in the seed stage has been much higher than the amount provided to other firms, providing evidence that life sciences research is expensive.

Figure 2. Average Seed Stage Funding per Deal



Source: MoneyTree.

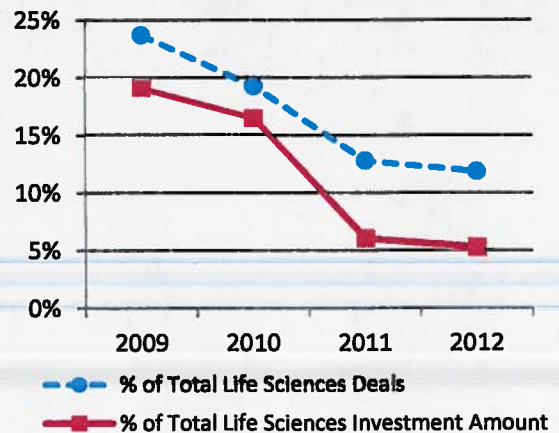
Figures 3a and 3b support the contention that, with respect to the life sciences sector, venture capitalists are becoming more risk averse and shifting their investments to later stage, lower-risk ventures. Figure 3a shows that seed stage VC investment in the life sciences sector declined significantly between 2009 and 2012, both in terms of number of deals and in terms of total dollars. Figure 3b shows that composition of the overall life sciences VC portfolio is changing and, in particular, that the portion of life sciences VC investments—both in terms of deals and dollars—going to seed stage ventures is shrinking. For example, in 2009, seed stage investments represented 24% of life sciences VC deals and 19% of life sciences VC dollars; however, in 2012, seed stage investments represented only 12% of deals and 5% of dollars.

Figure 3a. Declining Life Sciences Seed Stage Investments



Source: MoneyTree.

Figure 3b. Shrinking Share of Life Sciences Portfolio



Source: MoneyTree.

## **E. Ramifications of the Award Size Caps**

### **1. Using Non-SBIR Funding to Augment SBIR Awards**

In congressional testimony in March 2011, the Small Business Technology Council (SBTC) suggested that NIH could avoid problems with the SBIR program caps by keeping official SBIR awards under the cap amounts and then augmenting them as needed with other funding not allocated to the SBIR set-aside.<sup>11</sup> Some of the other SBIR agencies do this, but the nature of NIH's mission may make it difficult for NIH to explore such initiatives.

NIH's mission is to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability.<sup>12</sup>

To carry out its mission NIH awards only 3.7% of its extramural research dollars to for-profit institutions, and most of that goes to SBIR awards. The remaining majority goes to various types of non-profits led by universities with about 75% of the total funding.<sup>13</sup> NIH uses SBIR as its primary means of carrying out the second part of their mission—applying the fundamental knowledge their researchers have uncovered.

Unlike the procurement-oriented agencies such as the Department of Defense (DOD) or NASA, NIH does not have a major acquisition function that will procure the results of a successful Phase II award at Phase III. Instead, NIH, NSF and the other non-procuring SBIR agencies try to help their awardees succeed at selling their product in the general economy or to other government agencies. The funds spent on SBIR awards within the procuring agencies are within the same mission space as the rest of the research and development funds. Whereas, for NIH, most of the funding is focused on “seeking fundamental knowledge” and the SBIR portion focuses on “application of that knowledge.”

NIH, like most Federal agencies, is currently experiencing significant budget cuts. It may be difficult for NIH leadership to take funds from its other budget-constrained research programs to support the SBIR program.

### **2. Increasing the Number of Funded Applications**

The tradeoff between size of awards and number of awards is illustrated in Table 2, which shows that the total number of NIH Phase I and Phase II SBIR awards made in 2012 was 993. Of those awards, 477 (48%) were over the \$225,000 limit for Phase I and \$1.5 million limit for Phase II. NIH contends that the probability of success of those 477 awards would have been substantially reduced if the newly established caps had been in effect and enforced. In other words, NIH believes that the caps would have resulted in diminished commercialization successes for those 477 awards.

On the other hand, additional SBCs could have been afforded an opportunity to begin developing their proposed innovations. Specifically, as shown in Table 2, 348 more applications could have been awarded SBIR grants (namely, 299 Phase I grants of \$225,000 and 49 Phase II grants of \$1.5 million).

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<sup>11</sup> Testimony of M. R. Squillante, Chairman, Board of Directors, SBTC, on “Spurring Innovation and Job Creation, before the Committee on Small Business, U.S. House of Representatives, 16 March 2011, [http://www.nsba.biz/docs/sbtc\\_michael\\_squillante\\_hsbc\\_testimony\\_march\\_16\\_final.pdf](http://www.nsba.biz/docs/sbtc_michael_squillante_hsbc_testimony_march_16_final.pdf).

<sup>12</sup> See <http://www.nih.gov/about/mission.htm>.

<sup>13</sup> From [http://report.nih.gov/funded\\_organizations/index.aspx](http://report.nih.gov/funded_organizations/index.aspx).

**Table 2. Tradeoff between Size and Number of Awards**

NIH SBIR 2012	# Awards			Award Amount			# of Max-Size Grants Corresponding to Over-the-Cap Funds
	Total #	# Over Cap	% Over Cap	Total Award Amount	Award Amount Over Cap	% Over Cap	
Phase I	726	383	52.8%	\$210,908,461	\$67,331,669	31.9%	299
Phase II	267	94	35.2%	\$398,935,096	\$73,235,353	18.4%	49
<b>Total</b>	<b>993</b>	<b>477</b>	<b>48.0%</b>	<b>\$609,843,557</b>	<b>\$140,567,022</b>	<b>23.0%</b>	<b>348</b>

Source: SBIR.gov.

Because government agencies use careful criteria to select the awardees, those that have not been given awards have lower odds of success relative to those that were funded, but we do not know how large this effect is. It may be that the best companies that are rejected are nearly as good as those that win, or it may be that they are far behind the best that win. This has significant implications for the benefit of requiring that awards be reduced in size so that more firms can win awards.

#### **F. Findings**

Several key factors have been identified that differentiate the NIH environment from other agency environments:

1. Biomedical research is relatively expensive—with over a billion dollars being spent on drug research for each drug that reaches the marketplace. Even during early stages of research and development, biomedical research is expensive—with the average investment amount for seed stage VC deals being significantly higher in the life sciences sector than in the non-life-sciences sector in each year since 2006.
2. Drug development costs are increasing, nearly doubling every 9 years since 1950.
3. The composition of venture capital portfolios in the life sciences sector is changing—with investments shifting to lower-risk later stages—making NIH support at early stages of research and development more critical. NIH, through its rigorous evaluation process, as well as through its actual funding of very early stage research and development, can help to “de-risk” a proposed biomedical innovation enough to make it attractive to venture capitalists.
4. Unlike DOD and the other procuring agencies, NIH is not the intended “customer” of the products stemming from the SBIR projects that it funds. Therefore, whereas the DOD sometimes applies significant non-SBIR funds to supplement an SBIR project—when above-cap funding is required and when there is an urgent warfighter need for the results of a project—NIH and other non-procuring agencies do not have the same motivation to do so. Non-acquiring agencies do not have the same kind of demand for, and sources of, supplemental funding for SBIR projects.

#### **G. Recommendation**

The IPC believes that Congress should consider revising the Small Business Act to allow greater SBIR/STTR award size flexibility in line with the findings of this report.



## **Appendix A. List of Meetings and Events**

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**Table A-1. Schedule of Meetings and Other Activities**

***Organization(s)/Meeting(s)***

NIH SBIR/STTR Program

OSTP, SBA

OSTP, Small Business Technology Council (SBTC)

OSTP, National Academy of Sciences (NAS)

National Venture Capital Association (NVCA)

NIH/National Cancer Institute (NCI)

NIH/ National Institute of Mental Health (NIMH)

NIH/ National Institute of Allergy and Infectious Diseases (NIAID)

NIH/ National Heart, Lung, and Blood Institute (NHLBI)

Workshop - The SBIR Program: Opportunities for Program Evaluation

SBIR Interagency Policy Committee (IPC) Meeting

## Appendix B. Companies and Projects with Large Awards

In FYs 2009–2012, NIH funded 23 projects with large awards over \$3.225 million<sup>14</sup> or more and they are listed in Table B-1<sup>15</sup>. Each of these involved at least one award that was above the new limits, though we note that NIH was not violating any rules because they were not in effect at the time.

**Table B-1. Large NIH-Funded Projects, FY 2009–2012**

Rank by Cost	Company Name	Project Title	Serial Number	Award Years	Total Amount Awarded
1	ADVANTAGENE, INC	Clinical and Immunologic Evaluation of ProstAtak for Prostate Cancer	124032	3	\$5,293,474
2	LENTIGEN CORPORATION	Clinical Vector for TCR Immunotherapy Targeted to Melanoma	126461	3	\$5,082,389
3	VISTAGEN THERAPEUTICS, INC.	Clinical Development of 4-CI-KYN to Treat Pain	18515	3	\$4,604,082
4	SELEXYS PHARMACEUTICALS CORPORATION	Development of an Anti-P-selectin Antibody for the Treatment of Sickle Cell Disease	93893	3	\$4,380,425
5	TRANSCENDENT INTERNATIONAL, LLC	Knowledge Management System for Multilingual Health Content	80836	3	\$4,228,802
6	OMNIOX, INC.	Tumor Radiosensitization Using a Nitro-Oxide-Neutral, Tunable Oxygen-Binding Pro	138006	4	\$3,978,944
7	SANARIA, INC.	Attenuated Sporozoite Malaria Vaccine	55229	4	\$3,963,532
8	AUTOIMMUNE TECHNOLOGIES, LLC	Peptide inhibitors of influenza entry-FAST TRACK	82778	3	\$3,938,686
9	MICROTRANSPONDER, INC.	Targeted Neural Plasticity for the Treatment of Tinnitus	10084	7	\$3,828,360
10	CIRCULITE, INC.	CircuLite's Circulatory Support System in Children and Infants	96214	3	\$3,785,688
11	LYNCEAN TECHNOLOGIES, INC.	Compact X-ray Station for Protein Crystallography	74437	2	\$3,756,977

<sup>14</sup> This number was selected because it is the current limit: one phase I award for \$225 thousand and two phase II awards for \$1.5 million each. For the remainder of this appendix, this amount will be what is meant by "large awards."

<sup>15</sup> In this section, the data includes all SBIR and STTR awards between 2009 and 2012. This is different than the data in Appendix D, which looks at all data for projects started earlier, provided that the project was still active in 2009 or later. We made a different decision because the purpose was different. In this analysis we are looking at summary statistics of recent data rather than describing case studies that show how certain companies have performed over time.

12	PHARMACOGENETICS DIAGNOSTIC LABORATORIES	Personalized medicine informatics for anticoagulation therapy	90055	4	\$3,653,414
13	INVIVO SCIENCES, LLC.	Engineered tissue-based, high- throughput compound profiling	87784	4	\$3,647,125
14	SIGNUM BIOSCIENCES	A Topical Non-Steroidal Anti- inflammatory for Rosacea	62034	4	\$3,620,902
15	REGENEREX, LLC	Induction of Donor Tolerance in Renal Transplants	74331	2	\$3,588,048
16	ADVANCED CELL DIAGNOSTICS, INC.	Automated Systems for Detection and Molecular Characterization of Circulating Tum	122444	4	\$3,530,276
17	GEL-DEL TECHNOLOGIES, INC.	Arterial-Mimetic Grafts Molded from Purified Proteins	72670	3	\$3,492,034
18	ANGION BIOMEDICA CORPORATION	Novel Neuroprotective/Restorative Therapy for Ischemic Stroke	45373	3	\$3,491,534
19	AMBERGEN, INC	Expression-Based Multi-Gene Signatures for CRC Recurrence and Chemoselection	119565	4	\$3,468,150
20	ETUBICS CORPORATION	Development of an Ad5 [E1-, E2b-] HIV-1 vaccine for use in Ad5 Immunized Vaccine	71733	3	\$3,353,817
21	STRATATECH CORPORATION	Clinical Trial of Antimicrobial Skin to treat Diabetic Ulcers	69924	3	\$3,312,268
22	ARIETIS	Therapy Against Recalcitrant C. albicans Infection	74258	4	\$3,265,574
23	GLYSENS, INC.	Clinical Evaluation of a Long Term Implanted Glucose Sensor	77254	4	\$3,228,959
<b>Total in large projects</b>					<b>\$88,493,460</b>

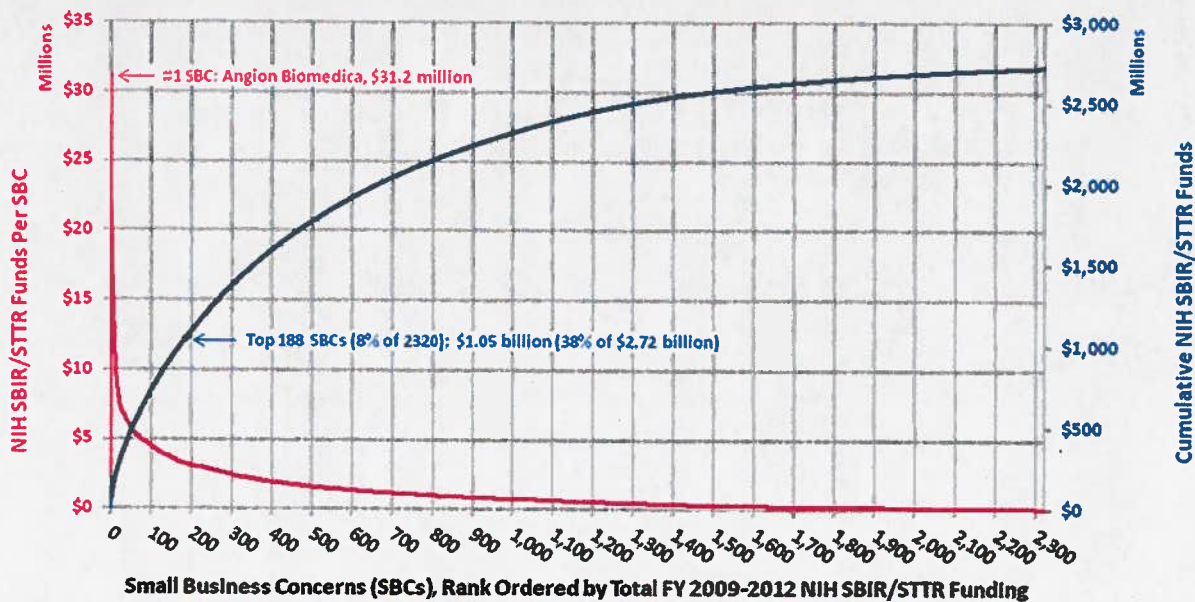
The data above shows the large projects for the time period FYs 2009–2012. Some of these amounts include awards earned prior to this timeframe. There were some projects not included here for which the total funding was greater than \$3.225 million over the entire period of performance for the award, but less than that amount was obligated during the timeframe.

There does not seem to be a strict definition of the term “project”. A body of work which some might think of as a single large project others might view as multiple small projects. Because of this, we also looked at companies that received high amounts of SBIR funding. In the same time period, there were many companies, including five of those listed above, that received SBIR and STTR awards for multiple projects. Thirteen companies received more than \$10 million in multiple SBIR awards during the FY2009-2012 timeframe.

**Table B-2. Companies with Over \$10 Million in SBIR Awards, FY 2009–2012**

Rank	Company Name	Number of Projects	Total Awards	Number of Large Projects
1	ANGION BIOMEDICA CORPORATION	24	\$31,188,677	1
2	OREGON CENTER FOR APPLIED SCIENCE, INC.	25	\$22,645,492	0
3	RADIATION MONITORING DEVICES, INC.	31	\$18,607,231	0
4	TRANSCENDENT INTERNATIONAL, LLC	11	\$17,398,740	1
5	SANARIA, INC.	13	\$17,310,524	1
6	INFLEXXION, INC.	15	\$14,683,976	0
7	AFFINERGY, INC	18	\$13,740,738	0
8	MICROBIOTIX, INC	19	\$13,493,215	0
9	PHYSICAL SCIENCES, INC	22	\$13,124,191	0
10	STRATATECH CORPORATION	8	\$11,768,370	1
11	ADVANCED MEDICAL ELECTRONICS CORPORATION	21	\$11,333,212	0
12	INFOSCITEX CORPORATION	9	\$10,766,117	0
13	AMBERGEN, INC	11	\$10,062,016	1

There were 2,320 SBCs that received over \$1,000 of SBIR funds from NIH in the time window, so these account for less than 0.6% of the total. Figure B-1 shows the cumulative distribution of awards to companies.



**Figure B-1. Distribution of NIH SBIR/STTR Funds across Small Business Concerns, FY 2009–2012**  
 The figure shows that the 2,136 SBCs, or 92% of the total, received amounts that were under the new limits for a single project. Of the 8% that were over this limit, many had multiple projects, so many were consistent with the new rules.

The analysis above shows that only a handful of companies receive SBIR funding that is above and beyond what can be done with the new rules, but there is an alternative view that looks different. While only 8% of companies received more than \$3.225 million between FY 2009 and FY 2012, these 188 companies received \$1.05 billion combined (or 38%) of the NIH's \$2.72 billion in SBIR awards. Most of these companies had multiple projects and few of them were large.

### **Summary**

While 38% of NIH's award dollars between FY 2009 and FY 2012 went to companies that received over \$3.225 million, even within these companies, most received them in smaller projects that fell under the limit. By the NIH definition of projects, using serial numbers from RePORTER, only 23 of the NIH projects received more funding than the current limits allow.

## Appendix C . Sample NIH-Funded Small Business Concerns, SBIR/STTR Projects, and Successes

In this appendix, we present success stories<sup>16</sup> of several small business concern (SBCs) that have had large NIH SBIR/STTR projects at some point during fiscal years 2000-2013:<sup>17</sup>

**Table C-1. Selected SBCs and Featured Successes**

	<b>Small Business Concern (SBC)</b>	<b>Featured Success</b>
<b>Pharmaceutical Drugs, Including Vaccines and Cell-Based Regenerative Therapies</b>	<b>Altor Bioscience Corp.</b> Miramar, Florida	Immunotherapeutic for Treatment of p53-positive Cancers
	<b>Angion Biomedica Corp.</b> Uniondale, New York	Harnessing the Body's Protective, Reparative, and Regenerative Systems for Treatment of Tissue Injury, Fibrosis, and Cancer
	<b>Microbiotix, Inc.</b> Worcester, Massachusetts	Small Molecule Drugs for Serious Infectious Diseases
	<b>Sanaria, Inc.</b> Rockville, Maryland	Promising Results from Clinical Trial on Novel Malaria Vaccine
	<b>SIGA Technologies, Inc.</b> New York, New York	\$433 Million Contract for Smallpox Antiviral
	<b>Stratatech Corp.</b> Madison, Wisconsin	Human Skin Substitute for Severe Burns and Non-Healing Ulcers
<b>Medical Devices, Including Software</b>	<b>Adv. Circulatory Systems, Inc.</b> Saint Paul, Minnesota	2012 Tibbetts Award Winner for Cardiopulmonary Resuscitation (CPR) Improvement
	<b>Cleveland Medical Devices, Inc.;</b> <b>Spin-off Great Lakes NeuroTech, Inc.</b> Cleveland, Ohio	Home Monitoring Solutions for Sleep Disorders; Tools and Telemed. Tech. for Parkinson's Disease
	<b>Guided Therapeutics, Inc.</b> Norcross, Georgia	Changing the Way Cervical Disease is Detected
	<b>Lyncean Technologies, Inc.</b> Palo Alto, California	Laboratory-Scale Synchrotron X-ray Light Source
	<b>Morphormics, Inc.</b> <sup>18</sup> Durham, North Carolina	Software for Radiation Planning for Prostate Cancer Treatment

The point of the success stories<sup>19</sup> is to give readers insights into the kinds of research and development activities funded by large NIH SBIR/STTR projects, namely, those exceeding the statutory cap of \$1.725

<sup>16</sup> Here, "success" is viewed as meeting at least one of the following goals of the SBIR program: 1) stimulate technological innovation, 2) use small business to meet Federal research and development needs, and 3) increase private sector commercialization innovations derived from Federal research and development.

<sup>17</sup> All the SBCs described herein were active SBIR/STTR participants during at least one year since 2009. The SBCs were selected based on total funding, funding for largest project, and availability of success stories at SBIR.gov, NIH or company websites, or other online resources. As shown in Table D-2, each of the selected SBCs had a project of at least \$2.5 million during fiscal years 2000-2013. The largest project was \$11.8 million.

<sup>18</sup> Acquired by Accuray, a radiation oncology company, in 2012 [<http://www accuray.com/pressroom/press-releases/accuray-acquire-morphormics-inc>].

million for a project with a single Phase I award and a single follow-on Phase II award.<sup>20</sup> Some highlights gleaned from a review of the selected SBCs, their SBIR/STTR projects, and their successes are as follows:<sup>21</sup>

- In some cases, all of an SBC's SBIR/STTR projects are aimed at a single goal:
  - Sanaria's mission is to develop and commercialize novel malaria vaccines, and all of its projects support this mission.
- In some cases, an SBC leverages a single innovation for multiple purposes:
  - Stratatech is applying its human skin substitute to severe burns, as well as to non-healing diabetic foot ulcers and other complex skin defects.
- In some cases, an SBC focuses on a specific disease or disorder:
  - Cleveland Medical Devices (CleveMed) focuses on sleep disorders, while its spin-off Great Lakes NeuroTechnologies (GLN) focuses on movement disorders such as Parkinson's disease.
- Some NIH SBIR/STTR projects are directed at orphan diseases:
  - Angion investigated a small-molecule drug candidate with potential to treat systemic scleroderma, a rare chronic autoimmune disease that causes skin to thicken and tighten, sometimes resulting in life-threatening damage to internal organs.<sup>22</sup>
- Some NIH SBIR/STTR projects are aimed at defending against bioterrorist attacks and other mass casualty events:
  - SIGA is developing a smallpox antiviral.
- In some cases, NIH applies non-SBIR/STTR funds to SBCs:
  - According to NIH RePORTER data, the National Institute of Allergy and Infectious Diseases (NIAID) awarded SIGA \$10.1 million through a "Research Projects" funding mechanism (including \$8.5 million in R01 funds for antivirals for Lassa Fever virus and dengue virus) and \$21.1 million through an "R and D Contract" funding mechanism (NO1 funds) for advanced development of its smallpox antiviral.
- In some cases, the Department of Health and Human Services (HHS), through the Biomedical Advanced Research and Development Authority (BARDA),<sup>23</sup> applies non-SBIR/STTR funds to innovations resulting from NIH SBIR/STTR projects:
  - BARDA awarded a five-year, \$433 million contract to SIGA for late-stage development of a smallpox antiviral drug.
  - BARDA awarded a contract of up to \$47.2 million to Stratatech for the advanced clinical and manufacturing development of its human skin substitute, as a medical countermeasure to treat patients with severe thermal burns.

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<sup>19</sup> Note that the success stories were, in most cases, drawn from material prepared by the subject SBC or the sponsoring NIH IC and therefore tend to cast the SBC in very favorable terms. We did not attempt to validate the claims made in the stories, but instead offer the stories as is. Nonetheless, we believe that the stories provide useful insights into the research and development activities being supported by large NIH SBIR/STTR awards.

<sup>20</sup> Phase I awards have a cap of \$225,000, and Phase II awards have a cap of \$1.5 million.

<sup>21</sup> Additional details and references are contained in the success stories appearing later in this appendix.

<sup>22</sup> <http://olpa.od.nih.gov/hearings/110/session2/Testimonies/sbir.asp>

<sup>23</sup> BARDA, an office in the HHS Office of the Assistant Secretary for Preparedness and Response (ASPR), develops and procures medical countermeasures (e.g., vaccines, drugs, therapies, and diagnostic tools) for public health medical emergencies [<http://www.phe.gov/about/barda/Pages/default.aspx>].

The remainder of this appendix is organized as follows, with overviews of the selected SBCs and their SBIR/STTR projects followed by brief descriptions of some of their successes:

- **Overview of the Selected SBCs: Line of Business, Year of Founding, Location, Number of Employees**
- **Overview of NIH Funding of the Selected SBCs: Number of Projects, Total Funding, Largest Project, Lead NIH Institute or Center (IC), Per Cent of Funding from Lead IC**
- **Sample Successes of the Selected SBCs:**
  - **Altor Bioscience Corporation: Immunotherapeutic for Treatment of p53-positive Cancers**
  - **Angion Biomedica Corporation: Harnessing the Body's Protective, Reparative, and Regenerative Systems for Treatment of Tissue Injury, Fibrosis, and Cancer**
  - **Microblotix, Inc.: Small Molecule Drugs for Serious Infectious Diseases**
  - **Sanaria, Inc.: Promising Results from Clinical Trial on Novel Malaria Vaccine**
  - **SIGA Technologies, Inc.: \$433 Million Contract for Smallpox Antiviral**
  - **Stratatech Corporation: Human Skin Substitute for Severe Burns and Non-Healing Ulcers**
  - **Advanced Circulatory Systems, Inc.: 2012 Tibbetts Award Winner for Cardiopulmonary Resuscitation (CPR) Improvement**
  - **Cleveland Medical Devices, Inc. (CleveMed): Home Monitoring Solutions for Sleep Disorders;**  
24  
**CleveMed Spin-Off Great Lakes NeuroTechnologies, Inc. (GLN): Tools and Telemedicine Technologies for Parkinson's Disease**
  - **Guided Therapeutics, Inc.: Changing the Way Cervical Disease is Detected**
  - **Lyncean Technologies, Inc.: Laboratory-Scale Synchrotron X-ray Light Source**
  - **Morphormics, Inc.: Software for Radiation Planning for Prostate Cancer Treatment**

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In the analysis reported in this appendix, CleveMed and its 2010 spin-off GLN are grouped together as a single SBC, unless otherwise noted.



## **Overview of the Selected SBCs: *Line of Business, Year of Founding, Location, Number of Employees***

- The selected SBCs are engaged in various lines of business, as indicated in Table C-1:
  - **Pharmaceutical drugs:**
    - Altor Bioscience Corporation of Miramar, Florida
    - Angion Biomedica Corporation of Uniondale, New York
    - Microbiotix, Inc., of Worcester, Massachusetts
    - SIGA Technologies, Inc., of New York, New York
  - **Vaccines:**
    - Sanaria, Inc., of Rockville, Maryland
  - **Cell-based regenerative therapies:**
    - Stratatech Corporation of Madison, Wisconsin
  - **Medical devices:**
    - Advanced Circulatory Systems, Inc., of Saint Paul, Minnesota
    - Cleveland Medical Devices, Inc. (CleveMed), and its spin-off Great Lakes Neurotechnologies (GLN), both of Cleveland, Ohio
    - Guided Therapeutics, Inc., of Norcross, Georgia
    - Lyncean Technologies, Inc., of Palo Alto, California
  - **Software:**
    - Morphormics, Inc., of Durham, North Carolina
- The selected SBCs represent 10 states: California, Florida, Georgia, Maryland, Massachusetts, Minnesota, New York, North Carolina, Ohio, and Wisconsin:<sup>25</sup>
  - Only one state—New York—was home to more than one of the SBCs. Angion is in Uniondale, New York, and SIGA Technologies is New York, New York.
- All the selected SBCs were founded between 1991 and 2003:<sup>25</sup>
  - 7 of the SBCs were founded in the 1990s.<sup>26</sup>
  - 4 of the SBCs were founded in the early 2000s, between 2001 and 2003.
- All but two of the SBCs, according to Hoover's, Inc., have 30 or fewer employees:<sup>25</sup>
  - Guided Therapeutics has 34 employees, and SIGA Technologies has 71 employees. CleveMed and its spin-off are each listed at 20 employees, but there appears to be some overlap among the employees in the Hoover's, Inc., reports.

<sup>25</sup>

Hoover's, Inc. (<https://subscriber.hoovers.com/H/login/login.html>).

<sup>26</sup>

CleveMed was founded in 1991 and eventually developed two lines of business, one on sleep disorders and one on movement disorders. It spun off GLN, to take over the movement disorder line, in 2010. CleveMed retained the sleep disorder line.

**Overview of NIH Funding of the Selected SBCs: Number of Projects, Total Funding, Largest Project, Lead IC, Percent of Funding from Lead**

Table D-2 summarizes the NIH SBIR/STTR funding received by the selected SBCs since fiscal year 2000. The source of the data is NIH RePORTER (<http://projectreporter.nih.gov/reporter.cfm>).

**Table D-2 Summary of NIH Funding for Selected SBCs<sup>27</sup>**

Organization Name	Number of SBIR/STTR Projects	Total SBIR/STTR Funding	Other Funding Shown in NIH RePORTER	Fiscal Years	Funding for Largest Project (All Phases)	Lead IC <sup>28</sup>	% of Funding from Lead IC
Altor BioScience Corporation	15	\$12,962,667		2000-2013	\$5,377,462	NCI	51.10%
Angion Biomedica Corporation	44	\$57,432,485		2000-2013	\$5,024,304	NIDDK	27.30%
Microbiotix, Inc.	40	\$41,422,410	\$19,867,724	2000-2013	\$5,299,786	NIAID	98.00%
Sanaria, Inc.	16	\$31,620,979		2003-2013	\$7,507,249	NIAID	100.00%
SIGA Technologies, Inc.	8	\$29,257,236	\$31,184,100	2000-2013	\$11,840,046	NIAID	99.80%
Stratatech Corporation	14	\$23,216,287	\$178,327	2001-2013	\$7,886,920	NIDDK	34.00%
Advanced Circulatory Systems, Inc.	8	\$10,942,771		2000-2013	\$5,653,211	NHLBI	87.60%
Cleveland Medical Devices, Inc., and Spln-Off Great Lakes Neurotechnologies	57	\$44,219,102	\$100,000	2000-2013	\$3,752,254	NINDS	55.60%
Guided Therapeutics, Inc.	3	\$7,005,816		2001-2012	\$3,621,981	NCI	82.20%
Lyncean Technologies, Inc.	3	\$20,174,020		2002-2009	\$9,577,715	NIGMS	93.60%
Morphormics, Inc.	3	\$3,714,361		2007-2012	\$2,527,869	NCI	100.00%

Below, we present additional details on the largest NIH SBIR/STTR projects (two SIGA projects), the SBC with the most NIH SBIR/STTR funding (Angion), and the SBC with the most NIH SBIR/STTR projects

<sup>27</sup> The SBCs are grouped as in Table C-1, with the SBCs focused on pharmaceutical drugs listed first (in alphabetical order), followed by the SBCs focused on medical devices (also in alphabetical order). The success stories are also presented in this order.

<sup>28</sup> Lead IC: NIH Institute or Center contributing the highest total SBIR/STTR funding for the SBC's projects.

(CleveMed and its spin-off GLN). We also point out that the number of NIH ICs sponsoring projects at the selected SBCs varies widely, from only one at two SBCs to nine at one SBC.

- **Of the selected SBCs, SIGA had the two largest NIH SBIR/STTR projects, each over \$10 million, over fiscal years 2000-2013:**
  - **Antiviral Drugs for Lassa Fever Virus (project serial number 56525):** Funded by the National Institute of Allergy and Infectious Diseases (NIAID) over fiscal years 2003-2008 for a total of \$11.8 million. This project was motivated by two factors: 1) the Lassa fever virus poses serious health concerns, annually infecting hundreds of thousands of individuals in West Africa and killing thousands and 2) the virus is a potential biological weapon.
  - **Small Molecule Inhibitors of Smallpox Virus Replication (project serial number 56409).** Funded by NIAID over fiscal years 2003-2008 for a total of \$10.4 million. This project was motivated by the threat of the use of the smallpox virus as a biological weapon.
- **Of all SBCs (not just the selected SBCs), Angion had the most NIH SBIR/STTR funding—44 projects for a total of \$57.4 million over fiscal years 2000-2013.**
  - The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) was responsible for projects totaling \$15.65 million, representing 27.3% of the NIH SBIR/STTR funds awarded to Angion.
  - Six other NIH Institutes and Centers (ICs)—NCI, NHLBI, NIAAA, NIAMS, NIGMS, and NINDS—were responsible for the remaining funds.
  - The largest Angion SBIR/STTR project was Hepatic Growth Factor Mimetic for Liver Fibrosis (project serial number 15223), funded by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) for a total of \$5 million.
- **Of the selected SBCs, CleveMed and its 2010 spin-off GLN had the most NIH SBIR/STTR projects—57 projects with total funding of \$44.2 million—over fiscal years 2000-2013.**
  - 45 projects, totaling \$33.2 million, were CleveMed only
  - 6 projects, totaling \$8.3 million, were launched at CleveMed and then transitioned to GLN
  - 6 projects, totaling \$2.7 million, were GLN only
- **For the selected SBCs, the number of NIH Institutes and Centers (ICs) sponsoring SBIR/STTR projects over fiscal years 2000-2013 ranged from 1 to 9 :**
  - **Four SBCs had a single IC account for 98% or more of their total NIH SBIR/STTR funding during fiscal years 2000-2013:**
    - The National Institute of Allergies and Infectious Diseases (NIAID) accounted for 100% of Sanaria's NIH SBIR/STTR funding (\$31.6 million), 99.8% of SIGA's NIH SBIR/STTR funding (\$29.2 million), and 98.0% of Microbiotix' funding (\$40.6 million).
    - The National Cancer Institute (NCI) accounted for 100% of Morphormics' funding (\$3.7 million).
  - **Of the selected SBCs, CleveMed and its spin-off GLN,<sup>29</sup> had the most (namely, 9) NIH IC sponsors:** NCCAM, NIMHD, NHLBI, NIA, NICHD, NIDDK, NIMH, NIMHD, and NINDS. The sponsor responsible for the most funding was the National Institute of Neurological

<sup>29</sup>

The nine sponsoring ICs have all funded CleveMed projects, whereas only a subset—NIA, NIMHD, and NINDS—have funded projects at its spin-off GLN to date (GLN was founded in 2010).

**Disorders and Stroke (NINDS), which accounted for 55.6% of the NIH SBIR/STTR funding awarded to CleveMed and GLN over fiscal years 2000-2013.**

- **Two other SBCs—Angion and Stratatech—each had 7 sponsoring ICs. The lead IC in each case was the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), which accounted for 27.3% of Angion’s SBIR/STTR funding and 34.0% of Stratatech’s funding over fiscal years 2000-2013.**

## Altor Bioscience Corporation: *Immunotherapeutic for Treatment of p53-positive Cancers*<sup>30,31</sup>

Primary Location	Miramar, FL
Web Address	<a href="http://www.althorbioscience.com">http://www.althorbioscience.com</a>
Line Of Business	Noncommercial research organizations, nsk
Ownership Type	Non-Public
Total Employees	21
Year of Founding	2002
Sales (US Dollars, million)	0.73
Prescreen Score	Low Risk
Primary Hoovers Industry	Scientific Research & Development Services

### National Cancer Institute Success Story, 10 May 2011:

Altor BioScience Corporation (Altor) is advancing the discovery and development of high-value, targeted immunotherapeutic agents for the treatment of cancer, viral infection, and inflammatory diseases. Most recently, Altor has been using funding from a \$3 million NCI SBIR Bridge grant to support clinical development of ALT-801, an immunotherapeutic agent for treatment of p53-positive cancers—representing a significant opportunity to advance cancer care for many patients.

In fact, given that p53 is mutated and overexpressed in roughly 50% of all human malignancies, the potential patient population for this therapy is large.<sup>32</sup>

### Market Potential:

ALT-801 would provide benefit to patients with bladder cancer, multiple myeloma, and melanoma. In 2010 in the U.S., 68,130 new cases of melanoma were diagnosed and 8,700 deaths occurred due to melanoma. In 2008, there were approximately 822,770 people alive in the U.S. who had a history of melanoma. It also estimated that 70,530 new cases of bladder cancer were diagnosed and 14,680 deaths occurred due to bladder cancer in the U.S. in 2010, and that there were approximately 537,428 people alive in the U.S. who had a history of bladder cancer in January 2008. In addition, an estimated 64,615 people in the U.S. were alive in 2008 with a history of multiple myeloma. This represents a market opportunity of over \$3 billion in the U.S. alone. Bladder cancer, a major unmet medical need, is currently Altor's main development focus.<sup>33</sup>

<sup>30</sup> p53 is a tumor suppressor protein. However, p53 *mutants* can exert cancer-promoting effects, by inactivation of wild-type (normal, non-mutated) p53, as well as through authentic oncogenic (cancer-causing) gain-of-function activities. [A.J. Levine and M. Oren, The first 30 years of p53: growing ever more complex, *Nature Reviews Cancer* 9, 749-758 (October 2009), <http://www.nature.com/nrc/journal/v9/n10/full/nrc2723.html>].

<sup>31</sup> Source of information in gray boxes at the top of each success story is Hoover's, Inc. (<https://subscriber.hoovers.com/H/login/login.html>).

<sup>32</sup> Excerpted from <http://sbir.cancer.gov/success/stories/altor/altor.asp>.

<sup>33</sup> Excerpted from <http://sbir.cancer.gov/investorforum/cfa.asp#Altor>.

## **Angion Biomedica Corporation: *Harnessing the Body's Protective, Reparative, and Regenerative Systems for Treatment of Tissue Injury, Fibrosis, and Cancer***

Primary Location	Uniondale, NY
Web Address	
Line Of Business	Commercial physical research, nsk
Ownership Type	Non-Public
Total Employees	25
Year of Founding	1999
Sales (US Dollars, million)	2.60
Prescreen Score	Medium Risk
Primary Hoovers Industry	Scientific Research & Development Services

### Angion Biomedica Corp. Press Release, 18 July 2012:

Angion Biomedica Corp. is a biopharmaceutical company founded in 1998 focused on discovery and development of drugs that harness the body's protective, reparative and regenerative systems for therapeutic benefit. The Company's drug discovery and development platform utilizes state-of-the-art, fully-integrated molecular modeling, medicinal chemistry and preclinical biology capabilities to identify and optimize small molecule and peptide-based drug candidates. Angion Biomedica's efforts have yielded a rich and diverse clinical and preclinical pipeline comprising novel therapeutics. Issued and pending U.S and international patents allow Angion Biomedica to retain worldwide rights to its proprietary molecules and uses for clinical benefit.

BB3 is a small molecule mimetic of HGF [hepatocyte growth factor, a substance causing cell division in hepatocytes (liver cells) and certain other cells]<sup>34</sup> that has been formulated for intravenous infusion and oral administration. BB3 has been granted Fast Track and Orphan Drug status by FDA for renal [kidney] transplantation. It is currently being evaluated in two Phase II clinical trials in renal recipients in the United States and Europe, as well as a Phase I study in patients with liver fibrosis. The enrollment of healthy volunteers in a Phase I clinical trial designed to look at the safety and pharmacokinetics [what the body does to the drugs] of BB3 oral formulation has just been completed.

<sup>34</sup>

HGF mimetics (so named because they mimic HGF in terms of structure, binding, and function) promote tissue repair in two ways: "first, as a *prophylactic*, by protecting healthy cells from ... death; and second, as a *therapeutic*, by promoting appropriate cell proliferation and migration needed for repair of pre-existing tissue injury" [<http://www.angion.com/science.asp>].

## Microbiotix, Inc.: *Small Molecule Drugs for Serious Infectious Diseases*

Primary Location	Worcester, MA
Web Address	<a href="http://www.microbiotix.com">http://www.microbiotix.com</a>
Line Of Business	Medicinals and botanicals, nsk
Ownership Type	Non-Public
Total Employees	24
Year of Founding	1998
Sales (US Dollars, million)	2.90
Prescreen Score	Low Risk
Primary Hoovers Industry	Pharmaceutical Manufacturing

### Small Molecule Drugs for Hepatitis C Virus (HCV) and Human Cytomegalovirus (HCMV) in Phase I Clinical Trials:

Microbiotix, Inc., is a biopharmaceutical company focused on the discovery and development of proprietary "small molecule drugs"<sup>35</sup> that target serious infectious diseases.

The company's lead therapeutic compound, MBX-700, is directed at the Hepatitis C virus (HCV), which, if left untreated, can lead to chronic liver disease, liver cancer, or death.

The company's second clinical compound, MBX-400, is directed at human cytomegalovirus (HCMV). HCMV (human herpesvirus 5, designated HHV-5) occurs as a benign infection in the majority of humans, with a high prevalence in the adult population. However, HCMV infection continues to be a major cause of morbidity and mortality in immunosuppressed patients, especially recipients of solid organ or bone marrow transplants. Additionally, HCMV remains the most important cause of congenital viral infection in the United States, and HCMV infection of neonates [newborn infants] is associated with deafness, mental retardation and mortality.

Both MBX-700 and MBX-400 are in Phase I clinical testing.<sup>36</sup>

<sup>35</sup> Drugs can be classified as "small molecule" drugs or "biomolecular" drugs (biologics). A small molecule drug is a "low molecular weight organic compound that may serve as a regulator of a biological process" [[http://en.wikipedia.org/wiki/Small\\_molecule](http://en.wikipedia.org/wiki/Small_molecule)]. Examples of small molecule drugs are Advair and Singulair for asthma, Crestor and Lipitor for high cholesterol, Abilify for major depressive disorder, and Lyrica for pain. Many small molecule drugs can be taken orally, whereas biomolecular drugs, such as Humira for rheumatoid arthritis and Lantus for diabetes, often require injection.

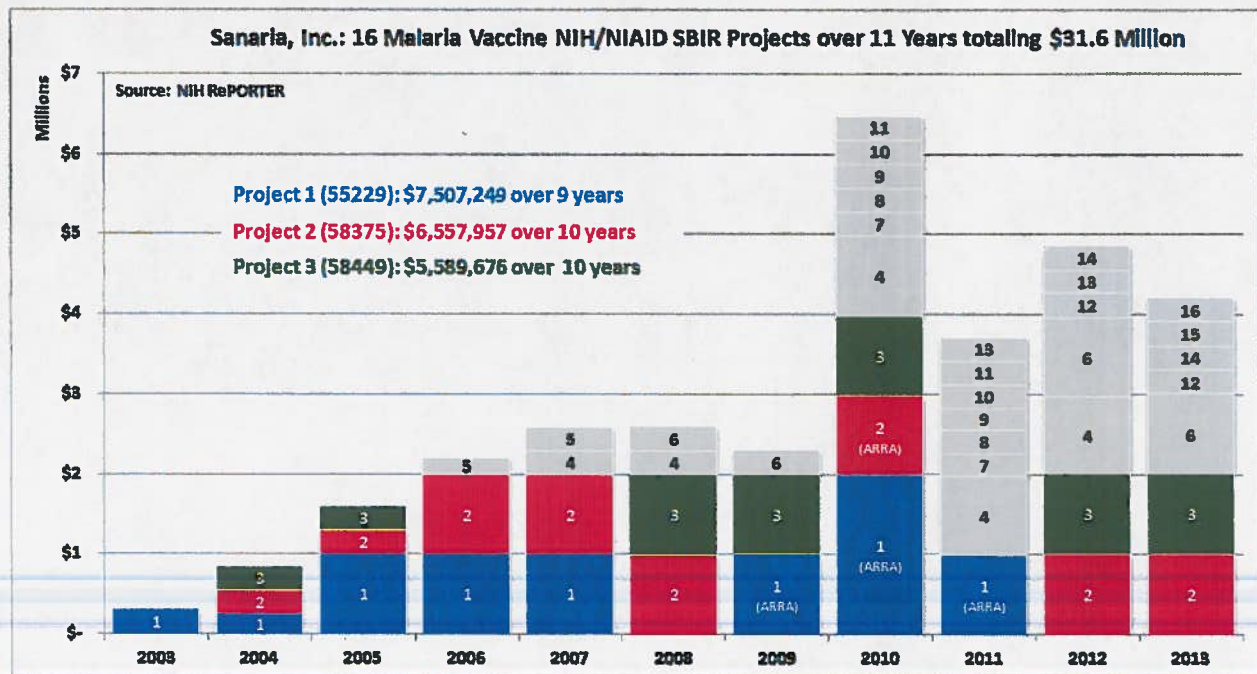
<sup>36</sup> Compiled from <http://www.microbiotix.com/overview.htm>, <http://www.microbiotix.com/therapeutic-programs-hcv.htm>, and <http://www.microbiotix.com/therapeutic-programs-hcmv.htm>.

## Sanaria, Inc.: Promising Results from Clinical Trial on Novel Malaria Vaccine

Primary Location	Rockville, MD
Web Address	<a href="http://www.sanaria.com">http://www.sanaria.com</a>
Line Of Business	Biological products, except diagnostic
Ownership Type	Non-Public
Total Employees	1
Year of Founding	2003
Sales (US Dollars, million)	0.14
Prescreen Score	Low Risk
Primary Hoovers Industry	Biopharmaceuticais & Biotherapeutics Manufacturing

### Notable SBIR Funding Facts:

- NIH/NIAID made awards to 16 Sanaria SBIR projects (counting all awards for all phases, including ARRA funds) over a period of 11 years, for a grand total of \$31.6 million. *All were aimed at a malaria vaccine.* The three largest projects were:
  - Attenuated Sporozoite Malaria Vaccine (#1: \$7.5 million)
  - Universal Attenuated Sporozoite Vaccine and Challenge System (#2: \$6.6 million)
  - Improving Manufacturing and Potency of Cryopreserved Malaria Sporozoite Vaccine (#3: \$5.6 million)
- In addition, Projects 2, 3, and 6 (Transgenic Mosquitoes for Improved Malaria Sporozoite Vaccine) are slated to receive \$1 million each in FY 2014.<sup>37</sup>





**Science News/Analysis Story, 9 August 2013:**

For the past decade, tropical disease researcher Stephen Hoffman [Sanaria] has been obsessed with a quixotic scheme for making a malaria vaccine: by bottling weakened malaria parasites. Online this week in *Science* (<http://scim.ag/SederVac>), Hoffman's company and federal researchers report that when given in a new way, their experimental vaccine protected 12 of 15 volunteers from malaria infection, including all six receiving the most doses.

Caused by *Plasmodium* parasites transmitted by mosquitoes, malaria infected an estimated 220 million people in 2010 and killed 660,000, most of them children, according to the World Health Organization. The current leading vaccine candidate, RTS,S, contains a single surface protein from the *Plasmodium falciparum* sporozoite, an immature form of the parasite. In recent phase III trials, RTS,S protected only 31% of young infants and 56% of older babies and toddlers (*Science*, 16 November 2012, p. 871).

Hoffman, who worked on RTS,S as a U.S. Navy researcher, concluded years ago that a single-protein vaccine would "never do the job" of achieving full protection against the complex, 5000-gene malaria parasite and that only a vaccine containing whole sporozoites would work. He seized on studies in the 1970s that showed that more than 90% of volunteers were protected against malaria infection after they received more than 1000 bites from *P. falciparum*-infected mosquitoes that had been irradiated to weaken the parasite. Hoffman launched Sanaria in 2002 to develop a vaccine that could mimic the effect of those bites.<sup>38</sup>

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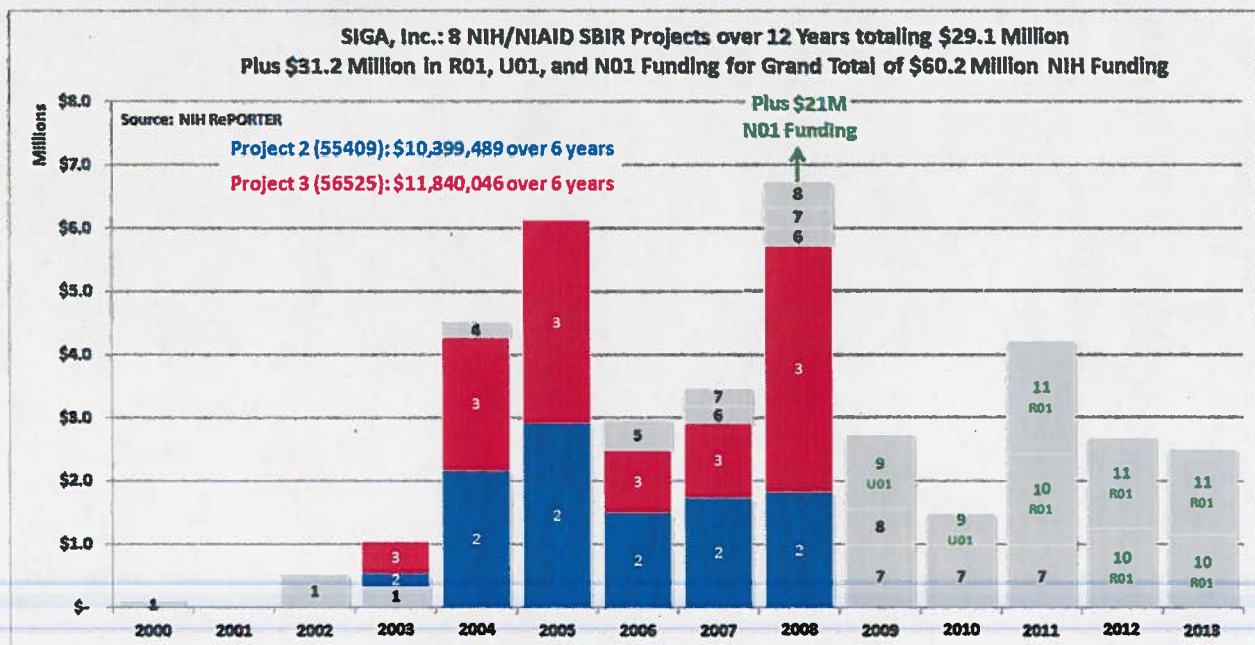
<sup>38</sup> Excerpted from Kaiser, J., Unconventional Vaccine Shows Promise Against Malaria, *Science* 341, News/Analysis, 9 August 2013, <http://m.sciencemag.org/content/341/6146/605.full>.

## SIGA Technologies, Inc.: \$433 Million Contract for Smallpox Antiviral

Primary Location	New York, NY
Web Address	<a href="http://www.siga.com">http://www.siga.com</a>
Line Of Business	Pharmaceutical preparations
Ownership Type	Public
Total Employees	71
Year of Founding	1995
Sales (US Dollars, million)	8.97
Prescreen Score	Low Risk
Primary Hoovers Industry	Biopharmaceuticals & Biotherapeutics Manufacturing

### Notable SBIR Funding Facts:

- Of the companies that received at least some NIH SBIR/STTR funding in 2009 or later, SIGA, Inc., had the two largest NIH SBIR projects (counting all awards for all phases):
  - Small Molecule Inhibitors of Smallpox Virus Replication (Serial Number 56409, shown as Project #2 in blue in the figure below, for \$10.4 million)
  - Antiviral Drugs for Lass Fever Virus (Serial Number 56525, shown as Project #3 in red below, for \$11.8 million)
- During the period 2009-2013, as shown in the figure below, NIH applied non-SBIR/ STTR funding mechanisms (R01 and U01) to SIGA research projects 9, 10, and 11.
- In 2008, as indicated in the figure, NIH applied \$21 million, in the form of two research and development contracts (N01)—Advanced Development of Smallpox Therapeutics and Development of a Smallpox Antiviral—to continued development of a smallpox antiviral.



**HHS as an Acquisition Agency—Biomedical Advanced Research and Development Authority (BARDA)**  
**Announcement of Contract for SIGA Smallpox Antiviral, 13 May 2011:**

The Biomedical Advanced Research and Development Authority (BARDA)<sup>39</sup> today announced a five-year, \$433 million contract for late-stage development of an antiviral drug to treat individuals infected with smallpox. The contract with SIGA Technologies Inc., of New York City also includes procurement of 1.7 million treatment courses of the drug, ST-246, within five years.

Today's contract is the first for smallpox antiviral drug development to be supported through Project BioShield, managed by BARDA within the U.S. Department of Health and Human Services' Office of the Assistant Secretary for Preparedness and Response.

The contract supports the final stages of ST-246 drug development needed to apply for U.S. Food and Drug Administration approval.

Under the contract, the company also will develop a pediatric oral formulation of the drug, in compliance with requirements of the Pandemic and All-Hazards Preparedness Act of 2006.

Project BioShield, as amended by the Pandemic and All-Hazards Preparedness Act, provides additional and more flexible authorities and funding to support and expedite the development and acquisition of medical countermeasures against chemical, biological, radiological, and nuclear threats.<sup>40</sup>

SIGA Technologies Press Release, 16 July 2013:<sup>41</sup>

SIGA Technologies, Inc. (Nasdaq:SIGA) today announced it has passed another significant commercial milestone with the third delivery of its proprietary smallpox antiviral drug, Arestvyr, to the United States Government's Strategic National Stockpile (SNS). With a cumulative delivery of approximately 590,000 courses of Arestvyr to the SNS over the past five months, SIGA has met a key requirement of its contract with the Government's Biomedical Advanced Research and Development Authority (BARDA) and has qualified for a payment of approximately \$79 million for the courses delivered to date.

[SIGA Technologies is] a pharmaceutical company specializing in discovering and developing pharmaceutical solutions for some of the most lethal pathogens—smallpox, Ebola, dengue, Lassa fever and other dangerous viruses.<sup>42</sup>

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<sup>39</sup> BARDA, an office in the HHS Office of the Assistant Secretary for Preparedness and Response (ASPR), develops and procures medical countermeasures (e.g., vaccines, drugs, therapies, and diagnostic tools) for public health medical emergencies [<http://www.phe.gov/about/barda/Pages/default.aspx>].

<sup>40</sup> Excerpted from <http://www.phe.gov/Preparedness/news/Pages/smallpox-antiviral-110513.aspx>.

<sup>41</sup> SIGA is involved in an ongoing legal dispute with Pharmathene, Inc. In May 2013, the Supreme Court of Delaware ruled that SIGA breached its contractual duty to negotiate the terms of a license agreement in good faith. However, the Supreme Court pushed the decision on expectation damages back to the Delaware Court of Chancery, where Pharmathene will seek to prove its expectation damages "with reasonable certainty.

See <http://seekingalpha.com/article/1464771-siga-or-pharmathene-who-really-won> and <http://ir.pharmathene.com/phoenix.zhtml?c=191999&p=irol-newsArticle&ID=1701523&highlight=>.

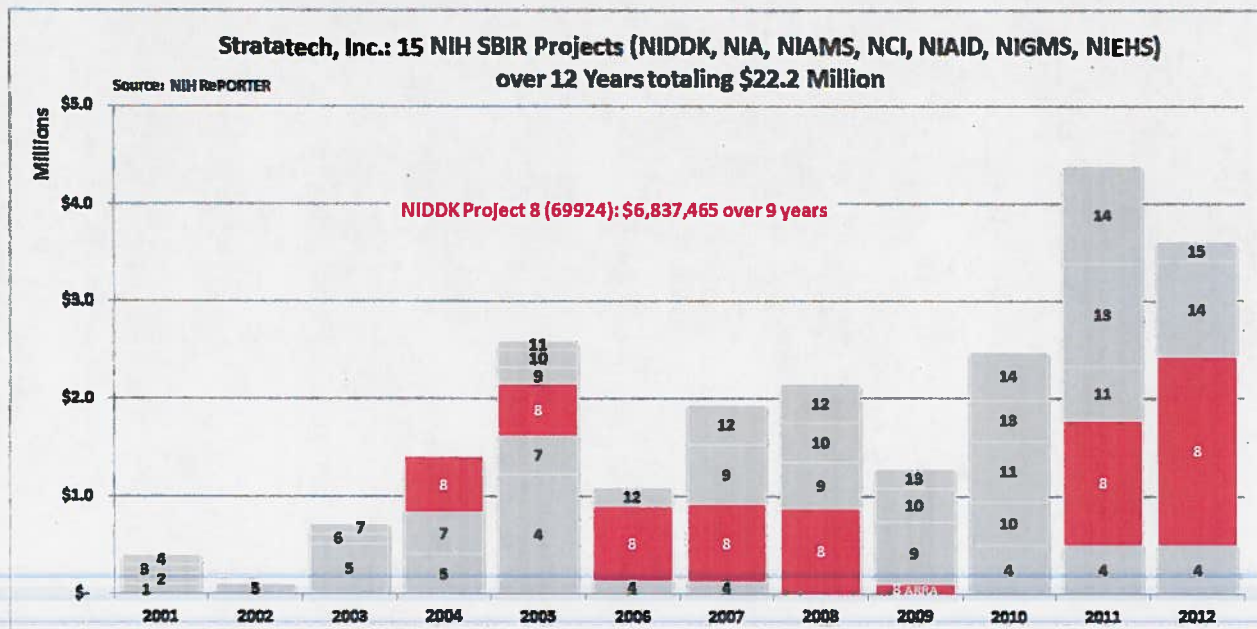
<sup>42</sup> Excerpted from <http://investor.siga.com/releasedetail.cfm?ReleaseID=777443>.

## Stratatech Corporation: *Human Skin Substitute for Severe Burns and Non-Healing Ulcers*

Primary Location	Madison, WI
Web Address	<a href="http://www.stratatechcorp.com">http://www.stratatechcorp.com</a>
Line Of Business	Noncommercial research organizations, nsk
Ownership Type	Non-Public
Total Employees	30
Year of Founding	1999
Sales (US Dollars, million)	3.20
Prescreen Score	Low Risk
Primary Hoovers Industry	Biotechnology Research Services

### Notable SBIR Funding Facts:

- Seven NIH ICs funded a total of 14 Stratatech Corporation (Stratatech) SBIR/STTR projects—all focused on the development and commercialization of cell-based, tissue-engineered skin substitute products—for a total of \$23.2 million:
  - National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) was the lead funding agency at \$7,886,920 (34% of Stratatech NIH SBIR/STTR funding)
  - Five ICs (NIA, NIAMS, NCI, NIAID, and NIGMS) each contributed from \$1 million to \$4.2 million. Another IC (NIEHS) contributed \$299,430.
- NIDDK funded the single largest Stratatech project:
  - Antimicrobial, Angiogenic Skin Substitutes for Diabetic Skin Ulcers (\$7,886,920)



**About Stratatech:**

Stratatech is a privately-held regenerative medicine company focused on the development and commercialization of cell-based, tissue-engineered skin substitute products for therapeutic and research applications. These products are made using the company's proprietary NIKS cells—a consistent and well-characterized source of human keratinocyte progenitor cells that faithfully reproduces normal epidermal skin architecture and barrier function. The company is using these progenitor cells to create a portfolio of therapeutic products to treat severe burns, non-healing ulcers, and other complex skin defects. The company's flagship product, StrataGraft tissue, is in human clinical testing for the treatment of severe burns and other traumatic skin loss. The company's second therapeutic product, ExpressGraft anti-infective tissue, is on track to enter clinical testing to treat non-healing diabetic foot ulcers.<sup>43</sup>

**Stratatech Press Release, 31 July 2013:**

Stratatech Corp., a leader in regenerative medicine, announced today that it has been awarded a contract valued at up to \$47.2 million by the U.S. Department of Health and Human Service's Biomedical Advanced Research and Development Authority (BARDA). The contract is for the advanced clinical and manufacturing development of StrataGraft skin tissue, the Company's flagship skin replacement product, as a medical countermeasure to treat patients with severe thermal burns.<sup>43</sup>

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<sup>43</sup> Excerpted from <http://www.stratatechcorp.com/news/20130731.php>.

**Advanced Circulatory Systems, Inc.: 2012 Tibbetts Award<sup>44</sup> Winner for  
Cardiopulmonary Resuscitation (CPR) Improvement**

Primary Location	Saint Paul, MN
Web Address	<a href="http://www.advancedcirculatory.com">http://www.advancedcirculatory.com</a>
Line Of Business	Electromedical equipment
Ownership Type	Non-Public
Total Employees	22
Year of Founding	1997
Sales (US Dollars, million)	2.30
Prescreen Score	Low Risk
Primary Hoovers Industry	Electromedical, Electrotherapeutic & X-Ray Apparatus Manufacturing

**National Heart, Lung, and Blood Institute (NHLBI) SBIR/STTR Success Story, May 2012:**

Advanced Circulatory Systems Receives 2012 Tibbetts Award.... Advanced Circulatory Systems develops technologies that non-invasively increase blood flow throughout the body and increase the chance of survival for patients suffering medical emergencies. Since 2000, the NHLBI has awarded Advanced Circulatory Systems more than \$8 million to perform research and clinical trials on devices to improve cardiopulmonary resuscitation (CPR). This research has resulted in the commercial availability of ResQPOD, an easy to use device that increases circulation during CPR.<sup>45</sup>

<sup>44</sup> The Tibbetts Awards [<http://sbir.gov/content/tibbetts-awards-0>] honor small businesses and individuals that exemplify the best in the SBIR and STTR programs. Winners are selected by the Small Business Administration based on the recommendations of a panel of judges.

<sup>45</sup> Excerpted from <http://www.nhlbi.nih.gov/funding/sbir/successstories/ACSTibbettsAward.htm>.

**Cleveland Medical Devices, Inc. (CleveMed): *Home Monitoring Solutions for Sleep Disorders***

Primary Location	Cleveland, OH
Web Address	<a href="http://www.clevemed.com">http://www.clevemed.com</a>
Line Of Business	Electromedical equipment
Ownership Type	Non-Public
Total Employees	20
Year of Founding	1991
Sales (US Dollars, million)	5.00
Prescreen Score	Low Risk
Primary Hoovers Industry	Medical Equipment & Supplies Manufacturing

**Great Lakes NeuroTechnologies, Inc. (GLN): *Spin-Off of CleveMed, Focused on Tools and Telemedicine Technologies for Parkinson's Disease***

Primary Location	Cleveland, OH
Web Address	<a href="http://www.glneurotech.com">http://www.glneurotech.com</a>
Line Of Business	Electromedical equipment
Ownership Type	Non-Public
Total Employees	20
Year of Founding	2010
Sales (US Dollars, million)	2.00
Prescreen Score	Low Risk
Primary Hoovers Industry	Electromedical, Electrotherapeutic & X-Ray Apparatus Manufacturing

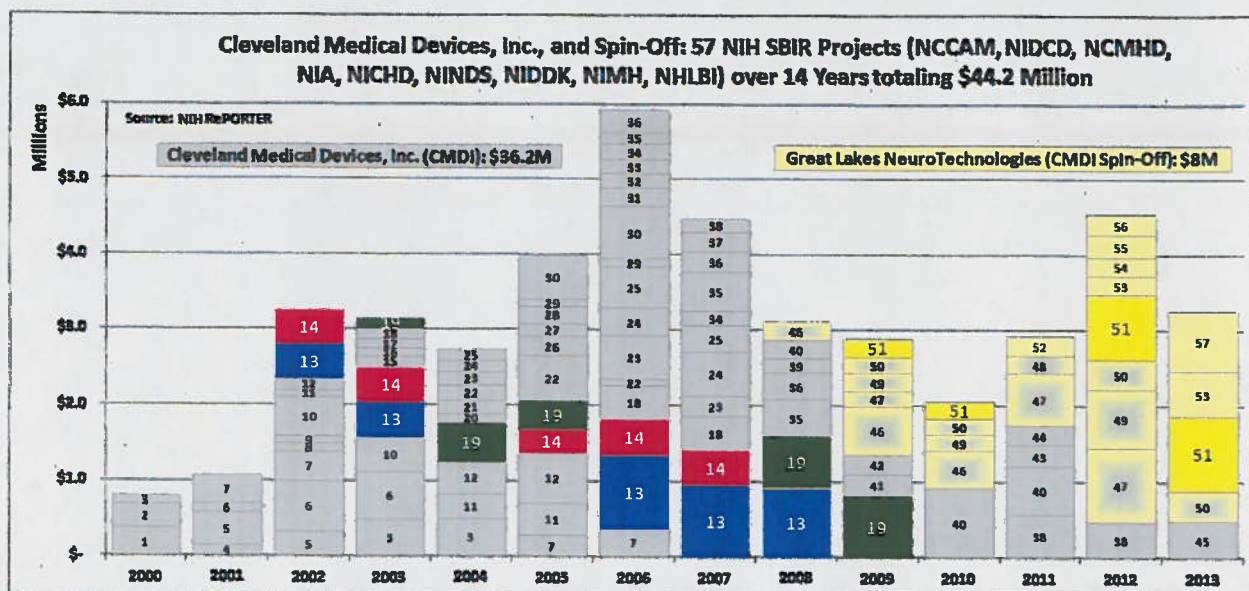
**Notable SBIR Funding Facts:**

- Nine NIH ICs funded a total of 57 CleveMed and GLN SBIR/STTR projects (counting all awards for all phases, including ARRA funds) over a period of 14 years, for a total of \$44.2 million. *Note that CleveMed focuses on sleep disorders, while GLN (a CleveMed spin-off founded in 2010) focuses on movement disorders such as Parkinson's disease.*
  - National Institute of Neurological Disorders and Stroke (NINDS) was the lead agency, with projects totaling \$24,586,079 (56% of the total funding).
  - Eight other ICs had SBIR/STTR projects:

<b>NHLBI</b>	<b>National Heart, Lung, and Blood Institute</b>	<b>\$8,119,533</b>
<b>NIA</b>	<b>National Institute on Aging</b>	<b>\$6,556,275</b>
<b>NICHD</b>	<b>National Institute of Child Health and Human Development</b>	<b>\$1,715,830</b>
<b>NIMH</b>	<b>National Institute of Mental Health</b>	<b>\$1,445,186</b>
<b>NIMHD</b>	<b>National Institute on Minority Health and Health Disparities</b>	<b>\$781,607</b>
<b>NCCAM</b>	<b>National Center for Complementary and Alternative Medicine</b>	<b>\$495,093</b>
<b>NIMHD</b>	<b>National Institute on Minority Health and Health Disparities</b>	<b>\$399,068</b>
<b>NIDDK</b>	<b>National Institute of Diabetes and Digestive and Kidney Diseases</b>	<b>\$120,431</b>

- The 57 projects were distributed among CleveMed and GLN as follows:
  - 45 projects (#1 through #45 below) were CleveMed only
  - 6 projects (#46 through #51) were launched at CleveMed and moved to GLN
  - 6 projects (#52 through #57) were GLN only
- The four largest projects were:
  - Pre-Operative Polysomnography (PSG) Assessment of Cardiac Surgery inpatients (#13: NINDS — \$3.75 million)
  - Emergency Brain Monitor with Telemetry (#14: NINDS — \$2.2 million)
  - Wireless Movement Disorder Monitor (#19: NINDS — \$2.5 million)
  - Parkinstep: Automated Parkinson’s Disease (PD) Gait and Balance Assessment for Optimizing deep brain stimulation (DBS) (#51: NIA — total of \$2.4 million — \$0.5 million to CleveMed and \$1.9 million to GLN)





**NIH SBIR/STTR Success Story on CleveMed and Sleep Disorder Products, 2 March 2010:**

**Technology Developed:** Portable telemetry-based sleep monitors that can be easily deployed in many settings including sleep labs, hospital rooms, patients' homes, nursing homes, and others.

**Uses of Technology/Products/Service:** The technology can be used to facilitate the diagnosis of many sleep disorders including sleep apnea, insomnia, and parasomnia in environments that are more convenient and cost effective to the patients and providers.

**How Products Were Commercialized:** [CleveMed] products are sold through our own direct sales force and national and international independent representatives and distributors. [CleveMed] products are sold in over 10 countries including Columbia, Malaysia, Australia, Philippines, Thailand, India, Dubai, Vietnam, and Singapore.<sup>46</sup>

**2012 Bronze Edison Award<sup>47</sup> for SleepView Monitor/Portal, Developed and Out-licensed by CleveMed to Midmark, 30 April 2012:**

The Midmark SleepView® Monitor/Portal has been recognized with a Bronze Award for most innovative product by the 2012 Edison Awards.... The technology is developed by Cleveland Medical Devices Inc. and exclusively distributed by Midmark Corporation. Nationally launched in late 2011, the Midmark SleepView Monitor is the market's smallest and lightest portable home sleep monitor that meets the American Academy of Sleep Medicine's recommended channel set for Type III monitors....

SleepView allows patients to be tested for obstructive sleep apnea (OSA) in the comfort, convenience and privacy of their own home. When connected to the Midmark SleepView Portal, this system provides prescribing physicians such as primary care physicians with online access to sleep study reports and treatment recommendations generated by sleep technologists and board certified sleep physicians.

OSA is a repeated interruption of normal breathing during sleep due to a collapse of the upper airway. It is estimated to impact as many people as asthma and diabetes; yet, up to 90 percent of the population with the disease is undiagnosed and untreated.... Numerous studies link OSA to major chronic diseases

<sup>46</sup> Excerpted from [http://grants.nih.gov/grants/funding/sbir\\_successes/3128.htm](http://grants.nih.gov/grants/funding/sbir_successes/3128.htm).

<sup>47</sup> The Edison Awards, established in 1987, honor innovative products, services, and business leaders according to four criteria: concept, value, delivery and impact [<http://www.edisonawards.com/Awards.php>].

such as stroke, heart failure, diabetes, obesity, hypertension and increased odds of serious car crash injuries.<sup>48</sup>

**CleveMed Spins-Off Great Lakes NeuroTechnologies, 23 March 2011:**

Cleveland Medical Devices Inc. has announced the formation of Great Lakes NeuroTechnologies, a spin-off company which has acquired the rights to develop, market, and manufacture clinical motor assessment and therapy systems for the movement disorders market as well as physiological monitors for research and education markets....

GLN's Division of Movement Disorders will target Parkinson's disease and other movement disorders through a portfolio of patient-centered diagnostic and therapy systems integrated with wireless, remote, and web based technologies. Devices to be manufactured by GLN will include KinetiSense™, Kinesia™, and Kinesia HomeView™ systems for capturing movement disorder motor symptoms both in the clinic, at home, and during clinical trials.<sup>49</sup>

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<sup>48</sup> Excerpted from [http://clevedmed.com/clevedmed\\_newsreleases/2012\\_Midmark\\_Sleepview\\_honored\\_at\\_Edison\\_Awards.shtml](http://clevedmed.com/clevedmed_newsreleases/2012_Midmark_Sleepview_honored_at_Edison_Awards.shtml).

<sup>49</sup> Excerpted from <http://glneurotech.com/pr/03232011-CleveMed-GLNT.pdf>.

## **Guided Therapeutics: *Changing the Way Cervical Disease is Detected***

Primary Location	Norcross, GA
Web Address	<a href="http://www.guidedtherapeutics.com">http://www.guidedtherapeutics.com</a>
Line Of Business	Surgical and medical instruments
Ownership Type	Public
Total Employees	34
Year of Founding	1992
Sales (US Dollars, million)	3.41
Prescreen Score	Not provided in Hoovers
Primary Hoovers Industry	Medical Equipment & Supplies Manufacturing

### **National Cancer Institute Success Story, 7 December 2011:**

Georgia-based Guided Therapeutics has developed LuViva, a non-invasive medical device designed to instantly detect cervical disease in a point-of-care setting. They have successfully moved from concept to prototype to product with awards from the NCI SBIR program, including a \$2.5 M Bridge Award in 2009. According to Guided Therapeutics Vice President of Product Development and Principal Investigator Shabbir Bambot, Ph.D., "Funding received through the SBIR Bridge program was especially critical because it reduced our risk and incentivized investors to contribute an additional \$5.5 million."<sup>50</sup>

### **Guided Therapeutics Press Release, 14 August 2013:**

"Today we have minimum contracted commitments from our existing distributor base that total over \$40 million and expect to sign additional distributors in the fall," added Dr. Faupel [Chief Executive Officer and President of Guided Therapeutics]. "We are gratified by the positive response we see all over the world to our technology, from current users in Canada and industry opinion leaders in the U.S., to government agencies in the Middle East."<sup>51</sup>

<sup>50</sup> Excerpted from [http://sbir.cancer.gov/success/stories/guided\\_therapeutics/index.asp](http://sbir.cancer.gov/success/stories/guided_therapeutics/index.asp)

<sup>51</sup> Excerpted from <http://www.guidedinc.com/News/Quarterly/2013/2Q%202013%20Release%20August%2014%202013.pdf>

## Lyncean Technologies, Inc.: *Laboratory-Scale Synchrotron X-ray Light Source*

Primary Location	Palo Alto, CA
Web Address	<a href="http://www.lynceantech.com">http://www.lynceantech.com</a>
Line Of Business	X-ray apparatus and tubes, nsk
Ownership Type	Non-Public
Total Employees	17
Year of Founding	2001
Sales (US Dollars, million)	3.70
Prescreen Score	Low Risk
Primary Hoovers Industry	Electromedical, Electrotherapeutic & X-Ray Apparatus Manufacturing

### Lyncean Press Release (Overview of Compact Light Source), 11 March 2013:

The Lyncean "Compact Light Source" (CLS) has been developed to offer high-quality X-ray beams, like those produced at synchrotrons, for applications that cover a broad range of X-ray science....

During the past 30 years, synchrotron light sources have become the X-ray probe of choice for material scientists, chemists, biologists and medical researchers....

Unlike the stadium-sized synchrotron radiation sources that require a highly technical support staff, the CLS fits in a typical laboratory space and is designed to be operated directly by academic or industrial end-users.

The Lyncean CLS is based on licensed technology from SLAC National Accelerator Laboratory. The commercial development was supported primarily by grants from the US National Institutes of Health, NIGMS and NCRR.

### Lyncean Press Release (First Sale of a Compact Light Source), 13 December 2012:

Palo Alto-based Lyncean Technologies, Inc., today announced its first sale of a Compact Light Source, a miniature synchrotron X-ray source employing state-of-the-art laser-beam and electron-beam technology.

A Lyncean "Compact Light Source" (CLS) was purchased by researchers from the newly-formed Center for Advanced Laser Applications (CALA) in Germany, a joint project of the Ludwig Maximilians University of Munich (LMU) and the Technical University Munich (TUM).

"Today is a milestone for us," said Ronald Ruth, Lyncean's founder and Chairman of the Board. "We feel we have an innovative tool, especially as X-rays are playing a growing role in areas like structural biology, medical science, nanotech and fuel cell research. We've been fortunate to have had so much support developing the technology, but putting a CLS in the hands of scientists has always been the ultimate goal."<sup>52</sup>

<sup>52</sup>

Excerpted from [http://www.eurekaalert.org/pub\\_releases/2012-12/lti-lti121312.php](http://www.eurekaalert.org/pub_releases/2012-12/lti-lti121312.php).

## **Morphormics, Inc.: Software to Facilitate Radiation Planning for Prostate Cancer Treatment**

<b>Primary Location</b>	Durham, NC
<b>Web Address</b>	
<b>Line Of Business</b>	Custom computer programming services, nsk
<b>Ownership Type</b>	Non-Public
<b>Total Employees</b>	8
<b>Year of Founding</b>	2002
<b>Sales (US Dollars, million)</b>	0.50
<b>Prescreen Score</b>	Low Risk
<b>Primary Hoovers Industry</b>	Information Technology Services

### **National Cancer Institute Success Story, 29 January 2013:**

Morphormics, Inc., has brought its technology—a software product that facilitates radiation planning called MxStructure—from prototype to marketed product. Furthermore, the company’s 2012 acquisition by radiation oncology company Accuray, Inc., increases the role that MxStructure will play in treating cancer patients throughout the United States and the world.

Morphormics, Inc. was founded by University of North Carolina researchers with the goal of making cancer treatment more efficient and effective. Their MxStructure contouring software automatically identifies and draws the boundaries of body organs and the surrounding critical structures from medical images.

The addition of MxStructure to Accuray’s systems extends the system’s capabilities, helping radiation planners better focus radiation doses and minimize delivery of radiation to surrounding healthy tissue. MxStructure is already acclaimed by Accuray users for its performance related to organs in the male pelvis. Products for other anatomical sites are under development. By 2014, Morphormics envisions gaining a 12% market share in the \$100 million global market for auto-segmentation<sup>53</sup> software applications.

Clinicians in the United States and 10 other countries are already using MxStructure to protect cancer patients from unwanted complications due to the potential destruction of healthy tissue by radiation therapy. With over 200,000 new cases of prostate cancer and 30,000 deaths every year, MxStructure’s auto-segmentation of organs in the male pelvis has great potential to impact prostate cancer treatment. Morphormics continues to develop the product to work on other anatomical structures, with the goal of bringing more efficient and accurate auto-segmentation to the table in more types of cancers in the coming years.<sup>54</sup>

<sup>53</sup> *Segmentation* is “the process of constructing three-dimensional (3D) anatomic configurations from CT scans and other medical images” [[http://sbir.cancer.gov/success/stories/morphormics\\_inc/index.asp](http://sbir.cancer.gov/success/stories/morphormics_inc/index.asp)].

<sup>54</sup> Excerpted from [http://sbir.cancer.gov/success/stories/morphormics\\_inc/index.asp](http://sbir.cancer.gov/success/stories/morphormics_inc/index.asp).