

The Economic Contributions of the Maryland Stem Cell Research Fund

2021 Update

PREPARED BY SAGE POLICY GROUP, INC.

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A Sage



Executive Summary

The Maryland Stem Cell Research Act of 2006 established the Maryland Stem Cell Research Fund (MSCRF or the Fund) for the purpose of promoting state-funded, scientifically meritorious stem cell research through grants and loans to public and private entities in Maryland.

This report by Sage Policy Group, Inc. (Sage) analyzes the economic and fiscal impact the MSCRF has had in Maryland since it was first funded in 2007. In 2017, the Fund commissioned Sage to estimate economic and fiscal impacts being generated at that time. This is an update to that 2017 report.

From 2018-2021, the MSCRF awarded over \$30 million in research grants to more than 100 projects, bringing the total amount distributed by the Fund since its inception to approximately \$170 million for over 500 grants. Currently, the MSCRF has six funding programs, which collectively support stem cell research across all stages, ranging from basic science to clinical trials and commercialization.

Because the Fund covers the full spectrum of stem cell scientists — from young postdoctoral fellows in university settings to experienced researchers in large and established companies — it contributes to the ongoing growth of the life science cluster in Maryland. Life scientists in Maryland earned a mean salary of more than \$100,000 in 2020 according to the Bureau of Labor Statistics' Occupational Employment and Wage Statistics (OEWS) program, and these high-wage jobs produce significant economic and fiscal impacts statewide.

It should be noted that this study does not endeavor to quantify two key aspects of the MSCRF's impact. The first relates to the companies operating in Maryland that would not exist but for the MSCRF's support. In 2020, a year plagued by pandemic and recession, two of the MSCRF's portfolio companies (Vita Therapeutics, Inc. and Theradaptive, Inc.) secured places on the Maryland Future 20 list based on growth potential and innovation, among other positive attributes. Many companies in the Fund's portfolio, like Frederick-based RoosterBio and Gaithersburg-based MaxCyte, have large employee bases and a significant presence in Maryland. However, data that characterizes the scale and scope of privately owned enterprises are not readily available. Accordingly, the important impacts generated by these companies are beyond the scope of this analysis.

The second area of impact left unquantified are the economic/fiscal benefits generated by the creation and diffusion of medical technologies rendered possible through MSCRF funded research. In 2020 alone, there were MSCRF-funded projects to address 27 distinct disease indications, including COVID-19, diabetes, heart disease, cancer, Alzheimer's, and Parkinson's. New technologies — drug tests, diagnostic tools, better treatments, preventions, and cures — can have transformative medical benefits, improving longevity and quality of life, but their economic impact is difficult to measure and is, therefore, also beyond the scope of this report.

Despite these necessary omissions, the impacts that can be measured are significant. Since 2007, the MSCRF has supported nearly 1,700 jobs statewide. These jobs are associated with more than \$145 million in compensation. During its initial 14 years, the MSCRF has supported sales of goods and services exceeding \$380 million. This economic activity has generated almost \$14 million in revenues for the state and local governments during this time, demonstrating that the State of Maryland has simultaneously done well while doing good.

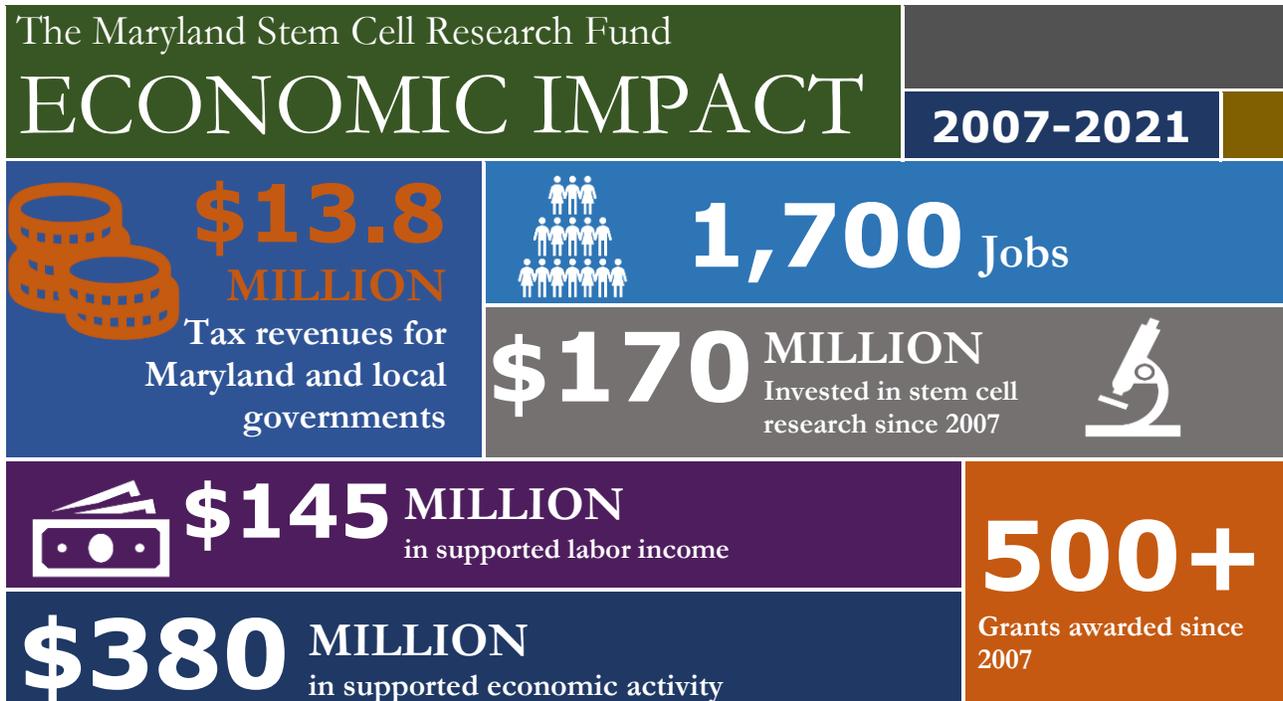


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The Economic Contributions of the Maryland Stem Cell Research Fund

BACKGROUND & NATURE OF THE ENDEAVOR

The Maryland Stem Cell Research Commission and the Maryland Technology Development Corporation (TEDCO) commissioned Sage policy Group, Inc. (Sage) to conduct an economic and fiscal impact analysis of the Maryland Stem Cell Research Fund (MSCRF) in 2017. That report examined the economic activity and tax revenues supported by the MSCRF through that time. The Maryland Stem Cell Research Act of 2006 established the Fund to promote state-funded stem cell research and cures through grants and loans to public and private entities located throughout Maryland.

At the time of the 2017 analysis, the MSCRF had awarded approximately \$140 million in grants to more than 400 research projects. During the ensuing four years, MSCRF awarded an additional \$30 million in grants to more than 100 additional projects. In 2020 alone, the Fund committed more than \$8 million to research focused on a wide range of medical conditions (diseases, injuries, and genetic defects), including COVID-19, diabetes, heart disease, stroke, cancer, Alzheimer's, and Parkinson's, among others.

These grants are distributed through the MSCRF's six distinct programs, which support all stages of the stem cell research process. These stages range from post-doctoral fellowships and grants for local university researchers, to grants for nascent and established companies, to technologies ready to be subject to clinical trials.

Because the array of funding opportunities offered by the MSCRF supports the entire stem-cell research industry, from young researchers operating in university settings to those in large established companies, it contributes to the ongoing formation and growth of Maryland's life sciences industry cluster. Life scientists in Maryland earned a mean salary of more than \$100,000 in 2020 according to the Bureau of Labor Statistics Occupational Employment and Wage Statistics (OEWS) program, and these high wage jobs have significant economic and fiscal impacts for Maryland and its local governments.

It must be stressed that the MSCRF creates impacts that extend far beyond economic and fiscal, as the Fund's goal is to improve human experience through the development of new medical strategies that utilize human stem cells for the prevention, diagnosis, and treatment of human diseases and conditions. This report does not seek to assign dollar values to impacts related to the development of new cures and treatments. The reason for this is simple; it's effectively impossible to determine how many lives have been saved and extended via MSCRF-supported research. Economic research estimates the value of a statistical life at \$7 million, with a 90 percent confidence interval of \$2.4 million



to \$11.2 million.¹ Therefore, saving a few hundred lives would translate into billions of dollars in social contribution.

The instance of MSCRF's clinical trial funding for treatment of acute respiratory distress syndrome (ARDS) is instructive. ARDS is a dangerous, potentially fatal respiratory condition and a prevalent complication associated with COVID-19 and other conditions. ARDS survivors face a high incidence of long-lasting impairments like cognitive dysfunction and physical impairment. Nearly half of previously employed adults who survive ARDS were unemployed one year after being discharged from a hospital.² Average lost earnings for a survivor of ARDS are estimated to be \$27,000 during the 12-month period following discharge, and among jobless survivors there was a 14-percentage point decline in private health insurance coverage.³ Accordingly, identifying an effective treatment for ARDS that reduces the incidence of hospitalization and economic dislocation would produce substantial socioeconomic benefits.

Another compelling example is embodied in the work of [Seraxis](#), a Germantown, Maryland company. The company received a 12-month grant from the MSCRF to bring a therapy for the treatment of insulin-dependent diabetes, which affects about 1 in 10 Americans, to the clinical stage. A study by the American Diabetes Association estimates that diabetes cost the U.S. \$237 billion in direct medical costs and \$90 billion in reduced productivity in 2017 alone.⁴ Assuming Maryland incurs a proportional share of those costs, diabetes costs the state's economy approximately \$6.2 billion per annum. If Seraxis' treatment improves outcomes for those with insulin-dependent diabetes, Maryland would experience billions of dollars in economic benefit. In short, this report only endeavors to measure a small fraction of MSCRF's contributions, which may be orders of magnitude greater than what this analysis reports.

There are also several examples of critical MSCRF-funded research in university settings. For example, [Dr. Valina Dawson](#) at the Johns Hopkins University and Dr. Ricardo Feldman at University of Maryland, Baltimore, who received funding from the MSCRF, study new therapeutic targets for the prevention and treatment of Parkinson's disease, which affects approximately one million Americans and an estimated 18,000 Marylanders. The Parkinson's Foundation reports that the direct and indirect effect of Parkinson's, including medical costs and lost income, is \$52 billion per year

¹ H. Spencer Banzhaf. The value of a statistical life: a meta-analysis of meta-analyses. National Bureau of Economic Research, working paper 29185 (August 2021). <https://www.nber.org/papers/w29185#fromrss>

² Ruhl, A.P., Huang, M., Colantuoni, E. *et al.* Healthcare utilization and costs in ARDS survivors: a 1-year longitudinal national US multicenter study. *Intensive Care Med* 43, 980–991 (2017). <https://doi.org/10.1007/s00134-017-4827-8>

³ Kamdar, B. B., Huang, M., Dinglas, V. D., Colantuoni, E., von Wachter, T. M., Hopkins, R. O., Needham, D. M., & National Heart, Lung, and Blood Institute Acute Respiratory Distress Syndrome Network (2017). Joblessness and Lost Earnings after Acute Respiratory Distress Syndrome in a 1-Year National Multicenter Study. *American journal of respiratory and critical care medicine*, 196(8), 1012–1020. <https://doi.org/10.1164/rccm.201611-2327OC>

⁴ Economic Costs of Diabetes in the U.S. in 2017, American Diabetes Association, *Diabetes Care* Mar 2018, dci180007; DOI: 10.2337/dci18-0007



nationwide.⁵ If Maryland incurs a proportional share of those costs, Parkinson’s disease costs Maryland’s economy approximately \$950 million each year.

There are several other noteworthy examples of the potentially far-reaching impacts of MSCRF-funded research. LifeSprout, LLC, a company that works to address soft tissue loss from cancer surgery, trauma, and aging, received commercialization funding from the MSCRF. NeoProgen, Inc., which also received a commercialization grant, is working to address heart tissue regeneration as a treatment for heart disease, the number one cause of death in America. In FY2021, the MSCRF funded projects to advance research addressing eye diseases, cardiovascular indications, orthopedic indications, diabetes, stroke, multiple sclerosis, Parkinson’s disease, and GI/liver conditions as well as ARDS.

In short, the economic and fiscal impacts estimated within this report correspond only to the jobs and labor income supported by MSCRF’s grants while funding is active. Ultimately, these impacts are small relative to the beneficial effects of therapies and treatments rendered possible by the Fund. This report uses IMPLAN, an industry standard input-output estimation platform, along with proprietary fiscal impact estimation techniques, to assess the economic and fiscal impacts supported by MSCRF since inception. These impacts are measured along several dimensions: job creation, labor income, economic activity/business sales, and State- and local-level fiscal impacts.

Methodology

To quantify economic impacts, Sage used IMPLAN economic modeling software and its embodied multipliers to generate estimates of employment, labor income, and output. Calculated employment impacts include both full- and part-time workers. Results are presented in the form of jobs, with one job being the equivalent of one year of employment. Labor income encompasses all forms of employment income including employee compensation (wages and benefits) and proprietor income (earnings of business owners). Output represents the sum of business sales (good and services) that occur as a result of the MSCRF’s efforts and the activities of the companies and organizations they fund.

To conduct the fiscal portion of the analysis, Sage accessed publicly available information, including government-published tax rates and budgetary information. Some fiscal impacts were generated implicitly within IMPLAN, which incorporates community-specific tax rates.

Economic impacts are presented in the form of **direct impacts** as well as in the form of secondary impacts. Direct impacts are generated by the activities of the MSCRF and the entities they fund. Secondary impacts can collectively be considered the multiplier effect, and can be segmented into two

⁵ Yang, G., Schmiel, L., Zhou, M., Cintina, I., Spencer, D., & Hogan, P. (2019). Economic Burden and Future Impact of Parkinson’s Disease



types of impacts – **indirect** and **induced**. Indirect benefits are generated through the expanded volume of business-to-business transactions attributable to a larger local economy. For instance, increased spending by medical supply companies directly implicated in stem cell research activities may in turn lead to increased spending at office supply companies, local hotels, and local restaurants. Induced benefits are triggered when workers primarily or secondarily supported through enhanced economic activity spend their earnings in the local economy.

To the extent that expenditures by businesses or consumers take place beyond Maryland’s boundaries, they are not considered in Sage’s impact estimates. Importantly, the impacts in this report are presented in 2021 dollars. The CPI Inflation Calculator developed by the United States Bureau of Labor Statistics was used to convert all impact estimates from prior years into current-year dollars. Appendix A of this report contains a glossary of economic impact-related terms.

A Statistical Profile of the MSCRF

MSCRF FUNDING PROGRAMS

Since its inception in 2007, MSCRF has awarded approximately \$170 million for over 500 grants. Among the major beneficiaries are researchers at Johns Hopkins and the University of Maryland system, which house many of Maryland’s stem-cell research specialists.⁶ MSCRF funding peaked in 2008 at \$22.7 million and has since radically declined due to State budgetary dynamics.

These funds have been awarded through the MSCRF’s various funding programs, which are routinely redesigned to address industry gaps and currently support the complete spectrum of stem-cell based research.⁷ The current funding programs are described below. Beyond funding, the MSCRF has nurtured a stem cell industry within Maryland by building a strong community that attracts new talent and companies to the region. The MSCRF serves as a resource for its awardees and offers support systems for researchers, many of whom have never been through the commercialization process.

DISCOVERY

The Discovery Program is designed to help advance cutting-edge stem cell research and technologies and can be applied for by faculty at Maryland-based universities and research institutes. The program encourages groundbreaking, high risk/high reward ideas presently associated with limited feasibility data. The program supplies grants of up to \$345,000 over a 24-month period. Since 2017, the MSCRF has funded 56 Discovery grants. In 2021, the MSCRF awarded seven Discovery grants.

⁶ Includes University of Maryland, Baltimore, University of Maryland, Baltimore County, and University of Maryland, College Park.

⁷ Federal labs are not eligible to receive the MSCRF grants.



Recipients include researchers at the University of Maryland, Baltimore evaluating therapeutic targets pertinent to autism spectrum disorders, a group of developmental disabilities that can cause significant social, communication, and behavioral challenges. Funding has also been made available for new therapeutic targets designed to prevent and treat Parkinson’s disease. Another recipient is a researcher at the University of Maryland, College Park who has been working toward cardiac tissue engineering and regeneration.

LAUNCH

New or new-to-the-field faculty at Maryland-based universities and research institutes, who have never received an MSCRF grant, are eligible for Launch grants, which provide up to \$345,000 to awardees over a 24-month period. Though this program was implemented first in 2020, the MSCRF has already issued nine Launch grants, five of which were awarded in 2021. The 2021 awardees include those researching therapies for Huntington’s disease, rotator cuff repair technologies, and cardiomyopathy.

VALIDATION

Researchers at Maryland-based universities or research labs who have intellectual property associated with stem cell-based technologies that require additional validation before they can be commercialized are eligible for Validation grants, which provide up to \$230,000 to awardees over an 18-month period. Since 2017, the MSCRF has supplied 11 Validation grants. Recent awardees at Johns Hopkins University are studying potential treatments for Alzheimer’s, eye disorders, bone regeneration as well as other disease indications, and tissue engineering approaches to advance treatments.

COMMERCIALIZATION

Commercialization grants, which provide up to \$300,000 in funding over one year, are for Maryland-based companies developing new human stem cell-based products. These grants are critical to the MSCRF’s mission and help Maryland develop, grow, and retain companies focused on regenerative medicine. Since 2017, the MSCRF has issued 18 Commercialization grants. In 2021, the MSCRF issued Commercialization grants to Domicell, Inc., which is developing a treatment for ARDS, and RenOVate Biosciences, Inc., a Maryland-based biotechnology company developing innovative solutions to address the global organ shortage for transplantation.

CLINICAL

Clinical grants support clinical trials for stem cell-based medical therapies in Maryland. Since 2017, the MSCRF has issued seven Clinical grants, each of which matches non-state money up to \$750,000 over a two-year period. In 2021, the MSCRF awarded two Clinical grants.

POST-DOCTORAL FELLOWSHIP

Post-doctoral fellows who have completed their doctoral degree within the past three years and who are conducting human stem cell research in Maryland are eligible for the MSCRF Post-Doctoral



Fellowship, which provides \$130,000 in funding over a two-year period. Since 2017, the MSCRF has funded 38 post-doctoral fellows.



Economic & Fiscal Impacts

ECONOMIC IMPACTS

Since its 2007 inception, the MSCRF has supported approximately 1,700 jobs in Maryland.⁸ That includes approximately 600 direct jobs, those that exist because of active MSCRF funding. Other jobs have been supported through secondary/multiplier effects, which include positions supported by attributable business-to-business spending (indirect effects) as well as stepped up consumer spending supported by direct wages (induced effects).

In total, jobs supported by the MSCRF are associated with more than \$145 million in labor income, which includes wages and benefits. According to data from the Bureau of Labor Statistics, an estimated 71.3 percent of total labor income, or \$104 million, takes the form of wages.

Exhibit 1: Economic Impacts Supported by MSCRF, 2007-2021⁹

Economic Impacts	Jobs	Labor Income (millions \$2021)	Business Sales (millions \$2021)
Direct effects	603	\$76.7	\$195.0
Indirect effects	534	\$38.1	\$95.5
Induced effects	562	\$30.5	\$90.6
Total*	1,698	\$145.3	\$381.2

Source: Sage, IMPLAN, MSCRF

*Note: totals may not add due to rounding

MSCRF funding has supported an estimated \$381 million in economic activity (the sum of goods and services sold that otherwise would not have occurred) from 2007-2021. While a majority of economic activity occurred in the scientific R&D services segment, real estate firms, consultants, marketers, restaurants, and hospitals all experienced at least \$5 million in augmented economic activity because of MSCRF operations and funding. Exhibit 2 supplies pertinent summary detail.

Note that these estimates do not include jobs that exist because a company received MSCRF funding in the past and therefore operates at a larger scale than it otherwise would. The population of such companies is large, but it is difficult to ascertain what fraction of enterprise employment and wages are attributable to previously received MSCRF funding. In 2020, two of the MSCRF’s portfolio companies (Vita Therapeutics, Inc., and Theradaptive, Inc.) made the Department of Commerce’s Maryland Future 20 list based on their innovation, growth potential, and “wow” factor.

⁸ This defines a job as one position that lasts for one year. For instance, ten positions that last for two years would equal twenty jobs supported. See Appendix A at the end of this report for more information on how to interpret economic impact estimates.

⁹ The impacts in this report are presented in 2021 dollars. The CPI Inflation Calculator developed by the United States Bureau of Labor Statistics was used to convert all impact estimates from prior years into current-year dollars.



Exhibit 2: Total Annual Economic Impacts Supported by MSCRF, 2007-2021¹⁰

Year	Jobs	Labor Income (millions \$2021)	Business sales (millions \$2021)	Funds Awarded (millions \$2021)
2007	150	\$13.0	\$34.3	\$17.5
2008	245	\$21.2	\$56.0	\$28.1
2009	206	\$17.9	\$47.1	\$23.4
2010	125	\$10.8	\$28.5	\$14.1
2011	113	\$9.8	\$25.7	\$13.0
2012	117	\$10.1	\$26.6	\$13.4
2013	107	\$9.3	\$24.4	\$12.2
2014	92	\$8.0	\$21.0	\$10.5
2015	88	\$7.6	\$20.1	\$10.2
2016	81	\$7.0	\$18.5	\$9.3
2017	81	\$7.0	\$18.5	\$9.1
2018	78	\$6.3	\$16.1	\$8.5
2019	68	\$5.5	\$13.9	\$7.5
2020	79	\$6.4	\$16.3	\$8.5
2021	68	\$5.5	\$14.0	\$7.2
Total*	1,698	\$145.3	\$381.2	\$192.5

Source: Sage, IMPLAN, MSCRF

*Note: totals may not add due to rounding

Several companies in the MSCRF portfolio, like Frederick-based [RoosterBio](#), have used Commercialization grants to hire employees. Any ongoing employment relating to that prior hiring is not measured in the contemporary impacts described in this report since only impacts that relate to ongoing funding are measured for any given year. Exhibit 2 reflects economic impact estimates for each year from 2007-2021. As noted, many of the jobs that existed in prior years continue to be sustained but are only reflected during years in which grant funding was operative.

FISCAL IMPACTS

MSCRF-supported economic activity augments tax revenues for both the State of Maryland and local governments. From 2007-2021, MSCRF grants generated an estimated \$4.2 million in State income tax revenues and \$2.5 million in local income tax revenues for Maryland’s 24 major jurisdictions.¹¹ Augmented sales tax revenues total \$3.6 million, while property taxes have been bolstered by an

¹⁰ The impacts in this report are presented in 2021 dollars. The CPI Inflation Calculator developed by the United States Bureau of Labor Statistics was used to convert all impact estimates from prior years into current-year dollars.

¹¹ Income tax estimates were generated using effective tax rates computed with data made available by the Office of the Maryland Comptroller. This study uses an effective income tax rate of 4.0 percent at the state level and 2.4 percent at the local level. These effective tax rates were applied to labor income estimates presented in the economic impact section of this report after those estimates were scaled by 71.3 percent, the wage-share of total compensation based on parameters sourced from the Bureau of Labor Statistics.



estimated \$3.5 million. In total, the MSCRF’s funding has supported an estimated \$13.8 million in State and local tax revenues since 2007. Exhibit 3 supplies relevant summary detail.

Exhibit 3: Annual Fiscal Impacts Supported by MSCRF, 2007-2021 (thousands \$2021)¹²

	State Income Taxes	Local Income Taxes	Sales Taxes	Property Taxes	Total	Funds Awarded (millions \$2021)
2007	\$375.0	\$223.6	\$323.4	\$309.2	\$1,231.2	\$17.5
2008	\$612.0	\$365.0	\$527.8	\$504.7	\$2,009.4	\$28.1
2009	\$515.4	\$307.4	\$444.4	\$425.0	\$1,692.2	\$23.4
2010	\$311.2	\$185.6	\$268.3	\$256.6	\$1,021.7	\$14.1
2011	\$281.5	\$167.9	\$242.8	\$232.1	\$924.3	\$13.0
2012	\$291.0	\$173.6	\$251.0	\$240.0	\$955.6	\$13.4
2013	\$266.9	\$159.2	\$230.1	\$220.1	\$876.2	\$12.2
2014	\$229.9	\$137.1	\$198.2	\$189.6	\$754.8	\$10.5
2015	\$220.2	\$131.3	\$189.9	\$181.6	\$723.1	\$10.2
2016	\$202.8	\$121.0	\$174.9	\$167.3	\$666.0	\$9.3
2017	\$202.8	\$121.0	\$174.9	\$167.3	\$666.0	\$9.1
2018	\$181.4	\$108.2	\$157.9	\$151.5	\$598.9	\$8.5
2019	\$157.2	\$93.8	\$136.8	\$131.2	\$519.0	\$7.5
2020	\$183.9	\$109.7	\$160.0	\$153.5	\$607.1	\$8.5
2021	\$157.3	\$93.8	\$136.9	\$131.3	\$519.3	\$7.2
Total *	\$4,188.5	\$2,498.0	\$3,617.4	\$3,461.0	\$13,764.8	\$192.5

Source: Sage, IMPLAN, MSCRF

*Note: totals may not add due to rounding

As with presented economic impacts, fiscal impact estimates capture only the tip of the iceberg. Many companies that received funding and support services from the MSCRF raised considerable amounts of follow-on funding, like Seraxis, which recently raised \$40 million in Series C funding, and now maintains massive operations in Maryland. MaxCyte Inc., for instance, a Gaithersburg-headquartered publicly traded company, employs 65 people and boasts a market capitalization in excess of \$1 billion. The company supports significant property and income tax revenues at both State and local levels, but those impacts are not included in reported estimates, as it is virtually impossible to estimate what fraction of a company’s success is attributable to MSCRF grant funding awarded in 2015. Importantly, the same is true for subsequent grant funding obtained for research that occurs in a university setting. Impacts generated by eventual commercialization of MSCRF-funded research that initially occurs at universities are not included in this report unless the resulting company was also supported by MSCRF.

¹² The impacts in this report are presented in 2021 dollars. The CPI Inflation Calculator developed by the United States Bureau of Labor Statistics was used to convert all impact estimates from prior years into current-year dollars.



Conclusion

To build upon the scientific advances that have already been achieved in 15 years, the state of Maryland must continue to adequately support the MSCRF going forward. If the State fails to do so, it will halt commercialization and forestall clinical trials that could lead to preventions, better treatments, and cures for scores of devastating and fatal human conditions.

In Maryland, state support for stem cell research has steadily declined. The MSCRF was awarded \$15 million in its inaugural year and \$23 million in its sophomore year. But, unfortunately, in subsequent years, state support has continued to decrease. The current level of state funding — \$8.2 million — is almost one-third of what it was at its height. Without adequate State funding, stem cell researchers in Maryland will be forced to move to areas that support their scientific endeavors, like California, where voters approved a referendum in 2020 that provides \$5.5 billion in general obligation bond funding to support stem cell research in that state.

Despite the waning dollar commitment, the MSCRF's economic impact on the state and its communities has remained strong. Needless to say, increased support would be even more impactful.

Through its six discrete grant programs, the MSCRF has supported nearly 1,700 jobs in Maryland associated with more than \$145 million in labor income and \$381 million in economic activity since 2007. That economic activity has helped to support nearly \$13.8 million in augmented tax revenues for the State of Maryland and area local governments.

As indicated throughout this report, if anything, these economic and fiscal impact estimates do a disservice to the MSCRF by vastly understating its contributions. Absent from impact estimates are benefits to population health produced by MSCRF-supported researchers at universities and private enterprises. Moreover, these estimates exclude the impacts of companies that have grown since receiving their MSCRF grants.

Increasingly, the MSCRF supports research that is ready for commercialization. At this point in the pipeline, the economic impact the MSCRF will have on the state is likely to accelerate exponentially. But this can only happen if Maryland reverses its pattern of diminished support and commits the resources required to more substantially fund the MSCRF.



Appendix A: How to Interpret Economic Impact Estimates

To quantify economic impacts, Sage used IMPLAN economic modeling software¹³ and its embodied multipliers to generate estimates of employment, labor income, and output. Below is an abbreviated glossary of terms that may prove helpful in interpreting analytical findings. Importantly, the impacts in this report are presented in 2021 dollars. The CPI Inflation Calculator developed by the United States Bureau of Labor Statistics was used to convert all impact estimates from prior years into current-year dollars.

KEY DEFINITIONS

EMPLOYMENT

As defined by IMPLAN, a job that lasts twelve months equals one job, two jobs that last six months equal one job, three jobs that last four months equal one job, etc. Based on this, job-years represents a useful term. For instance, an endeavor that supports 200 jobs for a six-month period would be considered to support 100 jobs measured in job-years.

For construction or capital investment events (one-time-only), for which economic and fiscal impacts occur only once, the stated number of jobs is the total number of job-years that will be supported across the duration of the capital project. For operational (ongoing) impacts, job figures are annual and will occur every year so long as operations persist.

Note that IMPLAN jobs aren't quite the same thing as full-time equivalents (FTEs). Each of IMPLAN's 536 unique industries has a different conversion rate between jobs and FTEs, although for almost every industry one job is equal to less than one FTE.

OUTPUT (BUSINESS ACTIVITY, ECONOMIC ACTIVITY)

Output equals the value of industry production or service provision. It might be easier to conceptualize this as total business sales or economic activity. For retail industries, it is the gross margin (not gross sales). For manufacturing, output is the quantity of total sales plus/minus the change in inventories. For the service sector, output is directly equal to sales. This is summarized by the following equation:

$$\text{Output} = (\text{Manufacturing sales} +/\text{- change in inventories}) + (\text{service sector sales}) +$$

¹³ IMPLAN is the most commonly used econometric software for analyses of its type and has emerged as the industry standard for this type of quantification. The model is comprised of economic multipliers that reflect the statistical relationship between various local industries and the likelihood that certain goods and services will be sourced locally as opposed to outside the community. These multipliers are updated each year and Sage purchases model licenses on an annual basis.



(gross margin for wholesale and retail trade)

LABOR INCOME

Labor income is comprised of wages, benefits, and proprietor income (money accruing to owners of businesses).

Labor income = all forms of employee compensation (wages/benefits) + proprietor income

DIRECT EFFECTS

Direct effects are impacts tightly aligned with the endeavor under consideration. In this instance, direct effects are produced by the MSCRF's grants and the activity they fund.

INDIRECT EFFECTS

Indirect effects stem from business-to-business spending activity within the study area that occurs as a result of the direct effects. These can also be considered broader supply chain effects.

INDUCED EFFECTS

Induced effects relate to household spending that occurs due to an expanded economy, whether in the Washington-Baltimore Corridor or the Eastern Shore.



About Sage Policy Group

Sage Policy Group is an economic and policy consulting firm headquartered in Baltimore, MD. Dr. Anirban Basu, Sage's chairman and CEO, founded the firm in 2004. Over a period spanning less than two decades, Sage has managed to create a client base that encompasses more than forty states and seven countries and includes Fortune 500 companies, NFL teams, aquariums and zoos, state and local governments, real estate developers, insurance companies, banks, major medical systems, trade organizations, and law firms among others.

The company is especially well known for its analytical capabilities in economic impact estimation, school enrollment forecasting, economic development, economic forecasting, fiscal impact analyses, legislative analyses, litigation support, and industry outlooks, and has significant experience in subject areas of construction, healthcare, energy, real estate, manufacturing, thoroughbred horse racing, lotteries, agriculture, tourism, entrepreneurship, government contracting, secondary and post-secondary education, and the economics of retirement. The firm is also known for its superior communications and messaging skills.

In addition to leading Sage, Dr. Basu has emerged as one of the nation's most recognizable economists, in part because of his consulting work on behalf of clients including state and local governments, prominent developers, bankers, brokerage houses, elected officials, energy suppliers, and law firms, among others. He serves as the chief economist to Associated Builders and Contractors and as the chief economic adviser to the Construction Financial Management Association. He chaired the Maryland Economic Development Commission from 2014 to 2021 and currently chairs the Baltimore County Economic Advisory Committee. He has been interviewed by CNBC, CNN, Fox Business, and many other networks.

Dr. Basu's lectures in economics are delivered to audiences across the U.S. and abroad. In recent years, he has focused upon health economics, the economics of education, and economic development. He has lectured at Johns Hopkins University in micro-, macro-, urban, international economics, and most recently, global strategy.