The Economic Contributions of the Maryland Stem Cell Research Fund

2024 Update

MSCRF
Maryland Stem Cell Research Fund

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Executive Summary

The Maryland Stem Cell Research Act of 2006 established the Maryland Stem Cell Research Fund (MSCRF) 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 and is an update to previous Sage studies conducted in 2017 and 2021.

From 2007 to 2024, the MSCRF awarded over $208 million in research grants to more than 640 research projects. These grants, administered through the Fund's seven programs, support stem cell research across all stages, ranging from basic science to clinical trials, manufacturing, and commercialization.

Because the Fund covers the full spectrum of stem cell researchers—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 earn a mean salary of approximately $110,000, 49 percent higher than the average across all statewide occupations.

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. 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. New technologies—drug tests, diagnostic tools, better treatments, preventions, and cures—can have transformative medical benefits, improving longevity and quality of life. Unfortunately, it is virtually impossible to determine the number of lives saved and/or extended by those technologies in Maryland.

Despite these necessary omissions, the impacts of the MSCRF that can be measured are significant. Since 2007, the MSCRF has supported approximately 2,000 statewide jobs, and those jobs are associated with more than $200 million in compensation and nearly $525 million in economic activity.

Exhibit ES1: Cumulative Economic Impacts Supported by MSCRF, 2007-2024

Economic Impacts	Jobs	Labor Income (millions $2024)	Business Sales (millions $2024)
Direct effects	755	$107.5	$270.9
Indirect effects	637	$52.0	$131.8
Induced effects	653	$41.0	$122.1
Total*	**2,044**	**$200.5**	**$524.7**

Source: Sage, IMPLAN, MSCRF *Note: totals may not add due to rounding

Those economic impacts have generated more than $19 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 by funding the MSCRF.

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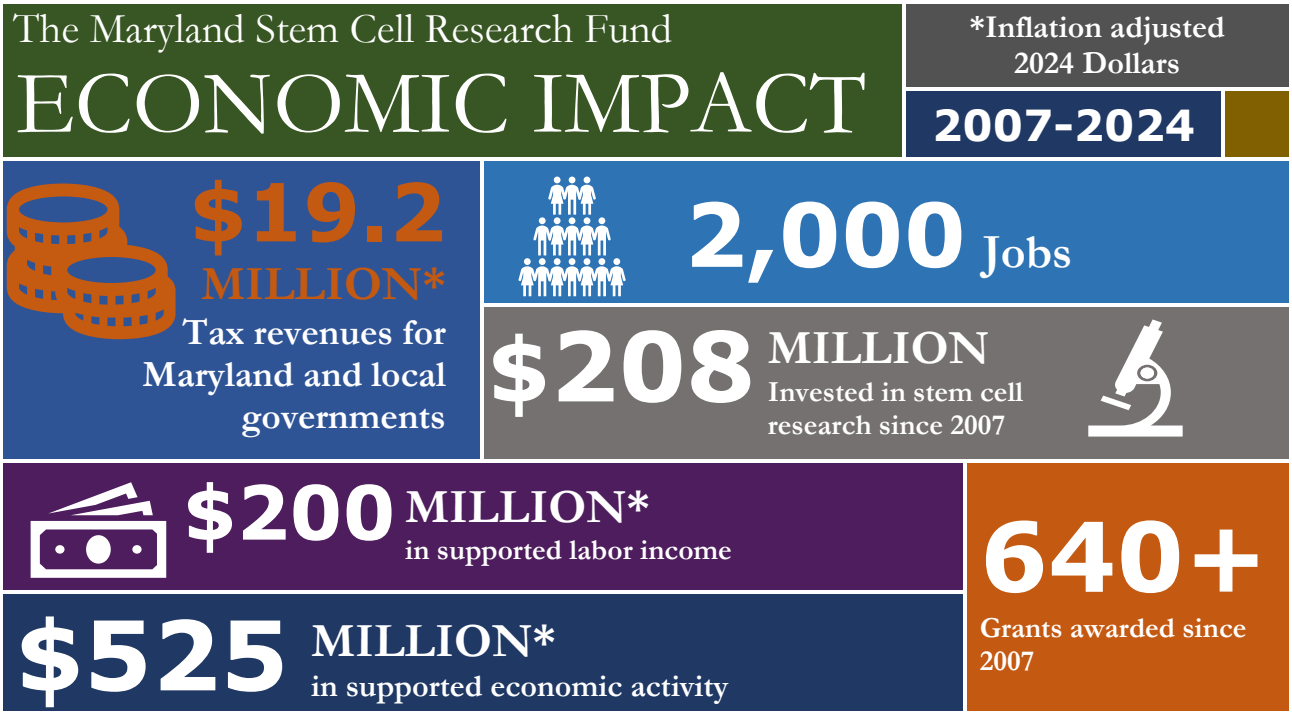


The Economic Contributions of the Maryland Stem Cell Research Fund

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 and 2021. Those reports examined the annual and cumulative economic activity and tax revenues supported by the MSCRF.

Since its establishment in 2006, the MSCRF has awarded approximately $208 million in grants to more than 640 research projects focused on a wide range of medical conditions, including diabetes, heart disease, stroke, cancer, Alzheimer's, and Parkinson's, among others. These grants are distributed through the MSCRF's seven distinct programs, which support all stages of the stem cell research process from post-doctoral fellowships and grants for local university researchers, to grants for nascent and established companies, to technologies ready to be tested in clinical trials and for scaling up manufacturing.

There are potentially massive economic benefits associated with the treatments and cures that could arise from this research. If the technologies made possible by MSCRF grants save just 100 Marylanders, it would generate more than $1 billion in economic benefit based on the most recent estimates of the value of a statistical life.[1] However, this analysis does not endeavor to estimate the economic and fiscal benefits related to those medical advances because it is effectively impossible to determine how many lives have been saved and extended via MSCRF-supported research.

This analysis also does not endeavor to estimate the long-term contributions of the MSCRF to the state's status as a hub for life sciences research. Maryland has a higher concentration of life scientists than any other state, and those scientists earn a mean salary of approximately $110,000, 49 percent higher than the average across all occupations.

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. For instance, RoosterBio, Inc., a leading supplier of human mesenchymal stem cell bioprocess systems located in Frederick, Maryland, received $1.9 million in MSCRF grants from 2017 to 2023. As a result, the company has attracted over $25 million in venture capital, expanded its facility from 500 to 19,000 square feet, and generated more than $60 million in revenues. Despite this substantial economic activity, this analysis only estimates the economic activity supported by that $1.9 million in MSCRF grant funding.

[1] HHS Standard Values for Regulatory Analysis, 2024. Assistant Secretary for Planning and Evaluation, Department of Health and Human Services Office of Science and Data Policy. https://aspe.hhs.gov/sites/default/files/documents/cd2a1348ea0777b1aa918089e4965b8c/standard-ria-values.pdf

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 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.

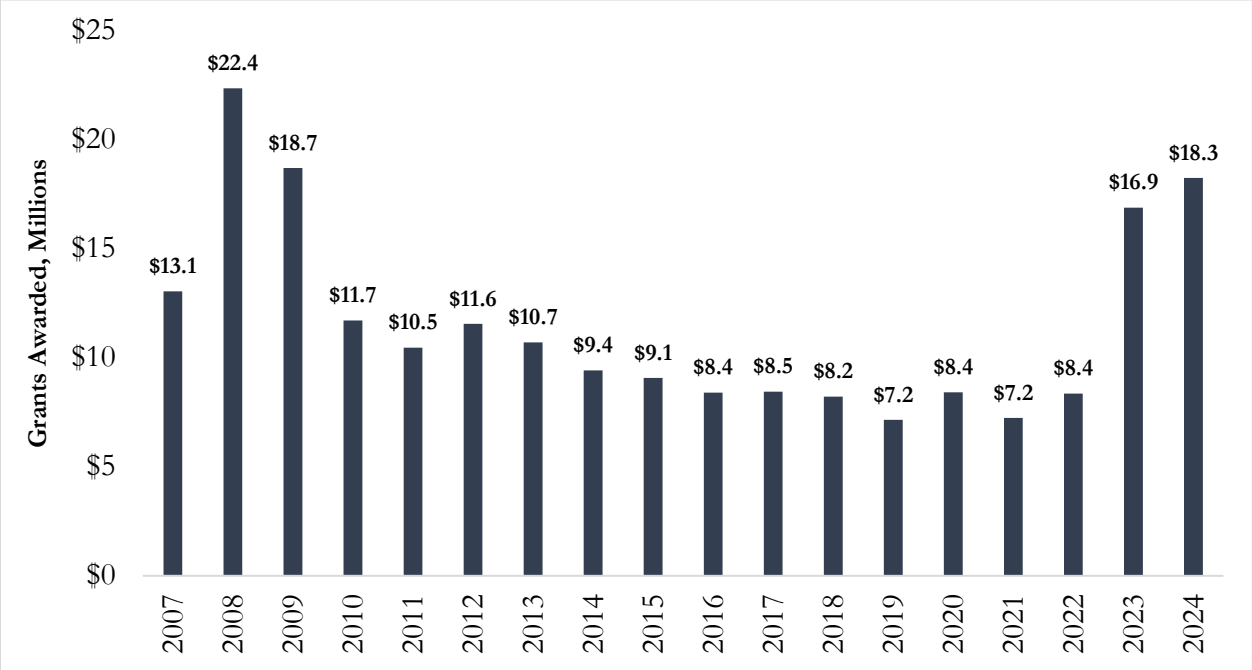
To the extent that expenditures by businesses or consumers take place beyond Maryland's boundaries, they are not considered in Sage's impact estimates. Importantly, the impacts in this report are presented in 2024 dollars. Appendix A of this report contains a glossary of economic impact-related terms.

A Statistical Profile of the MSCRF

MSCRF FUNDING PROGRAMS

Since its inception in 2007, MSCRF has awarded approximately $208 million for over 640 grants.[2] Among the major academic beneficiaries are researchers at Johns Hopkins and the University of Maryland system, which house many of Maryland's stem-cell research specialists.[3] MSCRF funding peaked in 2008 at $22.4 million. Despite significant declines due to budgetary reasons during the 2010s, funding has rebounded in recent years. The $18.3 million in grants awarded in 2024 is the third most in any year since the Fund's inception in 2006.

Exhibit 1: MSCRF Grants Awarded by Year*



Source: Maryland Stem Cell Research Fund *Note: Values are not adjusted for inflation

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.[4] The current funding programs are described in Appendix B of this report. 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.

[2] This equates to $267.9 million in inflation adjusted 2024 dollars.
[3] Includes University of Maryland, Baltimore, University of Maryland, Baltimore County, and University of Maryland, College Park.
[4] Federal labs are not directly eligible to receive MSCRF grants but can receive funding but can receive funding if the principal investigator from a Maryland-based university uses them as a collaborator.

Economic & Fiscal Impacts

ECONOMIC IMPACTS

Since its 2007 inception, the MSCRF has supported more than 2,000 jobs statewide.[5] That includes more than 700 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 bolstered labor income (induced effects).

In total, the jobs supported by the MSCRF are associated with more than $200 million in labor income, which includes wages and benefits.

Exhibit 2: Economic Impacts Supported by MSCRF, 2007-2024

Economic Impacts	Jobs	Labor Income (millions $2024)	Economic Activity (millions $2024)
Direct effects	755	$107.5	$270.9
Indirect effects	637	$52.0	$131.8
Induced effects	653	$41.0	$122.1
Total*	**2,044**	**$200.5**	**$524.7**

Source: Sage, IMPLAN, MSCRF *Note: totals may not add due to rounding

MSCRF funding has supported an estimated $525 million in economic activity (the sum of goods and services sold that otherwise would not have occurred) from 2007 through 2024. While a majority of economic activity occurred in the scientific R&D services segment, real estate firms, consultants, marketers, restaurants, and hospitals all experienced significantly augmented economic activity because of MSCRF operations and funding.

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 current enterprise employment and wages are attributable to previously received MSCRF funding.

Several companies in the MSCRF portfolio, like Frederick-based Theradaptive, have used MSCRF grants to hire employees for research, clinical operations and for manufacturing. 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 3 reflects economic impact estimates for each year from 2007 through 2024. As noted, many of the

[5] 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.

jobs that existed in prior years continue to be sustained but are only reflected during years in which grant funding was operative.

Exhibit 3: Total Annual Economic Impacts Supported by MSCRF, 2007-2024

Year	Jobs	Labor Income (millions $2024)	Economic Activity (millions $2024)
2007	150	$15.1	$39.8
2008	245	$24.6	$65.0
2009	206	$20.8	$54.6
2010	125	$12.5	$33.1
2011	113	$11.4	$29.8
2012	117	$11.7	$30.9
2013	107	$10.8	$28.3
2014	92	$9.3	$24.4
2015	88	$8.8	$23.3
2016	81	$8.1	$21.5
2017	81	$8.1	$21.5
2018	78	$7.3	$18.7
2019	68	$6.4	$16.1
2020	79	$7.4	$18.9
2021	68	$6.4	$16.2
2022	70	$6.4	$16.6
2023	135	$12.4	$32.2
2024	142	$13.0	$33.8
Total*	**2,044**	**$200.5**	**$524.7**

Source: Sage, IMPLAN, MSCRF *Note: totals may not add due to rounding

FISCAL IMPACTS

MSCRF-supported economic activity augments tax revenues for both the State of Maryland and local governments. From 2007 to 2024, MSCRF grants generated an estimated $5.8 million in State income tax revenues and $3.5 million in local income tax revenues for Maryland's 24 major jurisdictions.[6] Augmented sales tax revenues total $5.1 million, while property taxes have been bolstered by an estimated $4.8 million. In total, the MSCRF's grant funding has supported an estimated $19.2 million in State and local tax revenues since 2007. Exhibit 3 supplies relevant summary detail.

[6] 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.

Exhibit 4: Annual Fiscal Impacts Supported by MSCRF, 2007-2024 (thousands $2024)[7]

	State Income Taxes	Local Income Taxes	Sales Taxes	Property Taxes	Total
2007	$435.1	$259.5	$375.2	$358.8	**$1,428.5**
2008	$710.0	$423.5	$612.3	$585.5	**$2,331.3**
2009	$597.9	$356.6	$515.6	$493.1	**$1,963.3**
2010	$361.0	$215.3	$311.3	$297.7	**$1,185.4**
2011	$326.6	$194.8	$281.7	$269.3	**$1,072.4**
2012	$337.6	$201.4	$291.2	$278.4	**$1,108.6**
2013	$309.6	$184.6	$267.0	$255.3	**$1,016.6**
2014	$266.7	$159.1	$230.0	$219.9	**$875.7**
2015	$255.5	$152.4	$220.3	$210.7	**$838.9**
2016	$235.3	$140.4	$202.9	$194.1	**$772.7**
2017	$235.3	$140.4	$202.9	$194.1	**$772.7**
2018	$210.5	$125.5	$183.2	$175.7	**$694.9**
2019	$182.4	$108.8	$158.7	$152.3	**$602.2**
2020	$213.3	$127.2	$185.7	$178.1	**$704.4**
2021	$182.5	$108.8	$158.8	$152.4	**$602.5**
2022	$193.1	$116.3	$185.7	$161.0	**$656.1**
2023	$374.1	$225.4	$359.9	$312.0	**$1,271.4**
2024	$392.8	$236.6	$377.8	$327.6	**$1,334.8**
Total*	**$5,819.4**	**$3,476.5**	**$5,120.3**	**$4,816.0**	**$19,232.2**

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 raised over $50 million)from funding sources outside of Maryland and now maintains massive operations in Maryland. MaxCyte Inc., for instance, a Gaithersburg-headquartered publicly traded company, employs 114 people and has a market cap of $150M. . 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.

[7] The impacts in this report are presented in 2024 dollars. The Consumer Price Index from 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 nearly two decades of operations, the State of Maryland must continue to adequately support the MSCRF going forward. If the State fails to do so, it will slow commercialization and forestall clinical trials that could lead to better treatments and cures for scores of devastating and fatal human conditions. Without adequate State funding, stem cell researchers in Maryland will be forced to move to areas that support their scientific endeavors, like California, where in 2020 voters approved $5.5 billion in general obligation bond funding for the California Institute for Regenerative Medicine.

Despite the fact that MSCRF funding remains below its peak 2008 levels, the program continues to positively impact the state's economy. From 2007 to 2024, MSCRF grants supported approximately 2,000 jobs, more than $200 million in labor income, and nearly $525 million in economic activity. State and local tax revenues have been augmented by more than $19 million due to MSCRF grants.

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 commits the resources required to more substantially fund the MSCRF.

Appendix A: How to Interpret Economic Impact Estimates

To quantify the economic impacts of the MSCRF, Sage used IMPLAN economic modeling software 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.

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. Note that IMPLAN jobs are not 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:

Output = (Manufacturing sales +/- change in inventories) + (service sector sales) + (gross margin for wholesale and retail trade)

LABOR INCOME

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

Worker Compensation = 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 research activity funded by MSCRF grants.

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. This is a form of **secondary** effect.

INDUCED EFFECTS

Induced effects relate to household spending that occurs due to expanded levels of labor/household income. This is also a form of **secondary** effect.

Appendix B: MSCRF Funding Programs

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 $350,000 over a 24-month period. Since 2022, the MSCRF has funded 50 Discovery grants.

Recipients include researchers at Johns Hopkins University and the University of Maryland, Baltimore evaluating treatments for a variety of conditions including glaucoma, diabetes, and Parkinson's disease, among several others.

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 $350,000 to awardees over a 24-month period. The MSCRF has granted 27 Launch awards worth a combined $9.4 million since 2022. Recipients include researchers from a range of institutions studying a variety of topics including the development of a new therapy to treat Duchenne muscular dystrophy, a new approach to corneal transplantation, and several others.

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 $250,000 to awardees over a 24-month period. Since 2022, the MSCRF has supplied 10 Validation grants worth a combined $2.4 million. Recipients include researchers studying new gene therapies, among several other topics.

COMMERCIALIZATION

Commercialization grants, which provide up to $400,000 in funding over one year, are for 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 2022, the MSCRF has issued 12 Commercialization grants worth a combined $4.5 million. Recipients include researchers studying technologies to grow human livers, restore vision in those with retinitis pigmentosa, and others.

CLINICAL

Clinical grants support clinical trials for stem cell-based medical therapies in Maryland. Since 2022, the MSCRF has issued seven Clinical grants worth a combined $4.6 million, each of which matches non-state money up to $1,000,000 over a two-year period. For example, a researcher at Johns Hopkins received a clinical grant to study a stem cell therapy that converts stump skin to palmo-plantar skin in amputees.

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 2022, the MSCRF has funded 25 post-doctoral fellows. Awardees are studying bone regeneration and treatments for Parkinson's Disease and myocardial infarctions, among many other topics.

MANUFACTURING ASSISTANCE PROGRAM

Companies attempting to advance cell therapy products to the production stage are eligible to apply for grants of up to $1,000,000 (a 1:1 match of non-state money is required). This program began in 2023 and has provided three companies with more than $2.2 million in funding.

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. Sage has created 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, insurance companies, banks, brokerage houses, major medical systems, trade organizations, and law firms, among others.

The company is especially well known for its analytical capabilities in economic and fiscal impact estimation, economic development, forecasting, legislative analyses, litigation support, environmental economics, and industry outlooks.

In addition to leading Sage, Dr. Basu has emerged as one of the nation's most recognizable economists. He serves as the chief economist to Associated Builders and Contractors, the Maryland Bankers Association, and the International Food Distributors Association 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.

Dr. Basu's lectures in economics are delivered to audiences across the U.S. and abroad. He has lectured at Johns Hopkins University and is presently the Distinguished Economist in Residence at Goucher College, where he teaches History of Economic Thought.