

# Exploring the need for Basic Research support at Virginia's Higher Education Institutions

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State Council of Higher Education for Virginia (SCHEV)- Commonwealth  
of Virginia Engineering and Science (COVES) 2021 Fellow Project

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## EXECUTIVE SUMMARY

With an aim to understand whether there is a need for basic research support at Virginia's Higher Education Institutions (HEI), the State Council of Higher Education for Virginia (SCHEV) selected a Commonwealth of Virginia Engineering and Science (COVES) fellow to lead the project on Basic Research (BR). BR is research that is done without a specific application or use in mind. Thirty-one stakeholder inputs were gathered, including state/government personnel, universities' chief research officers, private sector CEOs, and association leaders to gauge the need for BR support in Virginia.

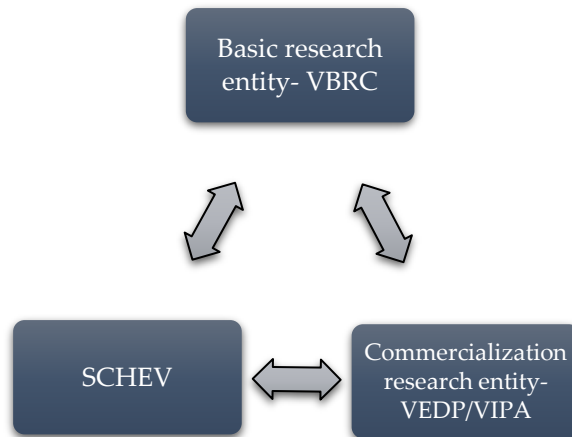
On analyzing the inputs from all it was found that there is a need for BR support in the Commonwealth as it has heavily focused on commercialization and economic development in the past. The need for BR support is acknowledged by all, but there are certain pre-requisites, awareness, and changes required for the same:

- The state needs to define its role in BR and pick leaders in an area of research: recognize the strengths of each university by having a repository, enhance, and advertise/communicate them.
- The state should look for more public-private and/or national labs partnerships and invest in key-research infrastructure & equipment (like the Higher Education Equipment Trust Fund-HEETF) and ensure equitable but differentiated regional distribution.
- SCHEV should act as a conduit/liaison/advisory/oversight entity that has an objective voice to ensure coordination and no duplication within universities BR activities.
- More investments are required for hiring eminent scholars, faculty, operational support, graduate students by evaluating current mechanisms, and providing seed grants or matching dollars for federal resources.
- BR is not restricted to higher education; it does involve non-profits/profit institutions as BR is the pipeline to commercialization/translational research, and
- The state should not expect immediate returns on investment.

Moreover, the state needs to move away from competition or the competitive grant processes as most with the means and best lobbying resources at their respective HEI get through. Rather the state/SCHEV should assign responsibilities to each research HEI by choosing an institutional leader as per their strengths. This would lead to focused and collaborative efforts with non-research HEI.

When interviewees were asked regarding who should provide BR support, the following observations were noted:

1. None of the existing entities can solely take charge of BR.
2. Recommendation of a state-sponsored committee/working group (referenced as VBRC-Virginia Basic Research Committee) that consists of subject matter experts like VASEM i.e., people with technical expertise, scientists, and out-of-state subject matter experts as consultants.
3. Coordination of 'basic research' to 'applied research' to operational value is needed and hence the below model is proposed:



Below are the expectations as per the acting entities:

<i>Action/Sector</i>	<i>Ask from the state</i>	<i>Ask from HEI</i>	<i>Ask from SCHEV</i>
<i>Planning</i>	Define its role in BR & understand its importance.	Communicate BR importance & value to state authorities through ongoing BR.	Get more faculty, operational support, and reinstate the eminent scholar program.
<i>Data Capture &amp; Use</i>	Identify Virginia HEI' strengths, enhance those strengths and communicate them.	Provide their top five strengths in six-year plans.	Should select leaders as per the different areas of research OR Align federal priorities of research to each research HEI.
<i>Engagement</i>	Invest in public-private and national labs partnerships. Provide funding for BR resources and create a non-biased BR entity.	Research HEI should collaborate with non-research HEI and assist them.	Increase funding for the HEETF.
<i>Scoping</i>	SCHEV, BR committee, and the commercialization/economic development team should work in collaboration to understand gaps and opportunities for improvement.		

## INTRODUCTION

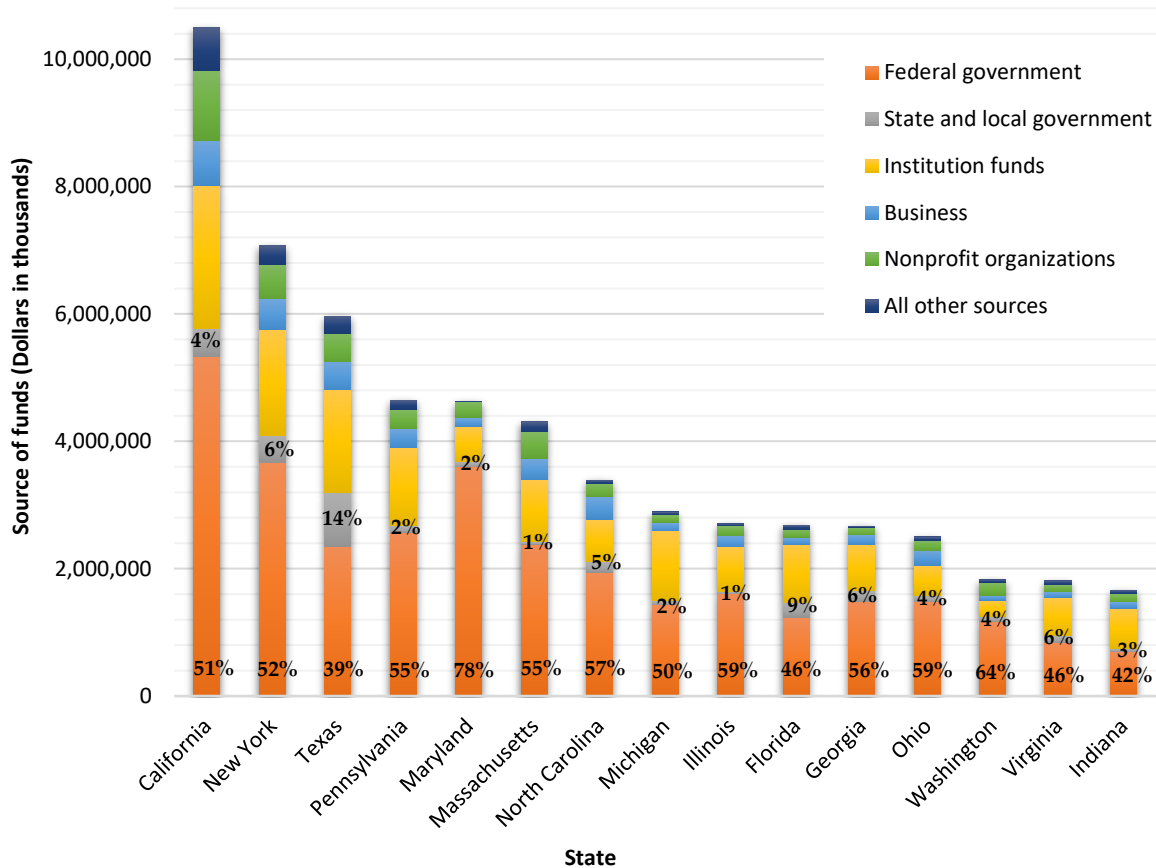
The National Center for Science and Engineering Statistics ([NCSES](#)) defines basic research as “Experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.”

The Commonwealth also has a definition of ‘basic research’ in their [administrative code](#): "Basic research" means a systematic study or search in a scientific or technical field of endeavor with the ultimate goal of advancing knowledge or technology in that field. The development of a tangible product or process need not occur in basic research activities. Examples of basic research activities include medical, chemical, or biological experiments conducted in a laboratory environment.

Most of the stakeholders had a similar understanding of BR and also referred to it as scientific exploration for the sake of knowledge, driven by curiosity rather than a specific application.

In the United States, businesses execute and fund the majority of total research and development (R&D) as well as the majority of applied research and experimental development. Higher education is the second-biggest R&D performer, with the greatest proportion of BR. The federal government is the second-largest R&D funder, with the largest share of basic research (Source: [The State of U.S. Science and Engineering 2020](#)). In overall R&D expenditures, Virginia ranks number 14 out of all 50 states and territories. (Source: [National Science Foundation \(NSF\) Higher Education Research and Development \(HERD\) survey data](#)). If we look at each state by the source of funds in the NSF HERD FY 2019 data, Virginia gets comparatively fewer funds from businesses, nonprofit sectors, and the state and local government with respect to the received federal funding. The total R&D expenses received by Virginia is \$1,814,048,000 out of which 46% comes from the federal government, 6% from the state and local government, 33% from institutions, 5% from businesses, 6% from non-profit organizations, and 4% from all other sources.

## Higher education R&D expenditures, by state and source of funds: FY 2019



\*The graph also displays source of funds in percentage from federal and state/local government

[Source: NSF Higher Education Research & Development Survey.](#)

This project was undertaken to solicit perspectives from the Commonwealth’s constituents’ regarding basic research (BR) performed at public universities in Virginia as the State Council of Higher Education for Virginia (SCHEV) was trying to explore the evolution of any current gaps and the potential need for state policy and/or legislation regarding public funding of BR at Virginia’s universities.

This report outlines the adopted project methodology, the common themes heard during the stakeholder interviews, the acting entities, and the recommended expectations from them. It also provides the next steps and the key takeaways of the project.

## SUMMARY OF THE BASIC RESEARCH PROJECT METHODOLOGY

SCHEV staff shared a few background resources regarding existing laws, policies, and practices in Virginia. The project started with an analysis of those secondary resources and the core set of interview questions were determined. The questions aimed at gauging the interviewee's understanding of BR, the requirements/need for BR support at Virginia's HEI, and an analysis of the state's successful and unsuccessful BR efforts. The interview was also designed to understand the gaps in BR at public universities, and if a gap was identified then the interviewee's opinion of who should take the responsibility and in what scope was also asked. Below are the core set of interview questions:

1. **Understanding of BR:** What do you think about "basic research" performed at public universities in Virginia? OR how do you define "basic research"?
  - Applicable to University Chief Research Officers (CROs): What does it look like at your university? OR What assets do you have at your institution that support "basic research" efforts? For example, research centers, institutes, eminent faculty, significant grants, or key industry or government partnerships.
2. **Requirements:** What would you like to know about current research investments/activities to fulfill your job responsibilities in a better way? OR What questions do you get from your leadership and others regarding "basic research" performed at public universities in Virginia?
3. **Historical analysis:** What has the state done in the past to support "basic research" at HEI?
  - a. What was successful? Why?
  - b. Where did efforts fall short and why? OR What could be improved?
4. **Filling gaps:** Should the state be doing more for "basic research" at public universities of Virginia? What is missing?
5. **Recommended entities:** Which state entities should be doing more for promoting basic research in Virginia's HEI? Why? How?
6. **Scope:** What form should SCHEV/other entities' involvement take?
7. **Examples:** What are other states doing in this area that Virginia should look to as "best practices" or models to learn from?
8. **Interviewee recommendations:** Who else I should speak with from the state, industry, or institutions to provide input on this topic?

After establishing a preliminary questionnaire, SCHEV staff then reached out to potential state/govt personnel, universities' CROs, private sector CEOs, and association leaders with a request for videoconference interviews. None of the SCHEV staff was present during the interview and hence only the interviewer was aware of the

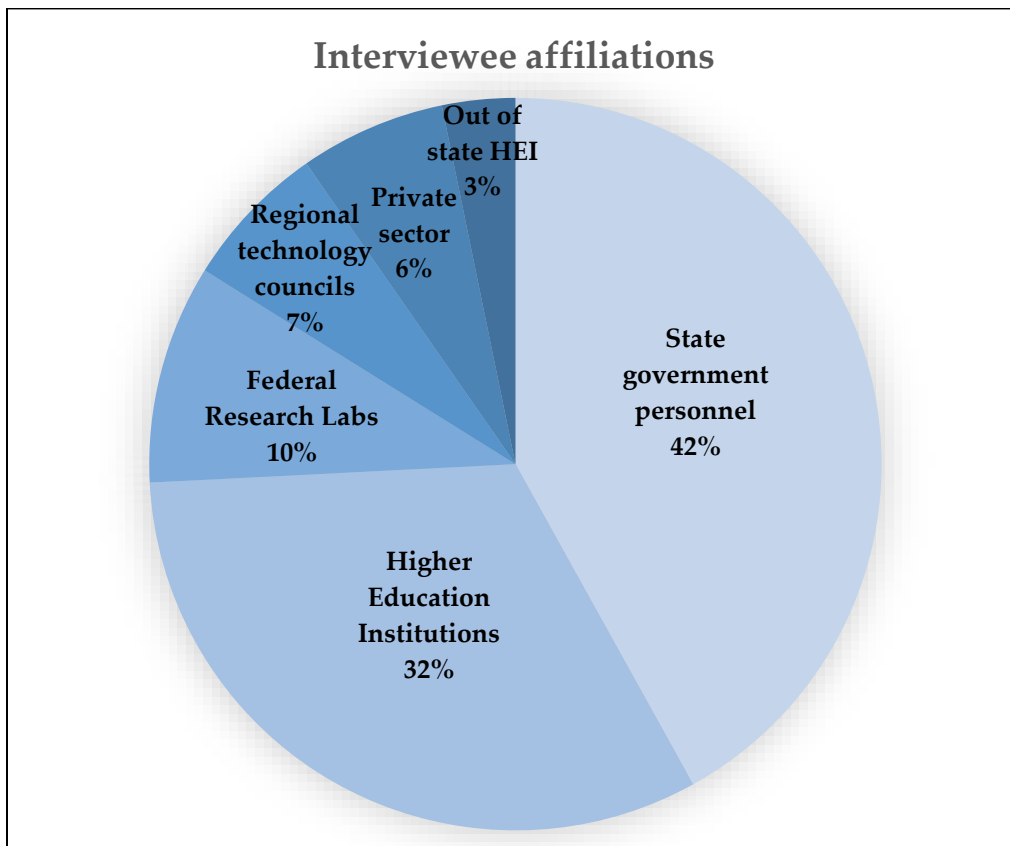


individual responses. Those responses were used to identify common themes, noted in the subsequent sections of this report.

Based on the eighth question i.e., the recommendation for other interviewees, several other candidates were discovered. This approach of interviewing stakeholders identified by other interviewees reduced the likelihood of selection bias. The interview duration ranged from 30-60 minutes, whereas two stakeholders shared written responses with the interviewer. The interview questions were consistent among all groups of stakeholders.

In total, 31 inputs were collected; they belonged to diverse sectors of the Commonwealth, and below is their distribution:

- ⊙ State Government Personnel, including the executive and legislative branch;
- ⊙ Higher education institutions (HEI), CROs, and a few university Presidents;
- ⊙ Federal research labs;
- ⊙ Regional technology councils;
- ⊙ Private sector; and
- ⊙ Out of state HEI.



## DETAILS OF THE COMMON THEMES HEARD

The stakeholder responses to the basic research (BR) questions, posed during individual interviews, revealed common and divergent themes. For thematic analysis, an [inductive approach](#) was used i.e., allowing the data to determine the themes. Below are some of the identified common themes:

- **The state needs to define its role in BR and pick institutional leaders in an area of research: recognize the strengths of each university by having a repository, then enhance, and advertise/communicate those strengths.**

Until now, the state has not explicitly incorporated 'basic research' in its statutes or appropriations but continues to support R&D in the state through various means. There is a need for the state to equally focus on BR as it has done in the past for applied research and commercialization/economic development. In order to do so, the state first needs to understand the importance of BR and define its role in it.

Once the state's role is defined, it needs to identify major players/research HEI in an area of research. This identification can take place only if the state is aware of each public universities strengths and capabilities. The metrics for strengths of universities need to be clearly defined and hence is recommended as a next step. Based on these metrics of research strengths, an HEI can be chosen as a leader/major player of a particular area of research and the non-research HEI can support those endeavors, thereby leading to collaborations and encouragement to non-research HEI.

Once each HEI is aligned to an area of research, these strengths need to be enhanced by providing the necessary resources, those strengths need to be advertised and communicated, both within and out of the state so that it can attract more research projects & faculties, public-private partnerships and thus lead to economic growth in the Commonwealth.

- **The state should look for more public-private and/or national labs partnerships and invest in key-research infrastructure & equipment (like the Higher Education Equipment Trust Fund- HEETF) and ensure equitable but differentiated regional distribution.**

Most states have advanced in BR through partnerships. One example is South Carolina's Clemson University International Center for Automotive Research ([CU-ICAR](#)) that started planning in 2003 and collaborated with [BMW, Michelin, and several others](#) intending to lead in the automotive sector but also viewed BR as an educational component that leads to experiential talent in universities. In terms of national lab

partnerships, Virginia's [Jefferson Lab](#) (Thomas Jefferson National Accelerator Facility) and the U.S. Department of Energy collaboration was reported as a great example by most interviewees. Additionally, both these examples show the need for the state to have a long-term plan.

The federal government funds those states that have proven the potential or have the infrastructure to conduct high-end research as seen in the latest [National Science Foundation \(NSF\) Partnership for National Artificial Intelligence \(AI\) Research Institutes](#). State funding of research infrastructure or targeted appropriations similar to Virginia's support of Jefferson Lab activities could be an effective and efficient way for the state to have a positive impact on research activities.

Both the above examples of partnerships suggest that the state should think big and long-term. It should invest in research infrastructure, buildings, and equipment rather than deciding which scientific proposals/projects to fund. Most interviewees mention that the Higher Education Equipment Trust Fund ([HEETF](#)), although a bond and debt service, is one of the successful efforts of the state. There is a recommendation to increase its finances and ensure the fulfillment of BR equipment needs. This research equipment can be used collaboratively but should be regionally distributed along with ensuring equitable usage by the HEI. Support of research infrastructure that has passed the scientific peer review process is another suggestion.

- **SCHEV should act as a conduit/liaison/advisory/oversight entity that has an objective voice to ensure coordination and no duplication within universities basic research activities.**

SCHEV is viewed to have a unique position as it acts as an interface between universities and legislators. It can act as a facilitating body as well as provide recommendations of what the Commonwealth can do to improve BR in HEI, such as those listed in this report. SCHEV has the power to act as a conduit and assist in choosing university leaders for an area of research as well as bring them together and ensure cooperation. SCHEV's major responsibility would be to ensure that there is no duplication regarding an area of BR and that the topics are well distributed within the state. SCHEV can act as an advisory or oversight entity that ensures that the experts/leaders in an area of research excel and collaborate, along with budget recommendations, and move away from competition within the state. The Commonwealth Cyber Initiative (CCI) can be taken as an example because the state did select a priority and fund the required resources, but it is not an effort totally in the BR field and without an HEI leader. It is viewed as more of an applied research effort.

- **More investments are required for hiring eminent scholars, faculty, operational support, graduate students by evaluating current mechanisms, and providing seed grants or matching dollars for federal resources.**

Even if the state focuses on infrastructure and equipment, getting world-class faculties and operational support is a challenge faced by HEI. Reinstating the [Eminent Scholars Program](#) is one of the common consensuses. Along with it, there should be an emphasis on faculty recruitment & retention, and providing more graduate resources as they are the ones generally conducting BR.

Texas ranks third among the U.S. states in total research expenditure. To view the state's support and the distribution of funds to various research programs, one can refer to the [Research Funding in Texas](#).

Another recommendation is the state can provide seed grants that can act as an aid for federal grants (such as the NSF, National Institute of Health, Department of Defense, etc.) or matching dollars for federal resources of BR.

All the above suggestions should be implemented after evaluating the current mechanisms of the state. Hence, there is a need for an assessment that provides a comprehensive view of the existing state's structure.

- **BR is not restricted to higher education; it does involve non-profits/profit institutions as BR is the pipeline to commercialization/translational research, and the state should not expect immediate returns on investment.**

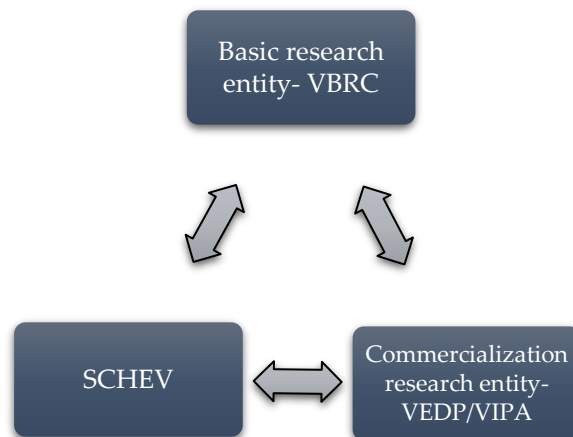
There is a need to communicate the importance of BR along with ensuring that it is not restricted to HEI only. The non-profit sector, as well as businesses, are involved in BR as seen through the [NSF sources of funds](#). Therefore, engaging the translational and commercialization research with BR is a very important aspect. BR is the pathway to applied science or commercialization. It is an easy way to justify or help explain the impact of things that don't necessarily help people today or tomorrow. Coordination of BR to 'applied research' is needed to operationalize its value and hence, the commercialization entities are involved in the recommended model as illustrated in the next section.

There should not be any pressure or expectation of immediate BR return on investment because research valuation is difficult, since the benefits are frequently unexpected or unanticipated, and they may not be recognized for a long time. Accountability of tax-paying dollars is needed, so there should be transparency of ongoing BR but without the hope of immediate application.

## RECOMMENDED EXPECTATIONS

None of the existing entities can fulfill all the above-expected themes. The state should not determine which is a valuable research project, rather it is the role of scientific experts. Hence, a new working group or committee is recommended. It is referenced as the Virginia Basic Research Committee (VBRC) in this report. This new committee should comprise technical experts, scientists, and out-of-state subject matter experts that can act as consultants to the state. All basic researchers of the state or the research officers are recommended to coordinate with VBRC.

As seen from all the common themes, it is observed that the basic research entity, commercialization entity/entities, and SCHEV need to work in harmony. As BR may eventually lead to commercialization, the Virginia Economic Development Partnership (VEDP) or Centre for Innovative Technology (CIT) should stay updated on ongoing BR projects and suggest public-private partnerships based on areas of research. Since SCHEV has the power to work with HEI, SCHEV is involved in the below model and all three entities need to work in harmony.



Apart from the above model, three types of requests were noted from the identified common themes. These requests can be fulfilled by the state, HEI, and SCHEV. It was identified that all three need to work simultaneously, rather than in sequential order, and can build off of each other.

<i>Action/Sector</i>	<i>Ask from the state</i>	<i>Ask from HEI</i>	<i>Ask from SCHEV</i>
<b><i>Planning</i></b>	Define its role in BR & understand its importance.	Communicate BR importance & value to state authorities through ongoing BR.	Get more faculty, operational support, and reinstate the eminent scholars program.
<b><i>Data Capture &amp; Use</i></b>	Identify Virginia HEI' strengths, enhance those strengths and communicate them.	Provide their top five strengths in six-year plans.	Should select leaders as per the different areas of research OR Align federal priorities of research to each research HEI.
<b><i>Engagement</i></b>	Invest in public-private and national labs partnerships. Provide funding for BR resources and create a non-biased BR entity.	Research HEI should collaborate with non-research HEI and assist them.	Increase funding for the HEETF.
<b><i>Scoping</i></b>	SCHEV, BR committee, and the commercialization/economic development team should work in collaboration to understand gaps and opportunities for improvement.		

When the state embarks on planning its role in BR, it needs to understand the importance of BR. This can be met with the help of HEI technical strengths. HEI can communicate BR value through some of their past examples as well as inform about the existing research. Simultaneously, SCHEV can work on gathering more faculty, operational support, and advocate for reinstating the eminent scholars program. If BR importance is understood well by the state, then it is presumed that the state would understand the need for the eminent scholars program and the other BR resources.

One of the requirements identified in the interviews is that all stakeholders need to know what is going on in the state and what are the strengths of the Commonwealth. Therefore, in terms of data capture & use, the HEI can provide their top five strengths in their six-year plans, and SCHEV along with VBRC needs to pick leaders of an area of research. Thus, SCHEV can request a list of each institution's research priorities that offer the most promise for basic research and decide the major players, as it was done for the Virginia

Research Investment Committee ([VRIC](#)) process. They can also ensure there is a correlation between the applied research and commercialization priorities with basic research strengths.

One other suggestion is aligning federal priorities of research to each research HEI: Identify a lead university for each of the ten technology areas outlined in the [Endless Frontiers legislation](#), and provide \$X across the biennial budget to invest up-front and boost university competitiveness or establish laboratory infrastructure in place. Targeted investments that support national research focus, are one of the potential strategies for promoting and enhancing BR in Virginia. Therefore, overall, as a state, we would have identified the Commonwealth's strengths and can pro-actively work towards building and marketing them.

In order to ensure engagement in the process, the state needs to continue looking for partnerships and fund the above-mentioned BR resources. SCHEV can try to increase the HEETF, as that is one of the recommendations by most. Once the leaders of an area of research are decided, the research HEI can be incentivized for collaboration with non-research HEI, as seen in the federal award mechanisms. The non-research HEI need assistance in developing their research capabilities as well as informing the research application processes such as the grant-writing activity and advancing submissions within a short period.

To recapitulate and to assess the scope of this overall effort, SCHEV, the BR committee, and the commercialization/economic development team need to work in collaboration to understand the gaps and opportunities for improvement in the state's BR efforts.

## NEXT STEPS

Once basic research importance is understood by the state, the next step will be to form a separate working group or a Virginia Basic Research Committee (VBRC) that does not comprise of Virginia's university-led people but includes subject matter experts with scientific and technical expertise, both from the state and out of state. This non-partisan group could be housed within SCHEV or as a separate entity that works in collaboration with SCHEV and the commercialization/economic development entities.

The new working group also needs to develop metrics for identifying Virginia's basic research strengths and align each HEI to one area of research, with SCHEV's support. The HEI can then be asked to report their strengths in their six-year plans.

In terms of allocating funds for BR resources, a needs assessment that provides a comprehensive view of the existing state's structure and investment would help.



## CONCLUSION

Basic research is the foundation of scientific advancements. Although significant strides have been made in the state for applied research, more can be done to optimize basic research participation in translational or applied research. There is a need for basic research (BR) support at Virginia's Higher Education Institutions (HEI) and to fulfill that need, the state first needs a repository of existing BR strengths to understand the scope for enhancement. Further, advertising and communicating the strengths will help the state in building partnerships. It is found that partnership is the key to promoting BR.

For Virginia to be a leader in BR, it needs to have a long-term plan by investing in BR resources such as increasing the infrastructure, equipment, and operational support. Basic research would benefit from more funding, resources, and support in order to move the scientist's discoveries forward more effectively and efficiently. There need to be budget recommendations for the same and SCHEV has the potential to play various roles to promote and recognize Virginia's BR. To assist with all the technical and scientific expertise, there is a recommendation of a new working group or Virginia Basic Research Committee (VBRC) that has varied responsibilities pertaining to BR. Implementing all the above recommendations will require actions from the state, HEI, scientific experts, and SCHEV.

The anticipated outcome of incorporating all the above recommendations is to best position the Commonwealth and its resources to conduct and attract cutting-edge basic research that utilizes the full potential of the state.

## ACKNOWLEDGEMENT

I would like to extend my sincere gratitude for the time, insights, and support provided by SCHEV and all the stakeholders. This report would not have happened without the candid input, follow-up data, and assistance from various stakeholders. I hope that this report will serve as a starting point for moving forward on this important issue.