

STATE COUNCIL OF HIGHER EDUCATION FOR VIRGINIA

Ad Hoc Committee on Research

**101 N. 14th Street, 9th floor
SCHEV Main Conference Room
Richmond, VA
February 23, 2017
1:00 p.m. – 4:00 p.m.**

Meeting Agenda

- | | |
|---|-----------|
| 1. Call to Order | 1:00 p.m. |
| 2. Welcome and Introductions | 1:00 p.m. |
| 3. Review of Trends and Current Strengths
in Virginia Higher Education Research (Page 2) | 1:15 p.m. |
| BREAK | 2:15 p.m. |
| 4. Discussion of Future Directions: Building on
Strengths and Identifying New Opportunities (Page 5) | 2:30 p.m. |
| 5. Discussion of Draft Organizing Principles and the
Placement of VRIF along the Research
Continuum (Page 12) | 3:30 p.m. |
| 6. Discussion of Next Steps | 3:45 p.m. |
| 7. Report from Staff | 3:55 p.m. |
| 8. Motion to Adjourn | 4:00 p.m. |

NEXT MEETING: March 20, 2017 – Virginia Military Institute, Lexington, Virginia

Committee Members:

Ken Ampy	William Murray
H. Eugene Lockhart	Minnis E. Ridenour

State Council of Higher Education for Virginia Agenda Item

Item: Ad Hoc Committee on Research – Item 3 – Review of Trends and Current Strengths in Virginia Higher Education Research

Date of Meeting: February 23, 2017

Presenters: Alan Edwards
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Lynn Seuffert
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Most Recent Review/Action:

- No previous Council review/action
 Previous review/action

Date:

Action:

Background Information/Summary of Major Elements:

At the January 10, 2017, meeting of the Ad Hoc Committee on Research, members expressed interest in learning more about the Commonwealth's competitive position and strengths in academic research nationally and public institutions' individual research strengths and most-commercializable research foci/topics.

Toward these ends, staff reviewed federal data on annual research expenditures at the state and institution levels, as well as by research field. Staff also reviewed data on patent awards assigned to Virginia's institutions of higher education and to entities in Virginia generally.

The full staff report will be distributed under separate cover prior to the meeting. The Executive Summary and Figure 1 are attached to this agenda item.

Materials Provided:

Excerpts from "Staff Report –Virginia's Areas of Research Strength"

- Executive Summary
- Figure 1

Page 3

Page 4

Financial Impact: None

Timetable for Further Review/Action: None

Resolution: None

Virginia's Areas of Research Strength Executive Summary

Academic research in Virginia is a \$1.4 billion enterprise annually. Significant investments at federal labs and by the private sector contribute to a robust research ecosystem. The entities charged with administering the Virginia Research Investment Fund (VRIF) have expressed interest in developing a full understanding of the scope and depth of research in Virginia. Pending legislation would provide an opportunity for the Virginia Research Investment Committee (VRIC) to participate in the update of the Commonwealth's Research and Technology Strategic Roadmap (R&T Roadmap) in 2017 and to continue in future years to refine that document to ensure that, in addition to providing reflective information on the current status of research, it provides actionable intelligence about future directions for Virginia's research enterprise. During that process, VRIC members will develop the full understanding they seek.

Against that longer-term backdrop, this brief report examines the strengths of Virginia's research ecosystem through the analysis of two major indicators: academic research expenditures and both academic and total patent awards. Additional indicators include start-up growth and peer-reviewed publications. Virginia and national trends for these indicators are also explored. Finally, the industries listed in the R&T Roadmap are mapped to the areas of strength to reveal potential foci for the Round 1 competition for VRIF funding.

Institutions of higher education must compete nationally to secure funding. Therefore, higher education research expenditures indicate areas of expertise with the muscle to win funding in a highly competitive environment. Because intellectual property must be protected prior to commercialization, patent awards are one indication of the areas of research that have commercial potential.

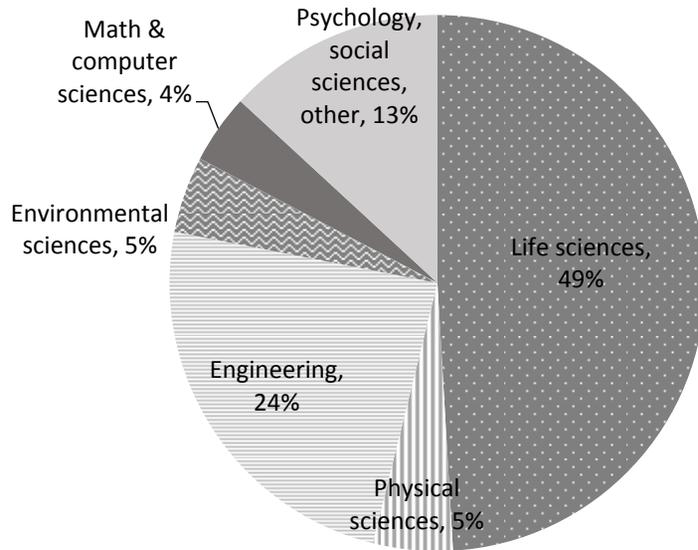
The graphic on the next page (Figure 1) illustrates the intersection between Virginia's areas of academic research strength and areas ripe for commercialization, with an overlay of the industries listed in the R&T Roadmap. Potential areas of collaboration among institutions and between institutions and the private sector are also revealed.

The remainder of the report provides more in-depth information on the indicators and national and Virginia trends including peer-reviewed publications, which confirm the areas of expertise revealed by expenditures and patent awards, and start-up growth which shows the strength of Virginia's innovation ecosystem.

In conclusion, staff suggest that the committee consider investing VRIF funds at the intersection of three vectors: university research strength and expertise; commercial potential; and the larger research ecosystem in Virginia.

Figure 1: Intersection of Virginia's Research Strengths and Areas with Commercial Potential

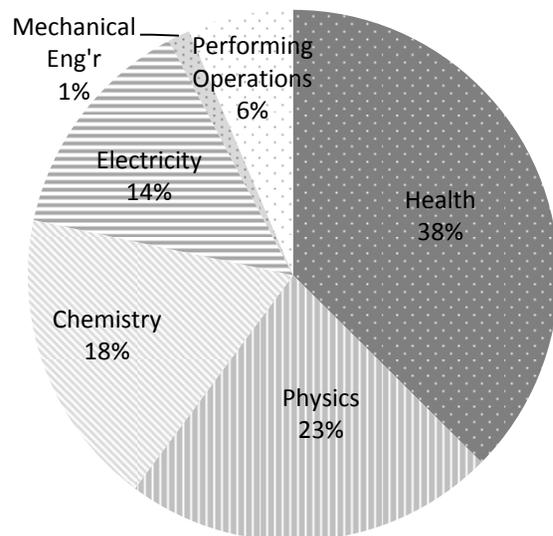
R&D Expenditures at Virginia Institutions (\$1.4 billion)



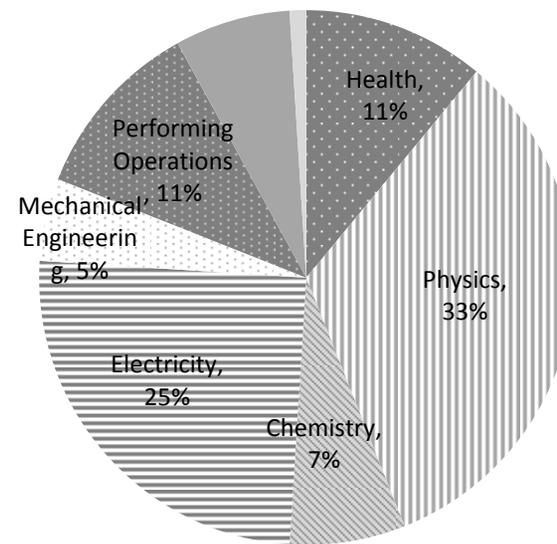
Statutory Focus Areas

- Life Sciences**
(includes health, physics, chemistry & electricity)
- IT – Data Analytics**
(includes health, physics, chemistry & electricity)
- Cybersecurity**
(includes health, physics, chemistry, electricity & computer science/math)

Academic Patents (2013-2016)



All Patents (2013-2016)



State Council of Higher Education for Virginia Agenda Item

Item: Ad Hoc Committee on Research – Item 4 – Discussion of Future Directions:
Building on Strengths and Identifying New Opportunities

Date of Meeting: February 23, 2017

Presenters: Alan Edwards
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Most Recent Review/Action:

- No previous Council review/action
 Previous review/action

Date:

Action:

Background Information/Summary of Major Elements:

At the January 10, 2017 meeting of the Ad Hoc Committee on Research, members expressed interest in learning more about the Commonwealth's past and present research strengths and the opportunities for future commercialization of its research results. (The prior agenda item summarized the past and present information.)

To inform committee members' knowledge and understanding of potential future research strengths, opportunities/gaps and commercializable results, staff submitted a brief survey to the public institutions to generate a summary snapshot. Nine institutions responded and a summary is included in the enclosed preliminary survey results document. Staff will continue to accept survey responses from the remaining institutions and have a final document prepared for use by the Virginia Research Investment Committee prior to their March 14 meeting and for the ad hoc committee's use at their March 20 meeting.

Staff encourages committee members to use this document as a starting point to facilitate a focused and informed discussion with the institutional representatives in attendance at today's meeting about their future research plans and expectations.

Materials Provided:

- Preliminary Survey Response Summary

Page 6

Financial Impact: None

Timetable for Further Review/Action: None

Resolution: None

Preliminary Survey Response Summary

Section 23.1-3133 of the *Code of Virginia* assigns to the State Council of Higher Education responsibility to “establish guidelines, procedures, and objective criteria for the application for and award of grants and loans” from the new Virginia Research Investment Fund. To fulfill this responsibility, Council chairman Gil Minor created a four-member ad hoc committee on research within the Council. At that committee’s second meeting on January 10, members requested that all public institutions be invited to the committee’s February 23 meeting to share each’s research priorities and strengths and to offer feedback on SCHEV staff’s draft organizing principles and the VRIF processes generally.

To facilitate the discussion on February 23, staff requested responses to the five-question informal survey below to complement data gathered from the NSF Higher Education R&D Survey from FY2015 and the U.S. Patent Office.

Responders were advised to use “back of the envelope” educated estimates, discussions with colleagues, and their own knowledge of research at their institutions. Staff also requested that answers be kept brief (a list, a sentence or two, at most a paragraph or two).

The survey was distributed at the end of the day on Monday, Feb. 6, with a requested response date of Wednesday, Feb. 15. Given the short timeframe, staff were pleased to receive nine responses, almost evenly split between “research” and “non-research” institutions.

Questions and Responses

Q1. § 23.1-3131.C. of the *Code of Virginia* stipulates: “Areas of focus for [VRIF] awards shall be those areas identified in the Commonwealth Research and Technology Strategic Roadmap, and shall include but not be limited to the biosciences, personalized medicine, cybersecurity, data analytics, and other areas designated in the general appropriation act.” Please add your institution’s MAJOR research foci to the list below and assign a number to each item on the list approximating its proportional share of your research expenditures for FY2016. (The total need not sum to 100%)

1. Responses

This question required institutions to examine and estimate FY2016 expenditures using R&T Roadmap categories and their own categories, rather than those categories required for their reporting to the NSF Higher Education Research and Development Survey.

Biosciences

The research institutions reported higher percentages expended in the biosciences, ranging from 15% to 100%. In contrast, non-research institutions reported expenditures in the biosciences ranging from 0% to 4%.

Within biosciences, the research institutions that estimated expenditures specifically in personalized medicine reported ranges from 6% to 40%. Other bioscience areas of research expenditure included women’s health, diabetes and metabolic diseases, neuroscience, and inflammatory diseases.

Cybersecurity

Five of eight institutions reported expenditures in this category ranging from 2% to 52%.

Data Analytics

Six of eight institutions reported expenditures in this category ranging from 1% to 22%.

Self-Identified Categories of Expenditures

Autonomous Systems & Mobility, Agriculture & Lifesciences, Material Science (includes nano-electronics, optical sensors, lasers) & Advanced Manufacturing, Energy & Environment or Environmental Conservation, Marine Science, Health and Human Services, Particle Physics, Nuclear Physics, Physics, Aerospace Engineering, International Stabilization, Humanities, Education, Educational Technologies, Social & Behavioral Sciences.

Q2. From the research foci in #1 above, which area/s of focus:

a. Does your institution believe hold/s the most promise for translating into commercializable outcomes and economic and job growth in the next decade in Virginia?

2a. Responses

Even those institutions whose expenditures on biosciences were low responded that this area held strong promise for translating into commercializable outcomes.

Within the biosciences, some institutions mentioned specific sub-categories with potential for commercialization: metrology, advanced imaging, inflammatory diseases, diabetes/metabolic diagnostics and care, biomarker discovery, women's health.

There was also strong agreement that the category of data analytics, predictive analytics, or healthcare analytics would yield commercializable outcomes, with at least one research institution projecting strong growth in the coming years (from 1% of expenditures to 10%) due to a new private-sector partnership.

Several institutions included cybersecurity and its variations, cyberphysical systems and security, information assurance, etc.

Additional research areas that reportedly hold promise for commercial outcomes include: Smart materials, materials and manufacturing, biofuels, autonomous systems, agriculture (through a new state-wide industry consortium that stimulates technology transition and commercialization in agriculture and life sciences), shellfish aquaculture, physics, energy & environment (including wind energy), engineering (including pharmaceutical engineering).

b. Has/Have yielded your institution multi-year grants in the past two years? Please explain whether and how you expect these and other pending awards to impact the percentages you provided above in the next five years.

2b. Responses

Most institutions reported recent multi-year grant awards in the areas of research they listed in Q1. While most did not expect the expenditure of those awards to change the percentages they reported, there were several exceptions.

One exception was already mentioned above (anticipated increased percentages in health analytics).

Several large awards to one institution could change the percentages in Q1, above, but new estimates were not yet available. The grants included an NSF-funded Molecular Science Software Institute (funded at >\$19M over 5 years), National University Transportation Center (funded at >\$28M over 5 years), IARPA-funded Pathogen Prediction (in final negotiation for >\$12M over 3 years); DTRA-funded Comprehensive National Incident Management System (in final negotiation for \$3.8M base/year sole source contracting vehicle with \$100M ceiling over 10 years).

Another reported that physics research is gaining in year-over-year awards, through the growth of a single research program.

A fourth reported that health and human services activities have grown significantly over the past half-decade; they anticipate this growth will lead to an increase in the percentage share for this field.

A fifth reported that new grants in education and the social and behavioral sciences would increase expenditures in that category to 10% (up from 7%).

One institution raised the potential that the new administration in Washington could have an impact on future expenditures, resulting in an increase in some research areas and a reduction in others.

c. Has/Have yielded your institution the most declines of grant proposals in the past two years? Please explain the extent to which these unfunded proposals indicate either gaps in accessible funding that the VRIF could address or a highly competitive research field in which VRIF funding could accelerate progress significantly.

2c. Responses

A research institution reported difficulty securing funding in the neurosciences. It was suggested that this and all areas listed would benefit by establishing a collaborative network and the recruitment and retention of researcher expertise.

Four institutions that reported low percentages of expenditures in the biosciences in Q1, above, stated that they have been aggressively pursuing funding in this area with some small successes. All believe that an award from VRIF would position them well for future funding in this competitive research area (either by using VRIF funds to generate preliminary data upon which future proposals would be based or through gaining credibility by successful implementation and outcomes on the VRIF-funded project).

Another institution reported difficulty securing funding for research in smart materials and biofuels due to a lack of funding opportunities.

A research institution explained their view that Virginia universities are underperforming in large center-level programs compared to peer institutions. It stated that these large programs lead to commercializable outcomes and economic and job growth. They typically require transition pathways and partners as an integral

part of the effort. Many of the competitions require cash and in-kind support commensurate with the federal investment. It was suggested that VRIF could play an instrumental role in building capacity and in providing and coordinating the required matching support to be competitive for these programs.

Other research areas for which grant proposals were declined included natural sciences, engineering, along with other areas not included on their lists of major research categories in Q1, above.

Q3. If your institution believes that one or more area of research focus NOT on its list above holds significant promise for commercialization, please identify the area(s) and summarize whether and how the institution will involve itself in the research area(s) in the next 10 years.

3. Responses

One research institution mentioned population health management and big data analytics from medical records. They are developing a private-sector partnership for an Institute for Healthcare Analytics and Discovery involving recruitment of key data analysts and population health faculty. Support to recruit experts in this area and to link to other Virginia universities will accelerate this initiative, with the potential to complement and benefit other programs in personalized medicine and health data analytics involving Virginia universities and companies.

Another mentioned their intent to increase their focus on pharmaceutical engineering.

As implied above, several of the non-research institutions are expanding into the biosciences. One has hired faculty in the STEM disciplines, particularly molecular biology and neuroscience. In addition, the institution recently enhanced its animal care and use program to support fundamental research in the areas of memory, addiction, neural disorders (e.g., Alzheimer's disease), and heart regeneration.

Another non-research university reported that biofuels is a new research area for them, focusing in bio-aviation, bio-diesel, and bio-gasoline. They expect the current research and proposed research to result in intellectual property and patents with potential for commercialization.

Another non-research university highlighted agricultural technology and unmanned aerial systems (UAS) as areas with future potential for commercialization.

Another research institution responded that additional areas that hold significant promise for commercialization include artificial intelligence, machine learning, and deep learning. These focus areas have broad applicability to technology domains that span digital manufacturing to autonomous systems to health sciences. That institution is making strategic investments to recruit leading research and teaching faculty with expertise in these areas to complement and extend strengths in autonomy and autonomous systems, manufacturing, health sciences, and analytics.

Q4. Collaboration – among public institutions of higher education and between public institutions and the private sector – is a key expectation, requirement and outcome in the enacting VRIF statutes (see § 23.1-3131.C. and § 23.1-3133.A. and B.). To shed light on the current state of collaboration generally, please identify the most common research areas in which your institution has received grant awards over the past five years that included sub-awards to any other Virginia institution. Please also provide information on how common inter-Virginia

collaboration is in your research enterprise and on your institution's most common partners (which institutions and companies; which institutional types and private-company sectors).

4. Responses

All respondents reported significant collaborations with other public institutions in Virginia, with most mentioning multiple other institutions with whom they partner.

The two land-grant institutions collaborate frequently on agricultural research.

Collaborations with Washington & Lee University, University of Richmond, and Virginia Union University were also reported.

All, including the non-research institutions, reported collaborations with federal, state, and private sector organizations, including non-profits.

Non-research institutions reported collaborations with Thomas Jefferson National Accelerator Facility, Commonwealth Center for Advanced Manufacturing, Northrop Grumman, and General Dynamics.

Another highlighted their participation, with two other Virginia institutions, in the Virginia Department of Agriculture and Consumer Services Industrial Hemp Research Program and the related partnerships both farmers and investors on industrial hemp projects that could have commercial potential.

Research universities highlighted partnerships with Sentara Healthcare, Virginia Biotechnology Research Park and Virginia Biotech companies, Rolls Royce, Northrop Grumman, CACI, Newport News Shipbuilding, Leidos, HP Enterprise, Dominion Energy, Volvo.

Areas of research that have commonly generated collaborative projects include: biomedical and health sciences, cancer biomarkers, neuroscience, diabetes, cardiovascular care, smart materials, life sciences, materials and manufacturing, energy and environment (including coastal and marine ecosystems).

Both research and non-research institutions reported that industry partnerships tend to cluster in the areas of data analytics, cyberphysical systems and security, physics, engineering, energy and environment, materials and manufacturing, energy and propulsion, and autonomy.

One institution highlighted the efforts of 4-VA, a collaboration between James Madison University, Virginia Tech, University of Virginia, George Mason University, and Old Dominion University. Since 2012, there have been 71 collaborative research projects among these five institutions and 4-VA has hosted two Virginia Robotics and Unmanned Systems Education Summits in the last year, which convened representatives from academia, industry, and government to discuss industry needs and requirements for the emerging drone market.

One institution highlighted an opportunity for future development of collaborations in beta cell biology as it relates to inflammation, genetics, and personalized care, and to apply expertise in congestive heart failure via an accredited bio repository to support collaborative research and attract new industry support and spin out companies from our universities. This biorepository will be a resource to advance RD in personalized medicine, drug discovery, and biomarkers.

Q5. If the Six-Year Plan that your institution prepares for Richmond policymakers includes start-up packages for eminent researchers/research faculty, please identify the disciplines/fields that will be targeted by these packages and the number of personnel to be recruited in each discipline/field.

5. Responses

Most institutions responded that their six-year plans did not include any mention of start-up packages or did not set targets for the number or type of researchers to be recruited or retained. One institution stated that they were in the process of identifying this information. Given that only one institution mentioned specific disciplines, we omitted their response as it would not be helpful to the committee in the decision-making process.

State Council of Higher Education for Virginia Agenda Item

Item: Ad Hoc Committee on Research – Item 5 – Discussion of Draft Organizing Principles and the Placement of VRIF along the Research Continuum

Date of Meeting: February 23, 2017

Presenters: Alan Edwards
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Most Recent Review/Action:

- No previous Council review/action
 Previous review/action

Date: December 21, 2016 and January 10, 2017

Action: Initial reviews of draft organizing principles proposed by staff

Background Information/Summary of Major Elements:

Enacted on July 1, 2016, § 32.1-3133 of the *Code of Virginia* requires the Council, in consultation with the Virginia Research Investment Committee (VRIC), to establish “guidelines, procedures and objective criteria for the application for and award of grants and loans” from the Virginia Research Investment Fund (VRIF).

Toward these ends, Council staff has reviewed relevant state-level research-grant programs in the Commonwealth and elsewhere, has consulted with the administrators of these programs and has received feedback on ideas and draft documents from members of the VRIC, public institutions’ chief research officers and SCHEV’s Instructional Programs Advisory Committee.

One result of these efforts was a set of potential organizing principles intended to begin to outline some basic parameters for VRIF award competitions. These proposed principles were shared with the ad hoc committee on December 21, 2016 for its information and discussion, and a revised version was discussed preliminarily by the committee on January 10, 2017.

At the committee’s January meeting, members expressed preference for developing a better understanding of the academic-research enterprise generally and public institutions’ research strengths and plans specifically, prior to a formal discussion of the draft organizing principles.

The enclosed “Proposed Organizing Principles” document is the same version discussed preliminarily at the January meeting of the ad hoc committee. Staff encourages members to discuss it in light of this meeting’s prior discussions and with input from the institutional representatives in attendance.

The enclosed “Research and Innovation Continuum and Public Sources of Funding” document is also the same as that discussed in January. It is replicated here for easy reference and to assist members in conceptualizing the current landscape of research funding available to public institutions and the gaps and opportunities therein.

Materials Provided:

- Proposed Organizing Principles for VRIF Proposals Page 14
- Research and Innovation Continuum and Public Sources of Funding Page 15

Financial Impact: None

Timetable for Further Review/Action:

Staff will review the results of today’s discussion with the VRIC at its meeting on March 14.

At the ad hoc committee’s March 20 meeting, staff will bring forward a revised organizing principles document for either further review or approval, depending on the results of the prior discussions (i.e., the extent of the additional revisions necessitated by the discussions).

Resolution: None

**Proposed Organizing Principles for VRIF Proposals
(Eminent Researcher Recruitment/Retention and Applied Research Proposals)**

SCHEV staff proposes the principles below to guide and organize the mechanics of the VRIF grant competition. The parameters for the kinds of projects to be supported will be included in a future proposal of conceptual frameworks.

1. Only public institutions of higher education in Virginia will be eligible as lead applicants.
2. The grant competition will be “standard” (rather than pitch-style, prize, etc.).
3. The grant competition will be “limited submission”; i.e., each institution can submit two proposals as lead institution and participate as a partner in unlimited additional applications.
4. Round 1 will be a single grant cycle with separate instructions and formats for applied R&D proposals and eminent researcher recruitment/retention proposals. If VRIC determines under #6 below that they will accept proposals requesting the maximum amount appropriated by the General Assembly, SCHEV staff will determine whether additional format and/or score/weighting guidelines will be required to ensure VRIC receives actionable information about, and SCHEV staff and peer review panel(s) can conduct appropriate due diligence for, the large-scale projects.
5. No stand-alone competition will be offered for equipment; all equipment requests will be made in the context of an applied research proposal or an eminent researcher recruitment/retention proposal.
6. Maximum award amounts are under consideration by VRIC (best practices for transparency in grantmaking hold that applicants be provided information regarding either the maximum amounts or the anticipated dollar range of average awards; for VRIF purposes, that includes guidance for requests for both general funds and bond funds).
7. In Round 1, VRIC is considering whether to indicate an estimated number of awards anticipated for applied R&D grants vs. eminent researcher recruitment/retention grants. VRIC has apparently reached consensus that, assuming the peer review process results in a recommendation, at least one award will fund R&D; they are still apparently divided whether any awards will fund eminent researcher recruitment/retention.
8. Any funds remaining after Round 1 award(s) are made will be rolled forward to Round 2.
9. As a lead applicant, an institution will be allowed to submit any combination of proposals, such as one applied R&D proposal and one recruitment/retention proposal, or two applied R&D proposals, or two recruitment/retention proposals. However, as lead applicant, an institution will be awarded a maximum of one grant in each category.
10. Grant periods may be proposed ranging from one year to five years.
11. A 1:1 match of the award amount will be required. [Details under development.]
12. All funds (VRIF, bonds, and matching) will be required to be expended by the end of the grant period.
13. The possibility will exist that an institution will be awarded no grant funds.

Research and Innovation Continuum and Public Funding Sources

