

# Request for Strategic Funding

For Fiscal Year 2015

**Campus/Admin. Unit:** Columbia Campus  
**Lever:** 2.1 Recruit additional high-impact faculty and staff to enhance MU's academic stature and to improve MU's competitive advantage  
**Priority Ranking:** 1

Funding Request	For President's Use Only
Total Recurring __\$8M_____ Total One-time _____	<input type="checkbox"/> Funded <input type="checkbox"/> Not Funded
Campus Match	
<p><i>For campus/ system administrative unit match, please indicate from where the source of funding will come (e.g. student fees, endowment income, etc.) Note: Item #2 below is available for additional narrative of the sources.</i></p> <p>Total Recurring __\$4M_____ Total One-time __\$8M_____</p> <p>Recurring Source __reallocation_ One-time Source _reserves and reallocation__</p>	<p>Total Recurring _____</p> <p>Total One-time _____</p> <p>Comments: _____</p> <p>_____</p> <p>_____</p>

**Justify the requested funding by responding to the criteria below.**

- The extent to which the actions under this lever will have a measurable and significant impact on the campus/system strategy (return on investment). Please include a description of the measure(s) to be used to assess the impact, the magnitude of the expected change, and the timeline for results.

Our priority is to improve our AAU indicators, and our top strategy is to hire 20 senior faculty, who will have an immediate and positive effect on our AAU indicators. These 20 faculty may be hired into almost any area on campus, but all 20 must meet or exceed the following criteria:

- These senior faculty are expected to enhance already strong programs. This initiative is not intended to fill gaps within weaker departments or programs.
- These senior faculty are expected to be in the top quintile of research productivity within their disciplines, as defined by Academic Analytics or other nationally normed standards appropriate for the discipline.
- These senior faculty should be at or near national academy level.
- They should be prepared to mentor junior faculty within their disciplines.

An additional 80 faculty will be hired in clusters of 3 to 5 to work with these national-academy level faculty. The faculty within these clusters will be highly productive research faculty who will also have the benefit of mentorship from the national-academy level faculty. All 100 faculty hired will be expected to have a positive impact on one or more of the following AAU Phase I indicators:

competitively funded federal research, membership in the national academies, awards and fellowships, and citations. Phase two indicators will also be part of the consideration: USDA, state, and industrial research funding; number of doctoral degrees; number of postdoctoral appointments; undergraduate education. Our plan is to create a long-term sustainable culture of extraordinarily high research productivity not only within these clusters, but also in the disciplines or multidisciplinary programs that they strengthen.

Our success depends on our ability to remain flexible enough to respond to unexpected hiring opportunities, and we have, therefore, not restricted these hires to specific areas of campus, but we have identified some possible areas for enhancement. Given the importance of health-related research funding, for example, in AAU indicators, it is likely that more than one of these senior hires will be within the School of Medicine. However, even with School of Medicine hires, these senior faculty will likely have significant impact on research elsewhere on campus. Several of the School of Medicine's research strengths, for example—Virology and Molecular Therapy, Cardiovascular Disease, Outcomes Research/Informatics, and Microbiology—have strong partners elsewhere on campus, in the College of Veterinary Medicine, the Regional Biocontainment Laboratory, Dalton Cardiovascular Research Center, Nursing, Engineering, MU Informatics Institute, and the College of Agriculture, Food, and Natural Resources. For an example of the kind of approach we will be taking with these hires, see the document “Strategic Hiring in Virology and Molecular Therapy,” provided as Appendix A.

In addition to having established criteria for these senior hires, we also have a mechanism, through the governance plan of MUSOP, for evaluating potential hires. Proposals for these senior hires will be considered by the MUSOP Evaluation Committee, which will make recommendations to the Provost and Chancellor. (In cases where confidentiality is required, the proposals regarding individual hiring opportunities may be considered by a smaller subset of the MUSOP Evaluation Committee.)

The total cost in salary and benefits for these 100 positions is \$20M in recurring costs and \$50M in one-time startup costs. (The \$20M in recurring costs includes an estimated \$400K in salary and benefits for each of the senior hires and \$150K for each of the faculty within the clusters.) The system provided \$1.94M toward this effort last year. We are now requesting an additional \$8M of recurring funds. This year we have hired 11 tenured midlevel faculty who appear to be rising “stars,” and one new NAS faculty who begins in March. We are on the right trajectory.

In order to take advantage of the highly dynamic recruiting environment, the exact timing of these hires is, in some cases, flexible. Receiving an allocation of \$8M in FY2015 will give us the flexibility that is necessary when recruiting nationally competitive senior faculty, but it is unlikely we will fill the number of positions for which funding is requested in FY2015. Those funds unused in FY2015, however, will allow us to generate the vital and often quite expensive one-time start up costs required for these and future hires.

We will assess the impact of this strategy using nationally normed data regarding research productivity. We expect to see improvements (both immediate, upon hiring, and continued growth) in numbers of publications, citations, and awards within the disciplines or multidisciplinary programs in which we make these hires, using Academic Analytics. We also expect to see improvements in AAU's Phase I and Phase II Indicators, provided above.

2. Campus/system administrative unit priority as evidenced by an investment match. Please describe the campus/system administrative unit investment and the source of funding and how this signifies a campus/system administrative unit priority.

MU has already begun a bold strategy of reallocation of 2% of our base budget to achieve our goals. In FY2015 this reallocation will produce \$4M of recurring funds for faculty positions and \$8M of one-time funds used toward this effort. This strategy has been endorsed by the Council of Deans and vetted with the Faculty Council.

3. Projected impact on student learning and success. Please include a description of the measure(s) to be used to assess the impact, the magnitude of the expected change, and the timeline for results.

Because of the focus within AAU indicators on research, the effect of these hires on student learning and success is most likely to be seen in increased access by our students to undergraduate research opportunities. With more faculty and more research grants, more students will be exposed to and participate in faculty research. (Many of our most productive research faculty already support 5-10 undergraduates in their labs, yet we have many more students qualified for such opportunities than we have openings.) Our strategy of hiring more research faculty will address these bottlenecks. These increased opportunities for undergraduate research also benefit our research faculty. All researchers funded through NSF, for example, are required to have a broader impact plan that addresses societal needs, and many of our faculty include support of the next generation of scientists as a key component of these broader impact plans. Most of the students involved in these new research opportunities will participate in our Spring Research Forum. As indicated by our best-in-class metrics, our goal is to increase the number of students participating in MU's Spring Research Forum from 276 to 350 by 2015 and from 350 to 450 by 2018. These increased opportunities for student engagement with research are essential components of what we describe in our Strategic Operating Plan as the "Mizzou Experience."

4. Cross campus/system initiative and/or replicable and scalable. Please describe the extent to which this initiative includes one or more other campuses in the UM System and leverages the system, and/or why this initiative would be worthy of replication or would be scalable.

Although membership in the AAU focuses on the MU campus rather than the system, there is no question that the University of Missouri system and our sister campuses benefit from MU's continued participation in the AAU, most notably in opportunities for high-impact research and teaching collaborations across the four campuses.

# Request for Strategic Funding

For Fiscal Year 2015

**Campus/Admin. Unit:** Columbia Campus  
**Lever:** 2.3 Ensure that MU is able to recruit and retain the best faculty, staff, postdoctoral fellows, and graduate students.  
**Priority Ranking:** 2

Funding Request	For President's Use Only
Total Recurring __\$3.7M_____ Total One-time _____	<input type="checkbox"/> Funded <input type="checkbox"/> Not Funded
Campus Match	
<i>For campus/ system administrative unit match, please indicate from where the source of funding will come (e.g. student fees, endowment income, etc.) Note: Item #2 below is available for additional narrative of the sources.</i>	Total Recurring _____
	Total One-time _____
	Comments: _____
	_____
	_____
Total Recurring __\$13.5M_____ Total One-time _____	
Recurring Source _Reallocation_ One-time Source _____	

## Justify the requested funding by responding to the criteria below.

1. The extent to which the actions under this lever will have a measurable and significant impact on the campus/system strategy (return on investment). Please include a description of the measure(s) to be used to assess the impact, the magnitude of the expected change, and the timeline for results.

Investing in human capital is a cornerstone of our overall strategy. As we described in the Strategic Operating Plan itself, “We must retain our best faculty. Nothing less is acceptable if we are to provide our students a quality learning experience, preparing them as engaged citizens and leaders in the divers, global, technologically-driven environment.”

With this commitment to investing in our faculty, we propose here to continue our efforts to finally address serious deficiencies with faculty salaries. According to our most recent data, MU ranks next to last among the 32 AAU public universities in terms of faculty salaries. (See figures below.)



## Public AAU Average Salaries—2013

NAME	Average Salary	Rank
UCLA	151,474	1
UC Berkeley	140,682	2
North Carolina	132,875	3
Michigan	125,298	4
UC San Diego	123,454	5
UC Santa Barbara	123,226	6
Virginia	121,209	7
UC Irvine	119,136	8
Texas	117,650	9
Georgia Tech	116,067	10
UC Davis	115,514	11
Maryland	113,650	12
Penn State	113,458	13
Illinois	112,252	14
Minnesota	110,037	15
Ohio State	109,400	16
Pittsburgh	108,883	17
Michigan State	108,819	18
SUNY-Buffalo	107,455	19
Wisconsin	106,675	20
Indiana	105,906	21
Iowa	104,708	22
Purdue	104,068	23
Colorado	103,409	24
Arizona	100,268	25
Texas A&M	100,226	26
Florida	99,731	27
Iowa State	98,673	28
Missouri	94,500	29
Kansas	93,593	30
Overall Average	112,821	



## How Far is MU Behind?

**Median**  
 MU = \$94,500  
 Median (Minnesota) = \$110,037  
 Difference = **\$(15,537)**  
 Times 1,008 Faculty  
 Equals **\$(15,661,296)**

**Mean**  
 MU = \$94,500  
 Mean (All Others) = \$112,821  
 Difference = **\$(18,321)**  
 Times 1,008 Faculty  
 Equals **\$(18,467,568)**

**Mean MU Ranks & Disciplines**  
 MU = \$94,500  
 Mean (All Others) = \$106,370  
 Difference = **\$(11,870)**  
 Times 1,008 Faculty  
 Equals **\$(11,964,960)**

If we are to recruit and retain the high-impact faculty that are necessary to improve on the AAU indicators, we must address this long-standing problem. Rather than focus all our resources on across-the-board raises, our strategy is to identify and reward our top-performing faculty. With key support from UM System, we distributed \$2.4M (including benefits) in FY2014 in mid-year raises to 226 of our most productive faculty, as determined by a highly competitive process with criteria focused on our strategic priorities, including AAU indicators.

With this request for \$3.7M, we wish to continue this effort. Over the course of our 5 year plan we believe a specific investment of \$12.5M in recurring dollars toward salary increases and the related benefits for our most promising and vital faculty—and staff—will aid us in keeping outstanding

employees and create an environment in which we can compete for other top notch talent. We are asking for \$2M toward these special faculty salary increases, as well as \$600K to support academic promotional raises, \$600K to support diversity and spousal faculty recruitment, and \$500K in support of staff raises to support meeting minimums in the global grading system for a total request of \$3.7M. This additional \$2M is critical to our overall success with faculty recruitment. Having adequate resources for spousal recruitment, for example, is especially important, given our strategy of hiring mid-level and senior faculty with established research programs. We have already funded \$2.6M in FY2014 to support diversity and spousal faculty recruitment with expectations for even greater needs in FY2015. Because these funds are already stretched thin, the additional \$600K is essential if we are to be able to offer competitive recruitment packages.

We have multiple methods for assessing our progress in regard to improving faculty salaries. In the long-term we expect to see improvement in our AAU ranking for average faculty salaries, but other institutions near the bottom are also making similar investments, so significant improvement on our part will likely take 3-5 of sustained investments. As important as improving faculty and staff salaries is, however, it ultimately is a means to a larger end: retaining our very best faculty, who are best able to contribute to our overall goals to prepare “our students to solve the global problems of the future” and to “produce and disseminate knowledge that will improve the quality of life in the state, the nation and the world” (MUSOP). Ultimately, we will assess our progress with these larger goals using Phase 1 and Phase 2 AAU indicators.

2. Campus/system administrative unit priority as evidenced by an investment match. Please describe the campus/system administrative unit investment and the source of funding and how this signifies a campus/system administrative unit priority.

Our investment in our highest-achieving faculty cannot succeed unless we also continue to build the salary base for all faculty. Having a sustainable plan for merit increases for all faculty is especially important to retention of pre-tenured faculty, who may not yet have achieved the highly productive research portfolio recognized in our mid-year raises, but who nevertheless are critical to our long-term success as a high-impact research university.

Although we have not had new general operating funds available for merit increases, we expect colleges and divisions to reallocate resources to provide merit increases and cover benefits increases. We estimate these combined reallocations to support the competitiveness of our salaries and total compensation to amount to \$13.5M in FY15.

3. Projected impact on student learning and success. Please include a description of the measure(s) to be used to assess the impact, the magnitude of the expected change, and the timeline for results.

We are confident that success in recruiting and retaining the best faculty will have a positive effect by 2018 on many of our key metrics as identified in our Strategic Operating Plan, including the following:

- Independent faculty-mentored research experience
- Experiential learning
- FTE enrollment
- Total degrees awarded

- All AAU Phase I and some Phase II indicators (which are included in our strategy metrics)

4. Cross campus/system initiative and/or replicable and scalable. Please describe the extent to which this initiative includes one or more other campuses in the UM System and leverages the system, and/or why this initiative would be worthy of replication or would be scalable.

As with our request for funding for new hires, this goal of improving our AAU indicators offers significant benefits to the University of Missouri System and our sister campuses, most notably in opportunities for high-impact research and teaching collaborations across the system.

# Request for Strategic Funding

For Fiscal Year 2015

**Campus/Admin. Unit:** Columbia Campus  
**Lever:** 1.3 and 4.1 Recruit and retain the best traditional, nontraditional, and distance students. Develop and implement strategies for producing new net revenues.  
**Priority Ranking:** 3

Funding Request	For President's Use Only
Total Recurring <u>__\$975K_____</u> Total One-time <u>_____</u>	<input type="checkbox"/> Funded <input type="checkbox"/> Not Funded
Campus Match	
<i>For campus/ system administrative unit match, please indicate from where the source of funding will come (e.g. student fees, endowment income, etc.) Note: Item #2 below is available for additional narrative of the sources.</i>	Total Recurring <u>_____</u> Total One-time <u>_____</u> Comments: <u>_____</u> <u>_____</u> <u>_____</u>
Total Recurring <u>__\$975K_____</u> Total One-time <u>_____</u>	
Recurring Source <u>_Reallocation_</u> One-time Source <u>_____</u>	

**Justify the requested funding by responding to the criteria below.**

1. The extent to which the actions under this lever will have a measurable and significant impact on the campus/system strategy (return on investment). Please include a description of the measure(s) to be used to assess the impact, the magnitude of the expected change, and the timeline for results.

Student success is at the very heart of MU's Strategic Operating Plan, and virtually all of our proposed initiatives are designed to prepare our students to solve the global problems of the future. This emphasis on student success is reflected in our strategy metrics: total enrollment, six-year graduation rate, average time to graduation, and first-year retention.

As much as our plan also depends on innovative programming and curricula (such as undergraduate research opportunities and experiential learning), none of these innovations can be successful if our students do not remain at MU. Therefore, improving our first-year retention and graduation rates is a primary focus for our campus.

This attention to student success is not new to MU. Indeed, our success in the last twenty years attests to our strategic investment in our students. In 1993, first-time college students at MU had a six-year graduation rate of 60.1%. In 2012, that six-year graduation rate reached 70.7%. Similar success can be seen with other indicators as well. MU's freshman retention rate of 83.5% compares favorable to the state and national averages (75.1% and 78%, respectively).

Still, there is considerable room for improvement, and MU has made several key strategic investments, designed to increase student success. MU recently, for example, commissioned a detailed study of why students leave MU. Conducted by faculty member Dr. Steve Whitney, this research has given us valuable information about the primary causes for students' failure to return. (Financial difficulties are the most commonly cited reason for not returning.) From 2010 to 2012, 6,362 students left MU early. Almost 52% of these students (n=3,293) were in Advising Groups 3 and 4. The majority of these students begin MU as undecided/undeclared or as a "pre-" major (pre-engineering, pre-journalism, pre-communication). Another student population needing increased support is the transfer student group. We had 1,219 students transfer to MU from other institutions of higher education that left MU early (19.2% of early exiters).

Armed with data about which students are most at risk, we have begun implementation of Starfish, an early alert solution designed to assist students with academic difficulties. The next steps, which we are currently implementing, are MU Connect and the Student Success Collaborative (SSC), systems that allow for better collaboration across student support offices and help us to track student success and, most importantly, to intervene in a timely manner when students experience difficulties. Full implementation of MU Connect offers particularly promising opportunities to link academic advising with financial aid advisors, who can assist students experiencing financial difficulties.

Our goals for improving student success are ambitious: to increase by 2018 our freshman retention rate to 85%, our six-year graduation rate to 71.5%, and to decrease the average time to graduation to 4.1 years. To achieve these goals, we intend to make the following strategic investments:

- Expand Student Success Course 1150 so that our most at-risk students (those in Advising Groups 3 and 4) can be placed in the course in Fall Semester. Estimated cost to extend this course to these 1,040 students: \$275,000.
- Create a Student Success Course for students on academic probation. Estimated cost to serve 400-500 students each year: \$115,000.
- Expand the Student Success Course 2100 that assists students with career planning. Undecided students, "pre-" majors and would support students transitioning from their first intended major to a new major. Estimated cost to expand the course to serve 600 students per year: \$125,000.
- Create a Transfer Student Academic Support Center. Estimated cost to serve our transfer students: \$150,000. (This could be modeled after our successful Veterans Center.)
- Expand tutoring services provided the MU Learning Center and Campus Writing Center to meet increased need of students including increased writing tutor support in the Ellis Library Information Commons. \$85,000 per year.
- Hire additional support to implement Starfish and Student Success Collaborative. Cost: \$125,000.
- Create a fund to support special initiatives developed by academic departments, schools, colleges and other student support programs. These funds would be released through RFP structured to provide seed money for new initiatives. The projects would target programs with low student retention (<70%) and graduation rates (<65%). Projects can include research leading to data driven program development at the department/school/college level. This effort would create intervention and support

programs that are closer to the students. Estimated cost for this initiative: \$100,000 per year.

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2. Campus/system administrative unit priority as evidenced by an investment match. Please describe the campus/system administrative unit investment and the source of funding and how this signifies a campus/system administrative unit priority.

Our investment match is based on increased commitments to scholarships, which increase our ability to recruit high-achieving students. This strategy of increased scholarships is directly tied to our commitment to improving student success. The more high-achieving students we are able to recruit, the higher our graduation and retention rates will be.

3. Projected impact on student learning and success. Please include a description of the measure(s) to be used to assess the impact, the magnitude of the expected change, and the timeline for results.

As indicated above, these investments offer a powerful opportunity to improve student success, as measured by our key strategy metrics: total enrollment, six-year graduation rate, average time to graduation, and first-year retention rate. In addition, although the primary indicator of success will be reaching or exceeding our targets these metrics by 2018, these retention efforts also offer promising opportunities for increased revenue. The financial impact of retaining an additional 300 students across the five years is \$3M, on our campus. If adapted and adopted on other UM campuses, these interventions could translate into even more significant savings.

4. Cross campus/system initiative and/or replicable and scalable. Please describe the extent to which this initiative includes one or more other campuses in the UM System and leverages the system, and/or why this initiative would be worthy of replication or would be scalable.

Because retention is an issue for all four campuses and because several of our earlier interventions—most notably the adoption of Starfish—have been system-wide collaborations, this funding request has considerable opportunities for application on other campuses. Certainly the data we collect on what is and what isn't successful with these interventions will be of great value to our sister campuses.

# Request for Strategic Funding

For Fiscal Year 2015

**Campus/Admin. Unit:** Columbia Campus  
**Lever:** 3.2 and 3.3 Invest in new technologies that promote collaborative and interdisciplinary research and teaching. Provide the scholarly infrastructure for libraries, research collections, and scholarly communication to ensure faculty and student success.  
**Priority Ranking:** 4

Funding Request	For President's Use Only
Total Recurring <u>__\$1.75M_____</u> Total One-time _____	<input type="checkbox"/> Funded <input type="checkbox"/> Not Funded
Campus Match	Total Recurring _____
<i>For campus/ system administrative unit match, please indicate from where the source of funding will come (e.g. student fees, endowment income, etc.) Note: Item #2 below is available for additional narrative of the sources.</i>  Total Recurring <u>__\$1.5M_____</u> Total One-time _____  Recurring Source <u>additional tuition revenue</u> One-time Source _____	Total One-time _____
	Comments: _____
	_____
	_____

**Justify the requested funding by responding to the criteria below.**

1. The extent to which the actions under this lever will have a measurable and significant impact on the campus/system strategy (return on investment). Please include a description of the measure(s) to be used to assess the impact, the magnitude of the expected change, and the timeline for results.

Hiring and retaining high-impact faculty and supporting student learning can only be successful if faculty have the tools necessary for their work, and campus infrastructure represents a key component of such success. This request focuses on two specific components of campus infrastructure: MU Research Core Facilities and IT needs related to big data storage.

The MU Research Core Facilities provide a centralized resource for cutting-edge technologies and state-of-the-art, high-end instrumentation to support the research and educational missions of the University of Missouri. By centralizing these capabilities and sharing the personnel and infrastructure investments among administrative units, MU faculty scientists and student trainees have access to the latest technology and equipment for pursuit of their research and academic goals. Two recent acquisitions, for example, include an Illumina MiSeq next generation genome analyzer capable of high throughput metagenomic analysis of biological samples and a custom-

designed single/dual photon confocal microscope for cellular and molecular imaging that addresses critical needs of over 85 investigator laboratories. In addition to providing cutting-edge technology for MU researchers, the MU Research Core Facilities are also available to regional academic and commercial interests as a component of the University's mission to contribute to the region's economic development. Investment in centralized Research Core Facilities provides individual investigators with cost-effective access to the latest technology development, as well as technical expertise on site for consultation in experimental strategy and design. It would be cost-prohibitive for any individual administrative unit or investigator to acquire, install and operate many of these instruments. Access to the instrumentation and technical support/training are provided to research teams using a fee structure that attempts to recoup as much of the operational costs as possible, yet provides these critical resources at a rate affordable and competitive for ever-tightening research budgets. Lack of access to the high-end technologies provided by the Research Cores would significantly weaken the quality of grant applications from many MU researchers. Additionally, access to these technologies has become an important classroom training tool for our next generation of research scientists.

We are requesting here \$1.0M in recurring funds to establish a designated fund for upgrading and replacing the high-tech instrumentation provided through the Research Core Facilities. Fortunately, we already have a well-established policy for investment decisions. These are continually assessed by the scientific faculty and the Office of Research administration, providing an annual updated priority list for acquisitions. At the top of the current list is an upgrade of MU's flow cytometric analysis capabilities. Current technology allows the simultaneous detection of some 20 cellular parameters using fluorescence detection of multiply labeled cellular molecules, while our current instrumentation allows detection of only 5-6 parameters. Without an upgrade to a 5-laser, 20-parameter instrument (~\$385K), our immunologists, cellular biologists, cancer biologists and others are at a distinct disadvantage in the complexity of experiments they can design and carry out. As a stark example of that disadvantage, one new investigator was recently strongly criticized in a grant review for not proposing cutting edge multiparameter experiments to more thoroughly address complex cellular responses in an immune response to infecting pathogens.

In addition to the \$1.0M investment in Core Facilities, we are also requesting \$750K to support increased needs within IT, particularly as related to big data storage needs. Similarly to Core Facilities, these are infrastructures that are too expensive for any one researcher to establish and/or maintain. But as needs for big data storage continue to grow, it will be essential that we have appropriate big data resources, if we are to be competitive for externally funded research.

We will measure the impact of these investments using nationally normed data about research productivity. Specifically, we expect to see increases within five years in research grants, citations, and publications from the research laboratories using these new or upgraded technologies.

2. Campus/system administrative unit priority as evidenced by an investment match. Please describe the campus/system administrative unit investment and the source of funding and how this signifies a campus/system administrative unit priority.

Our overall plan for improving Core Facilities and big data needs is to increase research core facilities by \$4M in recurring funds over the next four years and to increase IT/big data recurring resources by \$2M in that same time frame. We are asking that the system contribute to this effort

by providing \$1.75 in recurring funds for FY2015. We have been providing significant one time resources in the last couple of years to begin work on these important issues, having provided more than \$1.7M in one time resources in FY13 and FY14 for these purposes.

3. Projected impact on student learning and success. Please include a description of the measure(s) to be used to assess the impact, the magnitude of the expected change, and the timeline for results.

Graduate and undergraduate students involved in either independent or faculty-led research projects will benefit directly from the opportunities to participate in research possible through cutting-edge resources. For graduate students we will measure the impact of this investment using research productivity and specifically expect to see an increase in publication and citations from graduate students working with these new technologies. For undergraduate students, we expect to see an increase in the number of students from these research laboratories participating in our spring research forum.

4. Cross campus/system initiative and/or replicable and scalable. Please describe the extent to which this initiative includes one or more other campuses in the UM System and leverages the system, and/or why this initiative would be worthy of replication or would be scalable.

We are aware of significant opportunities for collaboration between our campus and the UM System regarding IT needs and hope that this request for big data needs can be coordinated with UM System plans.

## Appendix A: Strategic Hiring in Virology and Molecular Therapy

### Summary

We propose strategic recruitment of four prominent faculty investigators to enhance interdisciplinary and translational research in Virology and Molecular Therapy at MU. Because this effort builds upon an already solid foundation of research in this area, we are in an ideal position to recruit the highest caliber of scientists, including current Howard Hughes Investigators and members of the National Academy of Sciences, or scientists who are poised to join their ranks. This expansion will solidify our standing among national leaders in this field, and will significantly raise MU's distinction and visibility. It will immediately generate new research funding for the campus and will leverage additional future resources in the form of large federal research grants and commercial partnerships. As such, this expansion will directly and immediately strengthen our AAU status by enhancing phase I indicators (federal funding, NAS members, faculty awards and citations).

### Significance and Impact

Science has made astounding progress against diseases caused by viruses. Smallpox, polio and other scourges have been eradicated or reduced to preventable infections. Recently developed antiviral drugs have turned AIDS into a manageable chronic disease. Infection with HIV was considered a death sentence less than 20 years ago; now it is treated with one pill a day, and these pills have saved millions of person-years of human life in the US alone. MU researchers are at the forefront of this research. ***As one example, building directly from work carried out at MU, Merck recently licensed a compound called "EFdA," the most potent and promising anti-HIV agent to date for the treatment and prevention of HIV.***

And yet the battle continues. Viral diseases remain a leading cause of death worldwide. Right now, over 400 million individuals are chronically infected with Hepatitis B Virus (HBV), over 170 million with Hepatitis C Virus (HCV), and over 30 million with Human Immunodeficiency Virus (HIV). Every year, nearly 30,000 Americans die from these three viral diseases, and 50,000 more become chronically infected. Influenza epidemics annually result in about three to five million cases of severe illness and up to 500,000 deaths worldwide, and 50,000 deaths are predicted in the US during the current flu season. Importantly, in this era of globalization, worldwide outbreaks of new and emerging viruses continue to endanger humanity and contribute to an immense burden on the US and world economies. There is a real need for science to continue making groundbreaking progress against these deadly and ever-evolving viral pathogens.

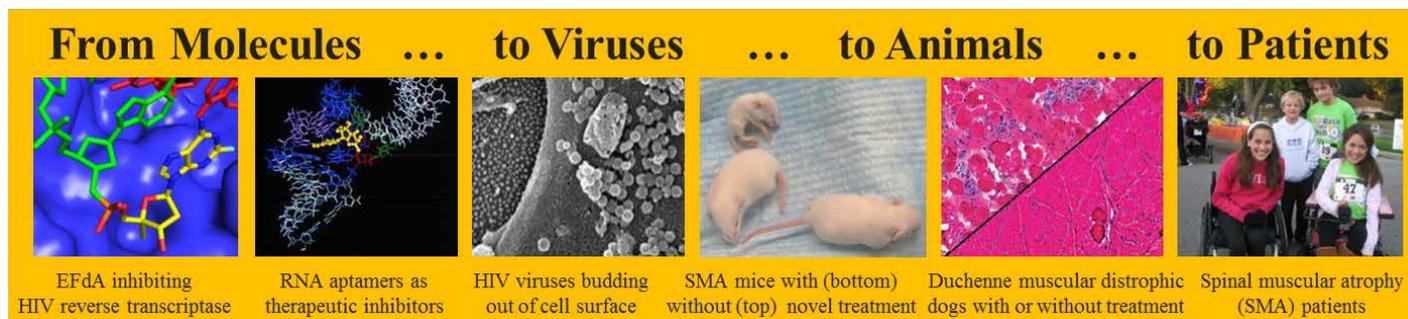
But viruses are not always harmful. Gene therapy researchers at MU are harnessing benign viruses to deliver genetic cargo that corrects genetic defects. The aim of gene therapy is to use viruses as vehicles that will deliver "corrected" copies of missing or dysfunctional genes. Work at MU has marshaled this exciting approach to address genetic diseases such as Muscular Dystrophy (MD), Spinal Muscular Atrophy (SMA), Cystic Fibrosis (CF), and Huntington's Disease (HD). Currently, there is no effective treatment or cure for any of these diseases, which is staggering considering the unmet

needs of the patients. For example MD occurs in 1 of every 2,500 boys and SMA in 1 of every 6,000 births. State-of-the-art research in gene therapy at MU has attracted nearly \$20 million dollars of NIH and private foundation research funds to support the goal of developing therapies for genetic diseases. **For example, a recently patented gene therapy product developed at MU has been shown to extend life expectancy 6-fold in animal models of SMA**, a human disease that is often fatal in childhood. MU is actively seeking a corporate partner for the commercial development of this product.

### Existing Strengths

We have established a highly interactive, thoroughly integrated, inter-departmental group that addresses some of the most significant contemporary issues in Virology and Molecular Therapy. Scientists in our group currently work on a variety of viral pathogens that cause major diseases such as AIDS, Hepatitis B, Hepatitis C, Influenza, Ebola, SARS, and Dengue Hemorrhagic Fever, in addition to diseases caused by emerging viruses that may be a threat in the future. Members of our group are also developing viral gene therapy treatments for Muscular Dystrophy, Spinal Muscular Atrophy, Cystic Fibrosis, Huntington’s Disease, and AIDS. Significant therapeutic advances are within reach for these diseases but have not yet developed to an advanced clinical stage, thus offering opportunities for tremendous impact on the field. We approach these problems in the following ways:

- *Discovering molecules that stop replication of pathogenic viruses.*
- *Developing methods for delivering genes and biomolecules to treat genetic and infectious diseases.*
- *Designing therapeutic strategies to promote protective immune response against infection.*
- *Conducting basic science research in the biology of viruses to identify molecular targets for next-generation therapeutics.*
- *Discovering and developing diagnostics that will provide immediate benefit to the medical community.*



Our strengths in these areas are recognized internationally, and we have a proven record in advancing the scientific frontiers of virology and molecular therapy, both individually and

collaboratively. By any measure, several of our members are among the world leaders in their respective areas. Our *per capita* research funding currently places us among the top tier Virology Programs in the country. Adding faculty with similar or greater levels of productivity will expand our total group strength and promote the acquisition of multi-investigator, center-type grants, elevating our Institute to international preeminence.

As evidence of these strengths (data are from 2007 - 2013):

- We have published over 250 scientific articles.
- We have been awarded over \$45 million federal and private research dollars.
- We have generated multiple invention disclosures and patents.
- We have presented our findings in well over 100 national and international scientific conferences.
- We have trained numerous post-doctoral fellows, graduate students, and undergraduate students, who have spread throughout the country's most prestigious research institutions, such as Harvard, Yale, Johns Hopkins, Mayo Clinic and Columbia University. Importantly, some of them return to Missouri and contribute further to the Missouri economy.
- We have already established an interactive, interdisciplinary and collaborative environment for scientific excellence.

These data establish confidence that we have an established a strong foundation in Virology and Molecular Therapy research that will enhance our ability to attract outstanding colleagues.

While the Virology and Molecular Therapy group comprises highly productive individual laboratories and outstanding scientists, it lacks critical expertise in a few key areas. Addressing these areas through new strategic hires will push us over a major threshold and will help us make quantifiable progress against the worst human afflictions. This expansion will provide critical mass leading to competitive applications for multimillion dollar federal "Center Grants" and "Program Project Grants" and will increase the potential for commercial applications.

### **Approach**

We propose to recruit four nationally-recognized investigators of the highest caliber. These investigators will be selected on the basis of having vigorous and well-funded research programs that are **translational and interdisciplinary** in nature and that are accelerating in productivity and innovation. Their programs will be synergistic and complementary to current research areas, and they

will combine a strong basic science foundation with a track record of translation into tangible deliverables. With this expansion we will:

- *Be more effective at targeting viral diseases and viral gene therapies, and translating these advances to practical application;*
- *Accelerate progress toward new, high-impact discoveries that benefit human health and boost our national and international visibility;*
- *Increase interaction with, and investment by, extra-mural translational research partners, such as government agencies and pharmaceutical companies; and*
- *Have direct tangible benefits to the local community by providing cutting-edge training and employment opportunities and by aiding in the recruitment of new faculty, students and clinicians.*
- *Increase MU's standing within the AAU by directly enhancing our phase I metrics (federal funding, NAS members, faculty awards and citations)*

### **Implementation and Leverage**

**Recruitment of new investigators:** The FOUR prominent, mid-career investigators will have well-funded research programs and strategic expertise in the following three highly visible areas:

**Human Viral Diseases.** Two of the recruited investigators will use state-of-the-art technologies to study viruses that cause high-impact human diseases. Examples of such viruses include influenza virus, hepatitis C virus (HCV), hepatitis B virus (HBV), mosquito-borne viruses (such as dengue virus, yellow fever virus, and West Nile virus), and rotavirus (the leading cause of water-borne diarrheal diseases worldwide). ***These viruses cause some of the most important infectious diseases in the world, and so are the targets of national and international funding agencies.*** Viruses that cause human and animal diseases are a major focus of current faculty in our department; hence, the new faculty will synergistically enhance existing strengths and collaborations, including those across campus with investigators outside the School of Medicine. We expect that this investigator will also have clinical experience to aid in potential translational applications. Moreover, addition of powerful new methodologies, expertise and tools will significantly augment the scientific scope and depth of our programs.

Examples of scientists who fit these profiles\*

- Dr. Michael Diamond (Washington University in St. Louis)
- Dr. Michael Farzan (The Scripps Florida Institute)

**Viral Vector-mediated Gene Therapy.** The third investigator will be a leader in the field of viral vector-mediated gene therapy. To complement program strengths in viral gene therapy of muscular dystrophy and neurological diseases, we will target investigators working on neurodegenerative, muscular degenerative and cardiovascular diseases. Our department is already home to two true leaders in viral vector-mediated gene therapy (Duan, Lorson). The addition of established investigators will further strengthen MU in the fields of novel viral gene delivery vector development and translation of these innovative therapies to patients.

Examples of scientists who fit these profiles\*

- Aravind Asokan (University of North Carolina-Chapel Hill)
- Federico Mingozzi (Children's Hospital of Philadelphia, UPenn)
- Brian Kaspar (Nationwide Children's Hospital)
- Beverly Davidson (University of Iowa)

**Viral Diagnostics and Discovery.** The fourth investigator will be at the cutting edge of developing 21st century diagnostics. We are especially interested in investigators who combine expertise in infectious disease and in sensor micro-engineering or nanotechnology and who will therefore interact with multiple disciplines across the MU campus, such as Virology, Nanotechnology, Veterinary Medicine, Animal Sciences and Engineering. Ideally, the person should also have a basic science interest in virus discovery to develop a complementary program in identifying emerging viral pathogens. ***Viral diagnostics and virus discovery are a top priority for government and private agencies, both for threat reduction and general health.*** MU has strengths in bioengineering and nanotechnology, so adding expertise in this area will provide critical leadership to focus these efforts toward viral diseases.

Examples of scientists who fit these profiles\*

- Ian Lipkin (Columbia University)

***\* These researchers have not been contacted for potential recruitment, but they exemplify the caliber of individuals we will be targeting for these positions.***

### **Administration Structure and Existing Resources**

The new hires will be housed either in the MU Bond Life Sciences Center (if available and appropriate) or in the Medical Sciences building of the MU Medical School. Decisions about location will largely depend on their research focus, proximity to natural collaborators, and proximity to the

University Hospital if the researchers interact with patients. Because the Virology and Molecular Therapy group already meets for internal research discussions on a weekly basis, the new hires will gain immediate scientific interactions with the rest of the group regardless of where their laboratory is located.

### **Leverage of External Resources**

We will restrict recruitment to prominent, mid-career investigators who have been awarded significant competitive federal funding. Collectively, we anticipate that they will transfer to MU approximately \$2 M per year. We will continue to leverage funding support through the acquisition of federal, state and private funds. While the current per capita funding of the Virology and Molecular Therapy group ranks high nationally, the proposed expansion will allow increased acquisition of new federally-funded individual research grants, multi-investigator grants, Program Project Grants, and Training Grants, several of which are specifically targeted to larger programs. Thus, this expansion will push our program into the top tier nationally. Our work will continue to generate translational intellectual property that will lead to licensing income that stays associated with MU and that will foster and facilitate launching of startup companies. These activities will strengthen our AAU standing by enhancing federal funding, number of members of the National Academy of Sciences, faculty awards and citations.

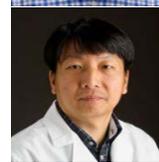
### **Research Profiles of MU's Current Virology and Molecular Therapy Team Leaders**

**Donald H. Burke** works on nucleic acid aptamers, which are potent anti-HIV-1 agents that are ideal for gene therapy, diagnostics and studying viral pathogenesis. He was recruited from Indiana University in 2005. Since 2007, he has received \$4.3 million in funding from NIH, NSF & NASA.

**Dongsheng Duan** is developing gene therapy to treat Duchenne muscular dystrophy, the most common fatal childhood muscle disease. The Duan lab's work in dystrophic dogs has paved the way for testing gene therapy in human patients. Since 2007, he has been awarded over \$10.3 million in NIH and foundation funding.

**Bumsuk Hahm** works on host immunity to infection and therapies to remedy viral diseases, including influenza. He was recruited from The Scripps Research Institute in 2008. In the last five years, he has been awarded over \$2.2 million in funding from NIH.

**Marc Johnson** studies how viruses coerce their host cells into assembling the viral raw materials for virus production. He has been awarded \$3.4 million in funding since 2007, including grants from NIH and a prestigious Beckman Young Investigator Fellowship.



**Shan-Lu Liu** works on viral pathogenesis and host factors that restrict HIV-1, Ebola, and HCV. He was recently recruited from McGill University where he was named as a Canada Research Chair in Virology and Gene Therapy. His work has been supported by \$2.7 million in funding.

**Christian Lorson** works on pediatric neurological disorders. Since 2007, he has been awarded over \$6.2 million in NIH and foundation funding. He is the National Scientific Director for FightSMA and is a member of the Scientific Advisory Committees of the Muscular Dystrophy Association and the California Institute of Regenerative Medicine.

**David Pintel** studies virus replication, gene expression and viral-host interactions that govern the outcome of infections. Since 2007 Dr. Pintel has been awarded \$6.2 million in funding from NIH. He is an elected member of the American Academy of Microbiology.

**Stefan G. Sarafianos** works on the development of antivirals that target major pathogens, including HIV, SARS, Hepatitis B and C viruses. His research helped the development of EFdA, a highly potent HIV inhibitor, currently in pre-clinical trials. He also holds patents on foot-and-mouth-disease virus and SARS Coronavirus antivirals. Since 2007, his research has been awarded \$9.7 million.

The above core members of the Molecular Virology and Molecular Therapy group interact extensively with other scientists on campus, including **Virologists** (Alexander Franz, Vet Pathol; William Folk, Biochemistry; Robert Ralston, MMI; George Smith, Bio Sci; James Schoelz, Plant Sci), **Structural Biologists** (Xiao Heng, Jack Tanner, Biochemistry;), **Microbial Pathogenesis and Infectious diseases researchers** (Deborah Anderson and George Stewart, Vet Pathol; Michael Baldwin, Huatao Guo, and Mark McIntosh, MMI; Mark Hannink, Biochemistry), **Immunologists** (Mark Daniels and Emma Teixeira-Pernas, MMI; Gary Clark, Daniel Schust, ObGyn), **Skeletal Muscle** researchers (Frank Booth, Ron Terjung, Harold Laughlin, Biomed Sci; Steve Segal, Med Pharm Physiol; and D Cornelison, Bio Sci) and **Cardiology and Cardiomyopathy** researchers (Bill Fay, Internal Med; Deborah Fine, Vet Med & Surg, and Kerry McDonald, Med Pharm Physiol).