A Historic Year for CSU Research

Alan S. Rudolph
VP Research

Dec 5, 2019
A Historic Year for CSU Scholarship, Research and Innovation

Our ROI: FY19 Highlights, Awards, and Impacts

Growth Drivers

Investment Options and Outcomes
What is our Return on Investment (ROI?) in Research: The 7 ROIs….

Return on Impact (from local to global)
Return on Inter- and Transdisciplinary Collaboration
Return on Investment and Resources (financial, human, time)
Return on Innovation (ideas to scale)
Return on Inclusivity (and principles of community)
Return on Initiatives (and strategic priorities)
Return on Imagination (did we learn, challenge and enlighten ourselves?)
Selected FY19 Research Highlights

- Multiple National Awards: Our newest National Academy Member (from presidential young investigator to lifelong society career awards)
- Our deep expertise in Atmospheric Science continues: NOAA-CIRA recompete won ($155M 5 year NOAA award)
- New Facilities On-line: TMI and Richardson Design opening and broke ground on vector research building
- New Columbine Center for Healthy Aging Launched
- New strategic corporate partnerships with Nutrien, Mars, HP, Lockheed Martin, Caterpillar, Arthrex, Zoetis
- New Cybersecurity centers and Data Sciences Launched
- Expansion of Foothills Impacts: Zoetis Incubator at Foothills and new global and One Health large impact projects
- Open Philanthropy project launches largest canine cancer clinical trials
- Research administrative investments payoff: NSF Audit completed with minimal outcomes

The administrative backbone:

RamAround Research Administrative Team and Sponsored Programs
2019 CSU College Awards and Honors

Highlights Include:

- Diana Wall, SOGES, British Ecological Society President’s Medal
- Kelly Wrighton, Agricultural Sciences, Presidential Early Career Award for Scientists and Engineers
- Sonia Kreidenweis, WSCOE, American Geophysical Union Fellow
- Sue VandeWoude, CVMBS, National Academy of Sciences

Number of Awards at Colorado State University

Award Type:
- Early Career
- Teaching
- Lifelong Learning
- Service
- Association

Ravi Ravishankara, Dept. Chemistry, Royal Society
FY 19 by the numbers...
Our Infrastructure Investments are Paying Off

$398.5M FY 2019 TOTAL EXPENDITURES (1) BY FEDERAL SOURCE

5 CONSECUTIVE YEARS OF INCREASED HHS EXPENDITURES

BAR SIZE REPRESENTS THE VALUE INDICATED AT THE BASE
Our Infrastructure Investments are Paying Off

36 PERCENT INCREASE
IN PROPOSALS
OVER THE LAST FIVE YEARS

$1.3 Billion TOTAL IN FY19

26 PERCENT INCREASE
IN SPONSORED EXPENDITURES IN THE LAST FIVE YEARS

BAR SIZE REPRESENTS THE VALUE INDICATED AT THE BASE

23 PERCENT INCREASE
IN INDUSTRY AWARDS IN THE LAST FIVE YEARS

29 PERCENT INCREASE
IN SPONSORED AWARDS
OVER THE LAST FIVE YEARS
Research Expenditures – All Funding Sources FY2018

FY 2018 Total R&D Expenditures - All Funding Sources ($000s)
BOG Peer Group (Source: NSF HERD Survey)

- Texas A&M U., College Station and Health Science Center: $922,178
- U. California, Davis: $788,832
- Michigan State U.: $715,290
- U. Illinois, Urbana-Champaign: $652,709
- Purdue U., West Lafayette: $631,574
- Virginia Polytechnic Institute and State U.: $531,636
- North Carolina State U.: $509,841
- Colorado State U., Fort Collins: $374,955
- Iowa State U.: $361,206
- Washington State U.: $360,522
- Oregon State U.: $272,433
- U. Tennessee, Knoxville: $259,607
- Kansas State U.: $218,299
- Oklahoma State U., Stillwater: $188,756
FY 19 by the numbers…

Corporate Strategic Partnerships

And Technology Transfer
A First of its Kind Corporate Discovery and Innovation Partnership for CSU

- World’s largest animal health company
- Established ‘Idea Incubator’ at Foothills Campus
- Hiring 15-20 local scientists in livestock health
- Engaged to establish research and student collaborations and work in our core labs
- Focus on early stage R&D in areas relevant to Colorado Agriculture
- Cluster Hire in similar areas underway at CSU which will bring largest talent pool in livestock health in the US to region
Video: Zoetis leadership on choosing CSU

“Our agreement with Zoetis represents the beginning of an era of collaboration, cooperation, and innovation between public and private research leaders, all in the interest of improving animal health.”

-Ray Goodrich, Executive Director, IDRC

https://youtu.be/RSIgl-iX83k
Industry Research Partner Activity
CSURF: Intellectual Property, Licenses and Start-ups

- Inventions: 127
- Patent Applications: 149
- Issued Patents: 47
- Licenses: 52
- Licensing income: $3.82M
- Startups: 6
Industry Supported Research Expenditures FY2018

FY 2018 Total R&D Expenditures Funded by Industry ($000s)

BOG Peer Group (Source: NSF HEDS Survey)

North Carolina State U. $54,683
Purdue U., West Lafayette $50,025
U. California, Davis $43,560
Virginia Polytechnic Institute and State U. $42,278
U. Illinois, Urbana-Champaign $41,524
Texas A&M U., College Station and Health Science Center $23,433
Iowa State U. $14,995
Washington State U. $13,191
Michigan State U. $11,880
Oklahoma State U., Stillwater $11,288
Colorado State U., Fort Collins $9,211
Oregon State U. $6,709
Kansas State U. $6,219
U. Tennessee, Knoxville

23% PERCENT INCREASE IN INDUSTRY AWARDS IN THE LAST FIVE YEARS
Growth Drivers

• Graduate Student Support
• New Strategic Centers and Institutes
• Internal and External Collaborative Networks
• Foothills Campus Development
Growth Drivers

- Graduate Student Support
- New Strategic Centers and Institutes
- Internal and External Collaborative Networks
- Foothills Campus Development
Growth Driver: Graduate Student Research Support

Afnan Shazwan Nasaruddin

PhD Student, Saving Colorado’s Crops from Disease
Award Winner at Western Regional Conference

“The experiences I gained will help me improve my skills in public science communication and make me more confident in putting myself out there,”

Hajar Homayouni

Masters student WRG award winner in Computer Science

“These experiences inspire me to do more in communicating science to the public.”
Graduate Student Support from External Funds

A total of $21,896,902 was provided by external sponsors in support of graduate students. These expenses include salary, benefits, tuition, stipend and hourly pay.

Number of Graduate Students Supported on Externally-Funded Research by College FY 2019

FY 2019 External Support for Graduate Students by College

FY 2019 External Support for Graduate Students by Sponsor Group

Number of Graduate Students Supported on Externally-Funded Research by Sponsor Group in FY 2019

Multiple sponsors include NSF, DOE, DOD, NASA, NIH, USA, DOE, and More.

Multiple funding sponsors include some non-federal domestic and foreign institutions of higher education and government entities.

Multiple funding sponsors include some non-federal domestic and foreign institutions of higher education and government entities.
Growth Drivers

• Graduate Student Support
• **New Strategic Centers and Institutes**
• Internal and External Collaborative Networks
• Foothills Campus Development
Growth Driver: One Health

- Climate driven health challenges
- Environmental and Ecosystem Health
- Animal and Human Health
- Food, Energy and Water Health
- Natural Resource Resiliency
- Disease transmission between animals and humans

Managing West Nile Virus in Colorado

Livestock Antimicrobial Resistance from Ranch to Retail

Complex community interactions
Growth Driver: Expanding Human Clinical Trials Research

New Hires:

Nicole Earhardt  
Director, CHA

Sue VanDeWoude  
Director, OHI

Heather Pidcoke  
Chief Medical Research Officer

- Enhanced Clinical Trials in Infectious Disease, Regenerative Medicine, and Cancer (approximately 35 ongoing human clinical trials)
  - Translational Medicine Institute
  - One Health Institute (OHI)
  - Columbine Center for Healthy Aging (CHA)
  - Mental Health and U@CSU
  - Clinical Regulatory Affairs and Operations

First Brain Images from Human Patients with new MRI at TMI
Growth Driver: Environmental Sciences

Dan Zimmerle
Senior Research Associate
Energy Institute

NOAA Cooperative Institute for Research in the Atmosphere

Methane Leak Detection Site
For ARPA-e Monitor Program

PACH: Partnership for Air Quality Climate and Health

Emily Fischer
Macelwane Medal from AGU & Presidential Award for mentoring in STEM in Women’s Network

Foundation for Food and Agricultural Research
• Cooperative agreement with US Army Corps of Engineers for over 20 years
• Leading institution in the US in support of Military Base Environmental Compliance
• Center has doubled in size over the last 5 years due to increasing regulation
• WCNR Leadership has positioned center to continue expansion and seek greater ties to CSU mission and visibility

680 employees (600 off campus) across US and Internationally
Growth Drivers

• Graduate Student Support
• New Strategic Centers and Institutes
• Internal and External Collaborative Networks
• Foothills Campus Development
Catalyst for Innovative Partnerships ROI

12 Teams in 2 cohorts, $200K, 2 Years to reach next investor ($10M)

- Proposals Submitted: 267/ $271m
- Awards Received: 76/ $23m
- Colleges Represented: 8
- Internal Team Members: 289
- External Partners: 77
- Publications: 168
- Citations: 28
- Presentations: 303
Partnering in Colorado

- **Colorado Energy Research Collaboratory** – unique partnership with DoE-NREL, CS Mines and CU. Primed for state renewal
- **Colorado School of Public Health** – strategic planning across the schools and collaborative seed funding started in FY 19
- **Colorado Clinical and Translational Sciences Institute** – A large NIH translational medical institute in collaboration with CU Anschutz
- **CSU Pueblo** – research administration support and programmatic support for Cannabis and Hemp programs
- **National Western Center** – supporting water and Ag innovation program development
CSU is Poised for Expanded Impact in Ag Biodefense and Biosecurity

- CSU Infectious disease faculty have been enhanced by recent awards and cluster hires
- Poised to expand capabilities for USG
  - African Swine Fever, Foot and Mouth Disease
  - VSV and regional endemic threats (Newcastle)
  - Potato and citrus diseases
  - Expanded human Rx production
- BioMARC manufacturing facility is positioned to expand toward new Advanced Development and Manufacturing for Ag threats

BioMARC wins Colorado Manufacturer Award for 2019

CSU Hosts the DC Bipartisan Commission on Biodefense
Focus: “Agricultural Biodefense, Too Important to Ignore”

Design Phase of BioMARC expansion for Ag growth
Growth Drivers

- Graduate Student Support
- New Strategic Centers and Institutes
- Internal and External Collaborative Networks
- Foothills Campus Development
Foothills Campus Planning:

- FY19 saw a dramatic increase in Foothills investments and impact with significant investments from public and private sector in animal and human health
- Vector Research Building ground breaking
- OVPR visioning task force in FY19 will lead to next phase of master planning

Infectious Disease Research Center

Foothills South Campus
Foothills North Campus
Science and Engineering of our Environment

Hydraulics and Water Testing Lab
XUV Laser Laboratory
Colorado Climate Center
NOAA Cooperative Institute for Research in the Atmosphere
A Historic Year for CSU Scholarship, Research and Innovation

Investment Options and Outcomes
Future Investments Planned and Outcomes

- Human clinical research with One Health and medical school expansions
- Core Research Facilities and Strategic Research Priorities
- Foothills Campus
- Graduate Students and Cluster Hires
- Strategic Transformation Priorities

- Clinical Trial support in regulatory affairs and management to support increased human medical impacts
- Additional core resources for wider access to existing and new research facilities
- New innovation campus on global health at Foothills?
- Research expenditures of $500M in 5 years
Key Considerations for Future Priorities and Investments in Research

• Base Support for Faculty Start Up and Retention and new cluster hires focused on research outcomes

• Expanding Diversity and Inclusion Initiatives

• Sustaining IDC returns from adjusted F&A rates and continued investments in Research and Scholarly Success Initiative and Strategic Transformation

• Evaluation of Resourcing to priorities/phases and using integrated sources from IDC, thematic philanthropic fundraising, expanding corporate strategic partners and networks

• Stabilizing Investments for Strategic Centers and Institutes (SRUs) similar to SAUs (Special Academic Units)

• Enhancing Strategic External Partnerships through all Mission elements including Engagement/Extension
## Office of the Vice President for Research - FY20 Financial Summary

<table>
<thead>
<tr>
<th>Operations</th>
<th>$9,452,073</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biosafety</td>
<td>394,564</td>
</tr>
<tr>
<td>Laboratory Animal Resources</td>
<td>962,566</td>
</tr>
<tr>
<td>Proteomics &amp; Metabolomics Facility</td>
<td>130,514</td>
</tr>
<tr>
<td>Research Integrity &amp; Compliance</td>
<td></td>
</tr>
<tr>
<td>Review Office</td>
<td>1,127,755</td>
</tr>
<tr>
<td>Research Services</td>
<td>1,206,442</td>
</tr>
<tr>
<td>Sponsored Programs</td>
<td>2,599,147</td>
</tr>
<tr>
<td>Vice President for Research Office</td>
<td>3,031,085</td>
</tr>
<tr>
<td>Kuali Research Administration</td>
<td>341,452</td>
</tr>
<tr>
<td>New Faculty Recruitment *</td>
<td>2,982,437</td>
</tr>
<tr>
<td>Centers/Institutes</td>
<td>3,456,686</td>
</tr>
<tr>
<td>Energy Institute</td>
<td>1,418,795</td>
</tr>
<tr>
<td>Infectious Disease Research Center</td>
<td>1,686,600</td>
</tr>
<tr>
<td>One Health Institute</td>
<td>351,291</td>
</tr>
<tr>
<td>Core &amp; Specialized Facilities</td>
<td>871,948</td>
</tr>
<tr>
<td>Programs of Research &amp; Scholarly Excellence</td>
<td>581,299</td>
</tr>
<tr>
<td>Research Building Revolving Fund</td>
<td>2,113,813</td>
</tr>
</tbody>
</table>

* Initial base allocation of funding to support new faculty recruitment
<table>
<thead>
<tr>
<th>Research &amp; Scholarship Success Initiative**</th>
<th>1,201,368</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY20 New Base Funding (Post-Award, Compliance, Safety, Inst. Facilities)</td>
<td>382,300</td>
</tr>
<tr>
<td>One-Time Return of F&amp;A for RSSI</td>
<td>1,520,000</td>
</tr>
<tr>
<td>** This amount already embedded in other budgeted funds listed above. Not included in GRAND TOTAL to avoid double-counting.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Strategic Initiatives ***</th>
<th>3,898,449</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag Biodefense</td>
<td>350,000</td>
</tr>
<tr>
<td>Catalyst for Innovative Partnerships</td>
<td>200,000</td>
</tr>
<tr>
<td>CSU/Davis/Mars</td>
<td>70,000</td>
</tr>
<tr>
<td>Cost Sharing</td>
<td>300,000</td>
</tr>
<tr>
<td>Fundraising/Development</td>
<td>117,575</td>
</tr>
<tr>
<td>Graduate/Undergraduate Research</td>
<td>50,000</td>
</tr>
<tr>
<td>Infectious Disease Research</td>
<td>200,000</td>
</tr>
<tr>
<td>Institutional Memberships</td>
<td>115,000</td>
</tr>
<tr>
<td>ISTeC</td>
<td>84,445</td>
</tr>
<tr>
<td>Multidisciplinary Research Awards</td>
<td>25,000</td>
</tr>
<tr>
<td>Strategic Centers &amp; Institutes</td>
<td>295,929</td>
</tr>
<tr>
<td>Team Science</td>
<td>46,500</td>
</tr>
<tr>
<td>Translational Medicine</td>
<td>1,000,000</td>
</tr>
<tr>
<td>VPR Fellows</td>
<td>69,000</td>
</tr>
<tr>
<td>Virtual Reality</td>
<td>100,000</td>
</tr>
<tr>
<td>You @ CSU</td>
<td>300,000</td>
</tr>
<tr>
<td>Initiatives Pending Return of DFC</td>
<td>575,000</td>
</tr>
<tr>
<td><strong>GRAND TOTAL</strong></td>
<td><strong>$26,419,525</strong></td>
</tr>
<tr>
<td>*** OVPR Investments in research and advocacy outside of the RSSI funding.</td>
<td></td>
</tr>
</tbody>
</table>
### Research Strategic Investments (OVPR and RSSI 1x)

<table>
<thead>
<tr>
<th>Investment Category</th>
<th>RSSI</th>
<th>OVPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centers and Institutes (OHI, CHA, TMI)</td>
<td>$ 717,152</td>
<td>$ 240,000</td>
</tr>
<tr>
<td>High Performance Computing</td>
<td>$ 50,000</td>
<td>-</td>
</tr>
<tr>
<td>National Western Center</td>
<td>$ 100,000</td>
<td>-</td>
</tr>
<tr>
<td>Agricultural Biosecurity</td>
<td>$ 200,000</td>
<td>$ 240,000</td>
</tr>
<tr>
<td>Cost Sharing</td>
<td>$ 436,482</td>
<td>$ 242,257</td>
</tr>
<tr>
<td>Catalyst for Innovative Partnerships</td>
<td>$ 600,000</td>
<td>$ 305,600</td>
</tr>
<tr>
<td>Cores/PRSE*</td>
<td>$ 300,000</td>
<td>$ 2,433,124</td>
</tr>
<tr>
<td>Infrastructure Upgrades**</td>
<td>-</td>
<td>$ 2,171,519</td>
</tr>
<tr>
<td>Translational Medicine (Bay Facility)</td>
<td>-</td>
<td>$ 1,000,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>$ 2,403,634</td>
<td>$ 6,632,500</td>
</tr>
</tbody>
</table>

* Cores: Foundational Cores (CIF, MIN, PMF, Stats Lab), Emerging (IRISS, Flow Cytometry, Exp. Pathology, Drones), 2 C-Cubed RFPs, Equipment Awards

** VPUO/OVPR RFP: Awards to 12 facilities across 7 Colleges, 11 Departments and 1 Institutional Core
Thank you!