

# COLLEGE OF BIOLOGICAL SCIENCES

## 2018 ANNUAL REPORT



College of  
**Biological Sciences**  
UNIVERSITY OF MINNESOTA

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# 2018 HIGHLIGHTS

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## **A thriving environment for research**

The University of Minnesota as a whole saw record levels of externally sponsored research funding last year according to the Office of the Vice President for Research's 2018 Annual Report on Research and Technology Commercialization, and CBS was among the most productive colleges at the University across research activity, production of high-profile publications, indirect cost recovery, and research expenditures. Moreover, of the 21 University of Minnesota faculty listed in Clarivate Analytics 2018 Highly Cited Researchers list, seven are associated with CBS.

## **An award-winning year for our faculty**

CBS faculty received recognition at every level in 2018 – from collegiate awards to international distinctions – including the American Academy of Arts and Sciences and the American Association for the Advancement of Science.

## **Strengthening funding for our graduate programs**

The College substantially increased graduate funding and implemented a new funding model that transparently allocates resources across our programs on the basis of the number of research-active faculty.

## **Fostering cross-disciplinary collaboration**

Every year, the College makes major investments in support of cross-college research infrastructure and initiatives. We also contribute financially to many events across the University that foster collaboration. One CBS program that supports cross-disciplinary collaboration – the Grand Challenges in Biology Postdoctoral Program – announced its third cohort. To date, the program has provided support for 10 postdocs pursuing research that spans disciplines and brings together labs from different departments within and beyond the College.

## **Continued demand for our undergraduate programs**

The College admitted its largest incoming class to date with nearly 600 incoming freshmen and expanded undergraduate offerings with a new major in Cellular and Organismal Physiology and two new minors in Computational Biology and Cellular and Molecular Neuroscience.

## **Connecting with alumni and the public**

The College continued to expand alumni engagement and public outreach with regional gatherings, programming at our field stations, and outreach to K-12 students. Cedar Creek welcomed a herd of bison to its oak savanna as part of a research project this spring, attracting media attention and sparking public interest. In addition, the College's field stations, Conservatory, Market Science, and InSciEd Out program engaged visitors at the UMN building at the Minnesota State Fair.

## **Making progress on capital projects**

The College broke ground on the new College of Biological Sciences Conservatory this fall with the grand opening set for fall 2019. Renovations in the Biological Sciences Center are underway with new research labs on the fourth floor done and work on the active-learning labs on the third floor in progress. The student BioCommons in Moos was also remodeled.

## **Full speed ahead for the Campaign for the College of Biological Sciences**

CBS had a record-breaking fundraising year in FY18, raising nearly double the amount of the year before and moving the College closer to achieving its \$21 million campaign goal. Since the start of the campaign, CBS has made significant progress toward achieving its campaign goal of offering 100 four-year scholarships, awarding 84 in 2018.

# COLLEGE SNAPSHOT

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## BY THE NUMBERS

- 2,559 undergraduates
- 269 graduate students
- 100 postdoctoral researchers
- 152 faculty members\*

\* including Medical School faculty in shared departments

## DEPARTMENTS

- Biochemistry, Molecular Biology and Biophysics (joint with Medical School)
- Biology Teaching and Learning
- Ecology, Evolution and Behavior
- Genetics, Cell Biology and Development (joint with Medical School)
- Plant and Microbial Biology

## FIELD STATIONS AND FACILITIES

- Cedar Creek Ecosystem Science Reserve
- Itasca Biological Station and Laboratories
- College of Biological Sciences Conservatory

## SIGNATURE PROGRAMS

- Nature of Life Program (Itasca and on campus)
- Genetic Counseling Graduate Program
- Active Learning Classrooms and Labs
- Petri Dish Science Event Series
- Market Science Community Engagement Program
- InSciEd Out STEM Pipeline Program

# STUDENTS

## UNDERGRADUATE STUDENTS

The College welcomed its largest freshman class to date while remaining highly selective.

### TOTAL ENROLLMENT [fall 2018]

2,559 undergraduates enrolled

- 1,540 from Minnesota (60%)
- 784 students of color (30%)
- 253 international students (10%)
- 596 freshmen
- 59 transfer students

### FRESHMAN CLASS [class of 2022]

596 freshmen from a pool of 8,082 applicants [fall 2018]

- 369 from Minnesota (62%)
  - 271 from Twin Cities Metro (45% of total)
  - 98 from Greater Minnesota (16% of total)
- 394 female (66%)
- 202 male (33%)
- 103 first-generation college students (17%)
- 24 international students (4%)
- 125 domestic students of color (21%)
- 93.1% average high school rank of 2018 freshman class

## MAJORS

Number of students enrolled in CBS majors\* from 2014-2018

|   | F2015 | F2016 | F2017 | F2018 |
|---|-------|-------|-------|-------|
| Biochemistry B.S.                           | 299   | 282   | 348   | 411   |
| Biology B.S.                                | 443   | 473   | 706   | 816   |
| Cellular and Organismal Physiology B.S.     | -     | -     | -     | 21    |
| Ecology, Evolution and Behavior B.S.        | 92    | 76    | 82    | 102   |
| Genetics, Cell Biology and Development B.S. | 250   | 251   | 284   | 273   |
| Microbiology B.S.                           | 132   | 116   | 136   | 133   |
| Neuroscience B.S.                           | 232   | 235   | 334   | 389   |
| Plant and Microbial Biology B.S.            | 14    | 15    | 18    | 31    |

\*Includes multiple majors

## BACHELOR DEGREES AWARDED

|  | 2015/16 | 2016/17 | 2017/18 |
|--|---------|---------|---------|
| Biochemistry                           | 115     | 113     | 88      |
| Biology                                | 159     | 195     | 196     |
| Ecology, Evolution and Behavior        | 34      | 26      | 19      |
| Genetics, Cell Biology and Development | 82      | 88      | 67      |
| Microbiology                           | 42      | 38      | 28      |
| Neuroscience                           | 55      | 71      | 76      |
| Plant and Microbial Biology            | 3       | 8       | 1       |
| Total                                  | 490     | 539     | 475     |

## **UNDERGRADUATE RESEARCH**

- 386 student-directed research projects were mentored by 261 faculty members, and many more students participated in research through course-based research experiences.

## **LEARNING ABROAD**

- 147 students participated in learning abroad during the 2017-18 academic year.

## **RETENTION AND GRADUATION RATES**

- First-year retention rates 94.4% (UMTC average 92.87%)
- Four-year graduation rates 80.08% (UMTC average 71.07%)

## **UNDERGRADUATE AWARDS AND RECOGNITION**

A number of students in the graduating CBS class of 2018 received major awards during their time as undergraduates in the College, including the Churchill Scholarship and a Fulbright Research Grant. Forty-seven graduating seniors were also welcomed into Phi Beta Kappa this year, which means that they are members of one of the most esteemed honors societies in the country.

- Churchill Scholarship – Merrick Smela
- Fulbright Research Grant – Chloe Fouilloux
- Astronaut Scholarship – Merrick Smela
- Gilman Scholarship – Karimatou Bah and Sarah Lentz
- Hollings Scholarship – Melissa Drown
- Thomas Burnett Advanced Leadership Program – Sarah Alabsi, Justin Dunnell, Evan Jobin, Amanda Nguyen, Bennett Olupo
- Scholarly Excellence in Equity and Diversity Award – Leah Alemu and Bennett Olupo
- President's Student Leadership and Service Award – Melissa Drown, Chloe Fouilloux, Jesus Garcia, Zakariya Hussein, Melat Weldesalasia

## **STUDENT SUPPORT [2017-18 academic year]**

CBS Student Services saw continued growth in student usage with a total of 4,416 student appointments across academic advising, career development and student engagement.

## GRADUATE STUDENTS

Enrollment in CBS graduate programs remained consistent with upticks in EEB, BMBB, and MCDB&G.

### ENROLLMENT

A total of 269 graduate students were enrolled in the College's graduate programs in fall 2018.

|   | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|------|------|------|------|------|
| Biochemistry, Molecular Biology and Biophysics          | 67   | 69   | 70   | 77   | 81   |
| Ecology, Evolution and Behavior                         | 64   | 65   | 61   | 60   | 69   |
| Molecular, Cellular, Developmental Biology and Genetics | 47   | 45   | 41   | 45   | 51   |
| Genetic Counseling (M.S.)                               | 12   | 14   | 16   | 16   | 16   |
| Microbial Engineering (M.S.)                            | 10   | 10   | 9    | 11   | 11   |
| Plant and Microbial Biology                             | 26   | 46   | 40   | 45   | 41   |

### DEGREES AWARDED

|   | M.S. (2018)             | Ph.D. (2018) |
|---|-------------------------|--------------|
| Biochemistry, Molecular Biology and Biophysics          | 0                       | 14           |
| Ecology, Evolution and Behavior                         | 2                       | 10           |
| Molecular, Cellular, Developmental Biology and Genetics | 10 (Genetic Counseling) | 10           |
| Microbial Engineering                                   | 4                       |              |
| Plant and Microbial Biology                             | 2                       | 6            |

### EXTERNAL AND UNIVERSITY AWARDS

CBS graduate students received 29 fellowships and grants, including one Fulbright Fellowship, two NIH Predoctoral Fellowships, three NSF Graduate Research Fellowships, a Simons Foundation Fellowship, and an American Heart Association Fellowship in 2018. **See the complete list of external and University awards in the In Detail section (p. 14) at the end of this report.**

### INCREASED INTERNAL FUNDING

Internal funding for CBS graduate programs had remained stable for a number of years. A combination of net growth in the number of research-active faculty in the College (from 61 in FY13 to 86 in FY19) and a 14 percent increase in graduate student stipends, tuition and fringe over this same time period resulted in a net decrease in program support. The College substantially increased graduate funding and implemented a new funding model that transparently allocates resources across our programs on the basis of the number of research-active CBS faculty in each program.

### THESES AND DISSERTATIONS

Graduate students produced 47 theses and dissertations in 2018. **See the complete list of theses and dissertations in the In Detail section (p. 15) at the end of this report.**

# FACULTY AND RESEARCH

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## FACULTY

The College has 152 faculty members including Medical School faculty in shared departments. Of the 21 University of Minnesota faculty listed in Clarivate Analytics 2018 Highly Cited Researchers list, a third are associated with the College. Five of the seven are principal investigators at Cedar Creek Ecosystem Science Reserve.

## FACULTY AWARDS AND RECOGNITION

In 2018, more than two dozen faculty and staff received professional, University or collegiate awards, including recognition from the American Academy of Arts and Sciences and the American Association for the Advancement of Science. **See the complete list of CBS faculty and staff awards in the In Detail section (p. 14) of this report.**

## PROMOTIONS, NEW HIRES AND RETIREMENTS

### Promotions

- Mark Bee (Ecology, Evolution and Behavior)
- Jeffrey Gralnick (Plant and Microbial Biology)
- Jonathan Schilling (Plant and Microbial Biology)
- Jeongsik Yong (Biochemistry, Molecular Biology and Biophysics)

### New Hires

- Kyle Costa (Plant and Microbial Biology)
- Feng Zhang (Plant and Microbial Biology)
- Paloma Gonzalez-Bellido (Ecology, Evolution and Behavior)
- Trevor Wardill (Ecology, Evolution and Behavior)
- Thomas Niehaus (Plant and Microbial Biology)

### Retirements

There were no retirements in 2018.

## RESEARCH

### PUBLICATIONS

College of Biological Sciences faculty published nearly 375 studies and articles in 209 journals authored or co-authored by faculty with primary appointments in CBS, including the following high-impact journals:

- 1 in *Science*
- 19 in *Nature*\*
- 12 in *Proceedings of the National Academy of Sciences*

\*Including associated *Nature* journals

[See the complete list of 2018 research publications.](#)

## ACTIVE GRANTS

The College had 351 active grants, including 136 exceeding \$100,000 in expenditures. Major sources of funding included:

- \$25,576,809 (total sponsored research spend)
- \$9,620,936 NIH
- \$5,427,286 NSF
- \$665,571 USDA
- \$1,868,019 LCCMR

[See the complete list of 2018 active grants.](#)

## GRAND CHALLENGES IN BIOLOGY POSTDOCTORAL PROGRAM

The Grand Challenges program hired its third cohort, which included the following teams/projects:

- “Reprogramming plant morphology and metabolism using the HACKER platform,” Postdoc: Arjun Khakhar. Faculty advisors: Daniel Voytas (Genetics, Cell Biology and Development) and Michael Smanski (Biochemistry, Molecular Biology and Biophysics).
- “Multimodal signal use in complex and variable environments,” Postdoc: Katie LaBarbera. Faculty advisors: Mark Bee (Ecology, Evolution and Behavior), Peggy Nelson (Speech, Language and Hearing) and Maria Gini (Computer Science and Engineering).

## CBS SUPPORT FOR MULTI-COLLEGIATE INFRASTRUCTURE AND COLLABORATIONS

CBS provides critical financial support to shared research infrastructure and initiatives and multi-collegiate events that foster research collaborations. For example, Cedar Creek Ecosystem Science Reserve is globally recognized for its long-term ecological research and attracts scientists from across the University and internationally. This year, Itasca Biological Station and Laboratories established a new seed grant program, Seed-to-Roots, to support place-based science that is open to all University of Minnesota faculty. A number of College of Biological Sciences faculty are affiliates of the Institute on the Environment that connects researchers from across the University with external partners to solve complex environmental challenges.

In addition, CBS supports the following interdisciplinary facilities and initiatives, providing over \$4M of annual support in 2018:

- BioTechnology Institute
- MnDRIVE
- Center for Mass Spectrometry and Proteomics
- Characterization Facility
- University Imaging Centers
- University of Minnesota Genomics Center
- Developmental Biology Center
- Center for Genome Engineering
- Microbial and Plant Genomics Institute
- Center for Plant Precision Genomics
- Lewis-Burke Government Relations
- The University of Minnesota Lion Center

In addition, the College provides space for:

- Electronic Instrumentation
- Machine Shop

- Bio-Technology Resource Center
- Caenorhabditis Genetics Center
- Chlamydomonas Resource Center

In 2018, the College distributed more than \$150,000 to support interdisciplinary collaborations, events and symposia, including:

- Norwegian Centennial Chair Collaboration
- Emerge BioScience Program
- Moos Lecture Series
- American Society for Virology Conference
- Institute for Molecular Virology Symposium
- Great Lakes Nuclear Receptors Conference
- Midwest Population Genetics Meeting
- Chemical Biology Symposium
- International Conference on One Medicine One Science (iCOMOS)
- International Society for Behavioral Ecology Conference
- Speaking Science Conference
- Journal of Young Investigators

## RESEARCH AND LEARNING TECHNOLOGIES

Research and Learning Technologies grew its programming capabilities by welcoming Vladimir Vladykin (application and database developer) and Chris Lee (web developer) to its team. In addition to handling more than 1,000 support requests, Research and Learning Technologies:

- Successfully migrated all 222 CBS course sites to the new Canvas learning management system nine months ahead of the fall 2019 deadline.
- Upgraded the delivery of five online courses – two with extensive at-home lab components.
- Joined Cedar Creek's *Eyes on the Wild* project team to develop a data management system to automate bringing camera trap images to the Zooniverse citizen science platform.
- Collaborated with the College of Biological Sciences Conservatory to develop a new plant inventory database that will be used as the foundation for possible future projects, such as facilitating specimen orders and providing digital content to Conservatory visitors.

# PUBLIC ENGAGEMENT

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The College expanded outreach activities through continued investment in Market Science, increased programming and community collaborations at our Cedar Creek and Itasca field stations, and continued K-12 outreach through Cedar Creek, the CBS Conservatory, and InSciEd Out. In addition, the College engaged alumni and donors through events designed to spark interest and enthusiasm for science, strengthen affinity with the College and build support for the Campaign for the College of Biological Sciences.

## OUTREACH PROGRAMMING

- **Market Science** expanded programming to greater Minnesota in conjunction with Itasca Biological Station and Laboratories and Cedar Creek Ecosystem Science Reserve and participated in science discovery days at the Bakken Museum, the Works Museum, and the Bell Museum. During the 2018 season, Market Science reached 6,452+ people at farmers markets, county fairs, open streets festivals, science festivals, and museums throughout the Twin Cities region and across the state. Market Science events focused on 61 topics from across disciplines and presented research from 161 scientist volunteers from across the University (CFANS, CSE, VetMed, Med School).
- **Cedar Creek Ecosystem Science Reserve** had another record-breaking year for public engagement. Cedar Creek programs reached 5,578 K-12 students and their teachers, 943 university students and their professors, and 6,339 members of the general public. The station expanded opportunities for the local community and broader public to visit and learn, including providing weekly interpretation at its new bison gazebo, launching an online citizen science project focused on wildlife trail camera research, and offering summer camps and homeschool programs for the first time.
- **Itasca Biological Station and Laboratories** expanded public engagement as the station transitioned to a new director and vision. Itasca worked with naturalists at Itasca State Park to offer joint programming, including station tours (three tours with 100+ attendees), interpretive hikes (three hikes with 150+ attendees), and booths at local events. The station also partnered with Market Science at the Bemidji and Park Rapids farmers markets this summer. With more than 600,000 visitors at the state park in 2018, the “reach” of the station’s outreach – including these uniquely personal interactions during hikes and tours alongside displays at both main park visitor centers – is easily in the tens of thousands, if not more.
- **InSciEd Out** reached 2,600 students in six Twin Cities metro elementary and middle schools, offering training for teachers and providing volunteer opportunities to CBS undergraduates interested in STEM education. In 2018, InSciEd Out saw several positive outcomes of its programming. At one partner school, fifth-grade science proficiency increased from 47% in the year prior to more than 60% after just three years of program implementation. This increase in proficiency was especially striking among female students who went from 45% proficient prior to InSciEd Out to more than 65% proficient three years later, closing the proficiency gender gap in the school.
- **College of Biological Sciences Conservatory** welcomed approximately 1,000 students and teachers throughout the University who toured the Conservatory and encountered plants they might never see otherwise. More than 1,400 people – including faculty and students, artists, garden clubs and plant societies – visited the Conservatory. Other Conservatory outreach activities included tabling at the American Swedish Institute and a workshop offered in collaboration with the Bell Museum and Good Acre.

## PUBLIC EVENTS

**Petri Dish:** The College's signature science conversations series regularly attracts 40-60 attendees, including alumni, donors, the public, and members of the University community. The College partnered with the Bell Museum on a series of discussions in fall 2018 focused on food in conjunction with the Bell's *Our Global Kitchen* exhibition. Topics for spring and fall 2018 included:

- *Our wired world: Monitoring and managing the world around us*
- *Your brain on science: The promise of new neurotechnologies*
- *A tiny take on toxins: Engineering enzymes to clean up the environment*
- *Super foods or super frauds?*
- *Romaine recalls and raw milk renegades*
- *Our ever-evolving diet*

**SciSpark:** The College's annual event focusing on women in science continued to attract a broad audience that included alumni as well as members of the public. More than 200 people attended in 2018.

# ADVANCEMENT

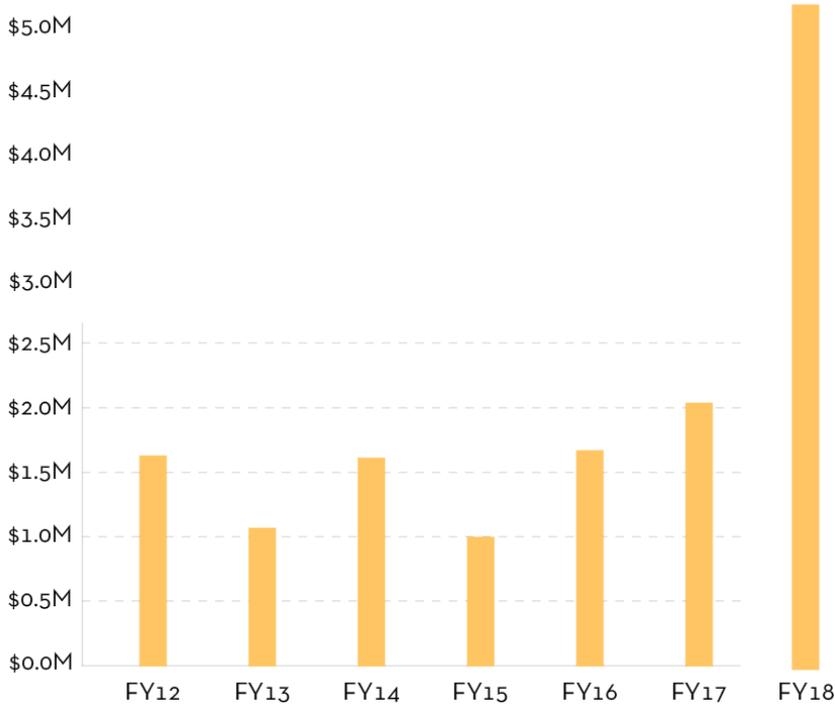
The College engaged more alumni and raised more money than ever before in 2018 and continued to raise the visibility of faculty research through media mentions, public events and marketing efforts.

## DEVELOPMENT

Thanks to the leadership of the College of Biological Sciences Campaign Steering Committee and our very generous donors, the Great Science at a Grand Scale Campaign is pacing ahead of schedule. As 2018 closed, the campaign was at 83 percent (\$17.4M) of its \$21 million goal, with 30 months remaining.

- \$5.1 million raised from private donors up from \$2.1 million the previous fiscal year.
- 611 donors gave gifts that included:
  - 1 gift of \$1M or more
  - 4 gifts of \$250K-\$999K
  - 3 gifts between \$100K-\$249K
  - 5 gifts between \$50K-99K
  - 5 gifts of \$25-49K
  - 8 gifts of \$10-24K
- 786 contacts with donors up from 366 the previous year.

## GIVING HISTORY



## SCHOLARSHIPS AND FELLOWSHIPS

The College committed more than \$1 million in scholarships and fellowships in 2018, awarding 109 scholarships, including 26 four-year awards, and three graduate fellowships. By comparison in fall 2015, the College awarded 33 scholarships (totaling \$80,500) to incoming freshmen and zero four-year scholarships. As of 2018, the total number of active four-year scholarships stands at 84.

## ALUMNI RELATIONS

In 2018, the College continued to build connections to alumni using a number of strategies, including regional alumni events, continued presence at MinneCollege and our alumni-student mentor program.

Here are some of the highlights.

- The College held regional alumni events in Chicago, New York and San Francisco, connecting with 15–25 alums and donors at each event, and meeting with donors and alums in each city.
- CBS alums and donors attended public events hosted by the College, including Petri Dish and SciSpark, CBS Conservatory Groundbreaking, MinneCollege, sporting events, senior send-off, and the annual recognition and appreciation dinner.
- The College continued its alumni award program, recognizing two alumni with Alumni Achievement Awards (Robert Desnick and Angela Trepanier) and one alumna with an Emerging Leader Award (Kimberly VanderWaal).
- The CBS alumni-student mentor program continued with 35 matches in 2018.

Here's a snapshot of the CBS alumni community in 2018:

- Total alumni: 16,613
- Alumni with B.S. degrees: 13,411
- Alumni with M.S. or PhD degrees: 3,608
- Alumni living in Minnesota: 9,461

## COMMUNICATIONS/MARKETING

CBS faculty and the College received 100+ media mentions in national, local, and University publications. Stories touching on CBS research appeared in *The New York Times*, *WIRED*, and *National Geographic* and the University publications *Inquiry*, *Legacy*, and *Minnesota Alumni* magazine.

Here are a few of the high-profile media mentions:

- “Crispr Can Speed Up Nature—and Change How We Grow Food” (*WIRED*)
- “Is the Paleo Diet Right for You?” (*The New York Times*)
- “There’s Nothing Inherent About the Fact That Men Outnumber Women in the Sciences” (*Los Angeles Times*)
- “The Future of Food” (*Washington Post*)
- “Cecil the Lion Died Amid Controversy—Here’s What’s Happened Since” (*National Geographic*)
- “Just Months of American Life Change the Microbiome” (*The Atlantic*)

Here are news releases that generated the most coverage:

- “New strategy discovered toward possible prevention of cancers tied to mono”
- “Immigration to the United States changes a person’s microbiome”
- “Small classes reduce performance gaps in science”

In addition, the University launched a new Driven to Discover marketing campaign highlighting a handful of University faculty, among them Genetics, Cell Biology and Development faculty member Perry Hackett. Perry’s video – *Sleeping Beauty, Sleeping Giant* – received the most web traffic.

# FINANCIALS

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## **FY18 OPERATING BUDGET**

The College's FY18 operating budget included \$96,158,540 in expenditures.

Largest sources of revenue:

- \$27,843,603 tuition and fees
- \$24,111,932 state appropriation
- \$25,576,809 external faculty grants and contracts
- \$2,908,728 private gifts and endowment income

## FACULTY AND STAFF AWARDS AND RECOGNITION

- American Academy of Arts and Sciences Fellow - Ruth Shaw (EEB)
- American Association for the Advancement of Science Fellow - David Bernlohr (BMBB)
- American Association for the Advancement of Science Fellow - Reuben Harris (BMBB)
- American Ornithological Society Brina Kessel Award - Keith Barker (EEB)
- American Society of Plant Biologists Fellow - Neil Olszewski (PMB)
- Association for the Sciences of Limnology and Oceanography Sustaining Fellow - James Cotner (EEB)
- Charles Albert Shull Award - Nathan Springer (PMB)
- Distinguished McKnight University Professor - Michael Travisano (EEB)
- Ecological Society of America Fellow - Eric Seabloom (EEB)
- Ecological Society of America Fellow - Allison Shaw (EEB)
- Helmholtz International Fellow Award - Valery Forbes (EEB)
- Horace T. Morse - University of Minnesota Alumni Association Award for Outstanding Contributions to Undergraduate Education - David Matthes (BTL)
- John and Abigail Wardle Chairs in Microbial Ecology - William Harcombe (EEB)
- John and Abigail Wardle Chairs in Microbial Ecology - Peter Tiffin (PMB)
- John S. Anderson Leadership Award - Abby Conover (BTL)
- McKnight Land Grant Professor - Ran Blekhman (GCB/EEB)
- National Society of Genetic Counselors Strategic Leader Award - Heather Zierhut (GCD)
- Sloan Research Fellow - Frank Albert (GCD)
- Stanley Dagley-Samuel Kirkwood Undergraduate Education Award - Jan Norrander (GCD)
- Stanley L. Miller Early Career Award - Aaron Engelhart (GCD)
- University of Minnesota Outstanding Community Service Award - Jim Krueger (Cedar Creek)
- Whitman Center Early Career Fellow - G.W. Gant Luxton (GCD)

## GRADUATE STUDENT AWARDS AND RECOGNITION

- American Heart Association Predoctoral Fellowship - Keenun Kim (MCDB&G)
- Bell Museum Natural History Award - Zacky Ezedin (PMB)
- Bell Museum Dayton Fellowship - Rebekah Mohn (PMB)
- Bell Museum Natural History Award - Christina Smith (PMB)
- Bell Museum Natural History Award - Laura Toro (PMB)
- Dayton Fellowship - Sean Keogh (EEB)
- Doctoral Dissertation Fellowship - Amanda Gorton (EEB)
- Doctoral Dissertation Fellowship - Megan Kobiela (EEB)
- Doctoral Dissertation Fellowship - Lotus Lofgren (PMB)
- Doctoral Dissertation Fellowship - Morgan Meissner (MCDB&G)
- DOVE Fellowship - Morgan Esler (BMBB)
- DOVE Fellowship - Gabriele Ilarde (EEB)
- DOVE Fellowship - Taryn Mueller (EEB)
- DOVE Fellowship - Tyler Seidel (EEB)
- DOVE Fellowship - Zachary Sperstad (EEB)
- DOVE Fellowship - Megan Wilcots (EEB)
- Ford Foundation Fellowship - Leno Smith (EEB)
- Fulbright Fellowship - John Cossette (EEB)

- Fulbright Fellowship – Rodrigo Gonzalez Zorrilla (EEB)
- HHMI Gilliam Graduate Fellowship – Willow Coyote (BMBB)
- ICGC Fellowship – Ariadna Mondragon (PMB)
- Interdisciplinary Doctoral Fellowship – Amod Zambre (EEB)
- Leakey Foundation Baldwin Fellowship – Elihuruma Kimaro (EEB)
- NIH F31 Predoctoral Fellowship – Ashley Arthur (MCDB&G)
- NIH F31 Predoctoral Fellowship – Natalya Goloviznina (MCDB&G)
- NSF Graduate Research Fellowship – Janine Mistrick (EEB)
- NSF Graduate Research Fellowship – Rebecca Walker (EEB)
- NSF Graduate Research Fellowship – Kelly Wallin (BMBB)
- Simons Foundation Fellowship – Dakota Rowsey (EEB)

## THESES AND DISSERTATIONS

### BIOCHEMISTRY, MOLECULAR BIOLOGY AND BIOPHYSICS – Ph.D.

- Thomas Bohl – *Structural studies of two enzymes in the Raetz pathway of lipid A synthesis, LpxB and LpxH*
- Claïressa Brown – *Evaluation of the use and limitations of a community-based microbial source tracking method*
- Aaron Edmund – *The role of post-translational modifications and allostery in the receptor guanylyl cyclases GC-A and GC-B*
- Douglas Grunwald – *An investigation into the roles of ATG8 proteins in autophagy initiation*
- Suzanne Haydon – *Examining the role of phospholamban phosphorylation on interaction with SERCA using fluorescence microscopy*
- Cheng Her – *Structural dynamics of the calmodulin-ryanodine receptor interaction using bifunctional spin labels and EPR*
- Fernanda Jimenez Otero – *Electron transfer through the outer membrane of Geobacter sulfurreducens*
- Ajeetha Joseph Rajan – *Unconventional protein secretion from adipocytes*
- Klaus Lovendahl – *Adaptation of HUH endonucleases for protein-DNA conjugation*
- Amy Molan – *Regulation of APOBEC3B and the restriction of HIV-1 in myeloid cells*
- Katherine Muratore – *Toward a subcellular description of cholesterol homeostasis*
- Xiaobai Patrinoastro – *Relative importance of beta and gamma cytoplasmic actins to cellular and organismal viability*
- Amber St. Martin – *Improved base editing technologies with novel editors and assays*
- Daniel Stroik – *A study of the SERCA-phospholamban regulatory interaction using time-resolved fluorescence*

### ECOLOGY, EVOLUTION AND BEHAVIOR – M.S.

- Narmin Ghalichi – *Female crickets reared in silence exhibit risk-sensitive behavior in response to the preferred song*
- Angela Les – *Developing methods for calculating individuality in moose movement behavior from remotely collected location data*

### ECOLOGY, EVOLUTION AND BEHAVIOR – Ph.D.

- Nicholas Goldsmith – *Human impacts on Minnesota prairie genetics: salted environments, Echinacea hybrids, and local seed sourcing*
- Jacob Grossman – *Consequences of biodiversity in tree diversity experiments*
- Andrew Honsey – *Fish growth, temperature, and life history: applying theory to improve fisheries research and management*
- Katherine Liu – *Reconceptualizing cancer: the development of new models and frameworks*

- Shelby Loberg - *Infectious disease ecology for future managers of the Anthropocene*
- Meredith Palmer - *Survival in a landscape of fear: prey behavioral responses to predation risk that varies in time and space*
- Jessie Tanner - *Sexual selection constrained: the expression of mating preferences in acoustically communicating animals*
- James Tumulty - *The evolution and mechanisms of social recognition in territorial frogs*
- Lauren White - *The effects of heterogeneity in individual infectiousness on disease modeling predictions*
- Laura Williams - *Scaling the effects of interactions among plants from individuals to ecosystems in experimental tree communities*

#### **MICROBIAL ENGINEERING - M.S.**

- Kim Hansol - *Cultivation of natural killer cell for immunotherapy*
- Mary Plunkett - *Optimization of ammonium and biohydrogen production from mutant strains of *Azotobacter vinelandii* deregulated for nitrogen fixation*
- Yu-Hsiang Wang - *Activated carbon fibers from cellulosic biomass with surface reductive treatment for air cleanup and VOCs sensing*

#### **MOLECULAR, CELLULAR, DEVELOPMENTAL BIOLOGY AND GENETICS - Ph.D.**

- Nick Blixt - *Osteoclast-specific deletion of *Mef2a* and *Mef2d* results in decreased trabecular and cortical thickness in vivo*
- Taylor Harding - *Pre-clinical strategies to overcome drug-resistant multiple myeloma: predictive transcriptomics and targeting the myeloma epigenome*
- Catherine Lee - *Applications of next-generation sequencing to rare disease*
- Lindsey Moss-Taylor - *Regulation of body size by TGF-beta signaling*
- Soumya Mukherjee - *A decreasing gradient in tension at metaphase elicits an escalating cellular response*
- John Olthoff - *Evidence for a reversible, redox-mediated component to eccentric contraction-induced force loss in dystrophin-deficient skeletal muscle*
- Katelyn Paz - *Signaling pathways and novel therapeutic strategies for the treatment of murine chronic graft versus host disease*
- Michael Przybylla - *Models of GM1-gangliosidosis and morquio syndrome type B for gene therapy*
- Keith Sabin - *Spinal cord regeneration: novel mechanisms or developmental déjà vu*
- Taylor Reid - *Microtubule structure recognition by end binding protein 1*

#### **PLANT AND MICROBIAL BIOLOGY - M.S.**

- Stephanie Erlandson - *History, dispersal limitation and environment shape the current and future ranges of forest herbs of the Southern Appalachians*
- Erin (Jewett) Evans - *Amino acid pool sizes, turnover, and kinetics in *Spirodela polyrhiza* grown under photoautotrophic, mixotrophic, and heterotrophic conditions*

#### **PLANT AND MICROBIAL BIOLOGY - Ph.D.**

- Joseph Guhlin - *Genomic complexities in the legume-rhizobial symbiosis*
- Allison Haaning - *Natural genetic variation and gene expression patterns underlying lateral shoot (tiller) development in barley (*Hordeum vulgare* L)*
- Elias Krumholz - *Reconstruction, reconciliation, and validation of metabolic networks*
- Nagendra Palani - *Molecular multiplexing methods for genome-scale measurements*
- Nu Wang - *Two projects: Improved prediction of metabolite retention times and analysis of ammonium transporters from *Marchantia polymorpha**
- Leland Werden - *Using functional traits to understand community assembly, responses to drought, and restoration in tropical dry forests*