TENNESSEE TECH UNIVERSITY

OFFICE OF RESEARCH AND ECONOMIC DEVELOPMENT | ANNUAL REPORT

2019-2020

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VISION AND MISSION OF THE OFFICE OF RESEARCH AND ECONOMIC DEVELOPMENT

Vision: Tennessee Tech will emerge as a prominent technological university for research with national impact.

Mission: The Office of Research and Economic Development (ORED) provides support and assistance to administrators, faculty, staff, and students in their efforts to secure external funding for research and scholarly activities. ORED reviews, negotiates, approves, and provides administrative oversight of proposals and awards in compliance with applicable laws, policies, and regulations. Additionally, ORED facilitates the protection and commercialization of intellectual property developed by TTU, and supports activities that promote economic development.

The ORED provides the following services to assist faculty in their pursuit of research and other scholastic activities:

- Assist in identifying appropriate and relevant funding opportunities;
- Promote and support collaborative, transdisciplinary research and scholarly activities;
- Conduct proposal writing workshops;
- Assist with proposal and budget development;
- Provide editorial and graphic support on proposals;
- Review proposals to ensure sponsor's requirements are addressed;
- Coordinate the submission of proposals to external sponsors using sponsors' portals;
- Process all awards from external sponsors;
- Negotiate and execute sponsored agreements;
- Ensure sponsored activities are in compliance with TTU, state, sponsor, and federal regulations;
- Contribute to start-up packages;
- Provide faculty initiation grants; and
- Assist faculty in all matters regarding intellectual property protection and commercialization.

SUMMARY

The bullets below summarize some of the key results from fiscal year 2019-20:

- Total external funding in the amount of $20,051,317 was received for the 2020 Fiscal Year (July 1, 2019 – June 30, 2020). This represents a 1% decrease from the total amount of external funding received in Fiscal Year 2019 ($20,228,105).

- State appropriations totaling $4,254,500 were received by the three Centers of Excellence and CEROC with an additional $85,530 received through Center testing accounts, representing 21% and 1% of total external funding received, respectively.

- Grants and contracts externally funded numbered 154 with a value of $15,711,287, representing 78% of total external funding.

- Grants and contracts sponsored by private entities, including industry and foundations, numbered 21 with a value of $530,222.

- The top funding agencies were the U.S. Department of Transportation ($2,533,466), National Science Foundation ($2,003,326), U.S. Department of Energy ($1,999,348), U.S. Department of Defense ($1,788,233), and U.S. Department of Interior ($1,090,050).

- Proposals submitted for external funding numbered 194 with a value of $40,117,231.

- Five provisional patent applications and three non-provisional patent applications were filed.

- Internal funds were provided in the amount of $105,000 for small grants to support faculty research. Five Track I proposals from 5 faculty were funded for a total of $15,000, and 9 Track II proposals from 10 faculty were funded for a total of $90,000.

LIST OF TABLES

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NOTES

The tables and figures on the following pages show the proposals and activations for FY 2020 (July 1, 2019 – June 30, 2020) broken down in various ways. Please note the following:

- The amounts listed in the activation amount column of each table represent the amount activated and do not reflect actual project expenditures.
- The number of activations may be greater than the number of proposals submitted because proposals submitted in previous years could be activated in the current year. Similarly, the amount activated may be greater than the amount requested for any given category for the same reason.
- All breakdowns by College and Department use the College and Department of the project Principal Investigator.
- In cases where two Centers share responsibility for a project, the entire project amount is listed with the Center that has greater than 50% responsibility for the project.

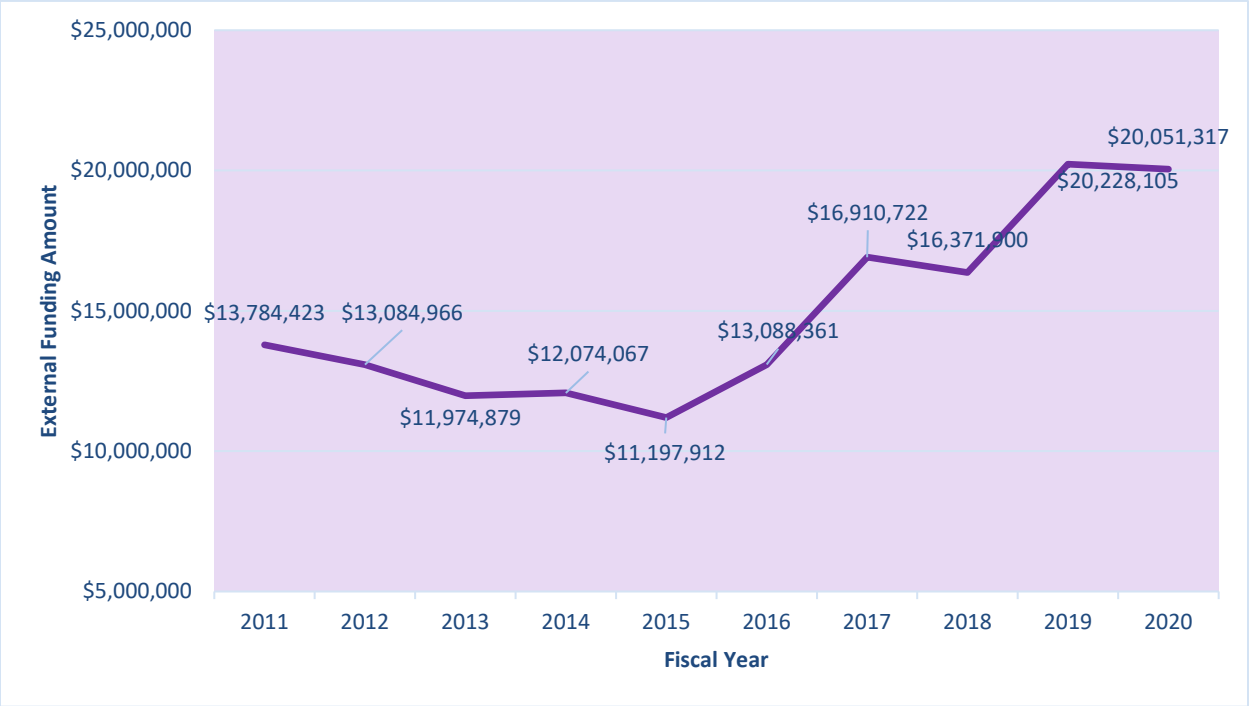

Figure 1
Total External Funding Received Historical (FY 2011-2020)

Table I: External Funding by College/University Unit/Center

PI's College	PI's Department, Center, Unit	Energy Center	Manufacturing Center	Water Center	STEM Center	CEROC	Department/ Other Units	Total
Agriculture and Human Ecology	Agriculture						$243,582	$243,582
	Human Ecology						$823,248	$823,248
	Subtotal						**$1,066,830**	**$1,066,830**
Arts and Sciences	Biology			$1,012,245			$166,868	$1,179,113
	Chemistry			$334,356			$94,802	$429,158
	Cooperative Fishery Research Unit			$471,832			$30,000	$501,832
	Earth Sciences						$53,760	$53,760
	Physics	$126,509			$37,600		$262,408	$426,517
	Sociology and Political Science						$24,077	$24,077
	Subtotal	**$126,509**		**$1,818,433**	**$37,600**		**$631,915**	**$2,614,457**
Business	iCube						$2,918,466	$2,918,466
	Dean's Office						$35,000	$35,000
	Decision Sciences and Management						$467,272	$467,272
	Economics, Finance and Marketing						$63,285	$63,285
	Small Business Development Center						$45,860	$45,860
	Subtotal						**$3,529,883**	**$3,529,883**
Education	Counseling and Psychology						$36,450	$36,450
	Curriculum and Instruction				$63,572		$2,023,537	$2,087,109
	Dean's Office						$24,092	$24,092
	STEM Center				$29,679			$29,679
	Subtotal				**$93,251**		**$2,084,079**	**$2,177,330**
Engineering	Basic Engineering						$133,973	$133,973
	Chemical Engineering	$8,000		$46,000				$54,000
	Civil and Environmental Engineering	$35,700		$401,066				$436,766
	Computer Science	$500,385				$1,955		$502,340
	CEROC		$451,737			$281,051		$732,788
	CESR	$1,080,929						$1,080,929
	CMR		$920,821					$920,821
	Dean's Office	$64,200					$38,195	$102,395
	Electrical and Computer Engineering	$267,056	$285,251					$552,307
	Manufacturing and Engineering Technology		$219,047					$219,047
	Mechanical Engineering	$227,878	$983,107		$102,466		$10,000	$1,323,451
	Subtotal	**$2,184,148**	**$2,859,963**	**$447,066**	**$102,466**	**$283,006**	**$182,168**	**$6,058,817**
Fine Arts	Appalachian Center for Craft						$17,730	$17,730
	Music						$4,250	$4,250
	Subtotal						**$21,980**	**$21,980**
Interdisciplinary Studies	Environmental Studies			$101,937				$101,937
	Subtotal			**$101,937**				**$101,937**
Nursing	Nursing						$12,053	$12,053
	Subtotal						**$12,053**	**$12,053**
Other	Communications and Marketing						$10,000	$10,000
	TN Center for Rural Innovation						$118,000	$118,000
	Subtotal						**$128,000**	**$128,000**
Centers of Excellence State Appropriations and Testing Accounts	CEROC Appropriation					$500,000		$500,000
	Energy Center Appropriation	$970,600						$970,600
	Energy Center Testing	$13,017						$13,017
	Manufacturing Center Appropriation		$1,576,400					$1,576,400
	Manufacturing Center Testing		$3,203					$3,203
	Water Center Appropriation			$1,207,500				$1,207,500
	Water Center Testing			$69,310				$69,310
	Subtotal	**$983,617**	**$1,579,603**	**$1,276,810**		**$500,000**		**$4,340,030**
Total	**All Units**	**$3,294,274**	**$4,439,566**	**$3,644,246**	**$233,317**	**$783,006**	**$7,656,908**	**$20,051,317**

Table II: Proposals and Activations By University Unit

University Unit	*# of Proposals*	*Amount Requested*	*# of Activations*	*Amount Activated*
Agriculture	2	$22,463	2	$243,582
Biology	12	$1,698,445	13	$1,179,113
Chemical Engineering	16	$5,647,139	2	$54,000
Chemistry	4	$2,409,419	2	$429,158
Civil and Environmental Engineering	12	$1,587,375	9	$436,766
Center for Energy Systems Research (CESR)	6	$541,878	6	$1,080,929
Center for Manufacturing Research (CMR)	1	$150,000	3	$920,821
Center for Rural Innovation (TCRI)	2	$923,061	1	$118,000
Communications & Marketing	1	$10,000	1	$10,000
Computer Science	28	$5,275,322	11	$502,340
Cooperative Fishery Research Unit	5	$244,241	12	$501,832
Counseling and Psychology	2	$249,428	2	$36,450
Craft Center	2	$14,000	3	$17,730
Counseling Center	1	$1,000	0	$0
Curriculum and Instruction	9	$1,976,690	11	$2,087,109
Cybersecurity Education, Research and Outreach	6	$2,377,995	5	$732,788
Dean's Office: Business	0	$0	1	$35,000
Dean's Office: Education	2	$174,944	1	$24,092
Dean's Office: Engineering	3	$1,320,528	4	$102,395
Decision Sciences and Management	3	$467,272	3	$467,272
Earth Sciences	4	$1,007,257	1	$53,760
Economics, Finance and Marketing	1	$63,285	1	$63,285
Electrical and Computer Engineering	13	$4,037,753	10	$552,307
Environmental Studies	1	$33,000	3	$101,937
General and Basic Engineering	1	$133,973	1	$133,973
Human Ecology	2	$229,000	4	$823,248
iCube	6	$675,730	9	$2,918,466
Interdisciplinary Studies	1	$50,000	0	$0
Library	1	$15,526	0	$0
Manufacturing and Engineering Technology	9	$3,341,361	4	$219,047
Mathematics	1	$5,000	0	$0
Mechanical Engineering	17	$1,806,012	17	$1,323,451
Multicultural Affairs Office	1	$50,000	0	$0
Music	1	$16,680	1	$4,250
Nursing	8	$2,562,937	1	$12,053
Physics	2	$594,016	7	$426,517
Small Business Development Center	0	$0	1	$45,860
Sociology and Political Science	2	$160,039	1	$24,077
Sustainability Office	2	$20,000	0	$0
STEM Center	3	$134,851	1	$29,679
Water Center	1	$89,611	0	$0
Subtotal	**194**	**$40,117,231**	**154**	**$15,711,287**
CESR State Appropriation/Testing	---	---	---	$983,617
CMR State Appropriation/Testing	---	---	---	$1,579,603
Water Center State Appropriation/Testing	---	---	---	$1,276,810
CEROC State Appropriation	---	---	---	$500,000
Total	**194**	**$40,117,231**	**154**	**$20,051,317**

Table III: Proposals and Activations Through Centers

University Unit	*# of Proposals*	*Amount Requested*	*# of Activations*	*Amount Activated*
CEROC				
CEROC	5	$2,019,412	2	$281,051
Computer Science	17	$2,832,923	1	$1,955
State Appropriation	---	---	---	$500,000
Total	*22*	*$4,852,335*	*3*	*$783,006*
Craft Center				
Appalachian Center for Craft	2	$14,000	3	$17,730
Total	*2*	*$14,000*	*3*	*$17,730*
Energy Center				
CESR	6	$541,878	6	$1,080,929
Chemical Engineering	13	$5,150,659	1	$8,000
Civil and Environmental Engineering	7	$975,133	3	$47,700
Computer Science	8	$1,669,585	10	$500,385
Electrical and Computer Engineering	8	$2,045,694	6	$267,056
Mechanical Engineering	7	$773,640	5	$227,878
Physics	1	$448,880	2	$126,509
Dean's Office	1	$26,100	2	$52,200
State Appropriation	---	---	---	$970,600
Center Testing Account	---	---	---	$13,017
Total	*51*	*$11,631,569*	*35*	*$3,294,274*
iCube				
iCube	6	$675,730	9	$2,918,466
Total	*6*	*$675,730*	*9*	*$2,918,466*
Manufacturing Center				
CMR	1	$150,000	3	$920,821
CEROC	1	$358,583	3	$451,737
Chemical Engineering	2	$35,000	0	$0
Computer Science	2	$722,854	0	$0
Electrical and Computer Engineering	4	$1,792,136	4	$285,251
Manufacturing and Engineering Technology	9	$3,341,361	4	$219,047
Mechanical Engineering	9	$1,022,372	9	$983,107
Nursing	1	$5,000	0	$0
State Appropriation	---	---	---	$1,576,400
Center Testing Account	---	---	---	$3,203
Total	*29*	*$7,427,306*	*23*	*$4,439,566*
STEM Center				
Curriculum and Instruction	3	$1,759,824	3	$63,572
Electrical and Computer Engineering	1	$199,923	2	$102,466
Physics	1	$145,136	1	$37,600
STEM Center	3	$134,851	1	$29,679
Total	*8*	*$2,239,734*	*7*	*$233,317*
TCRI				
TN Center for Rural Innovation	2	$923,061	1	$118,000
Total	*2*	*$923,061*	*1*	*$118,000*
Water Center				
Biology	9	$1,194,517	8	$1,012,245
Chemical Engineering	1	$461,480	1	$46,000
Chemistry	0	$0	1	$334,356
Civil and Environmental Engineering	5	$612,242	7	$401,066
Cooperative Fisheries Research Unit	5	$244,241	11	$471,832
Earth Sciences	3	$509,514	0	$0
Environmental Studies	1	$33,000	3	$101,937
Water Center	1	$89,611	0	$0
State Appropriation	---	---	---	$1,207,500
Center Testing Account	---	---	---	$69,310
Total	*25*	*$3,144,605*	*31*	*$3,644,246*

Table IV: Proposals and Activations By Funder Classification				
Classification	*# of Proposals*	*Amount Requested*	*# of Activations*	*Amount Activated*
Federal	120	$34,781,926	98	$11,803,424
State	29	$2,838,623	27	$3,170,659
Private	38	$1,937,048	21	$530,222
International Foreign	5	$539,197	7	$194,929
Local	2	$20,437	1	$12,053
State Appropriations	---	---	---	$4,254,500
Center Testing Accounts	---	---	---	$85,530
Total	**194**	**$40,117,231**	**154**	**$20,051,317**

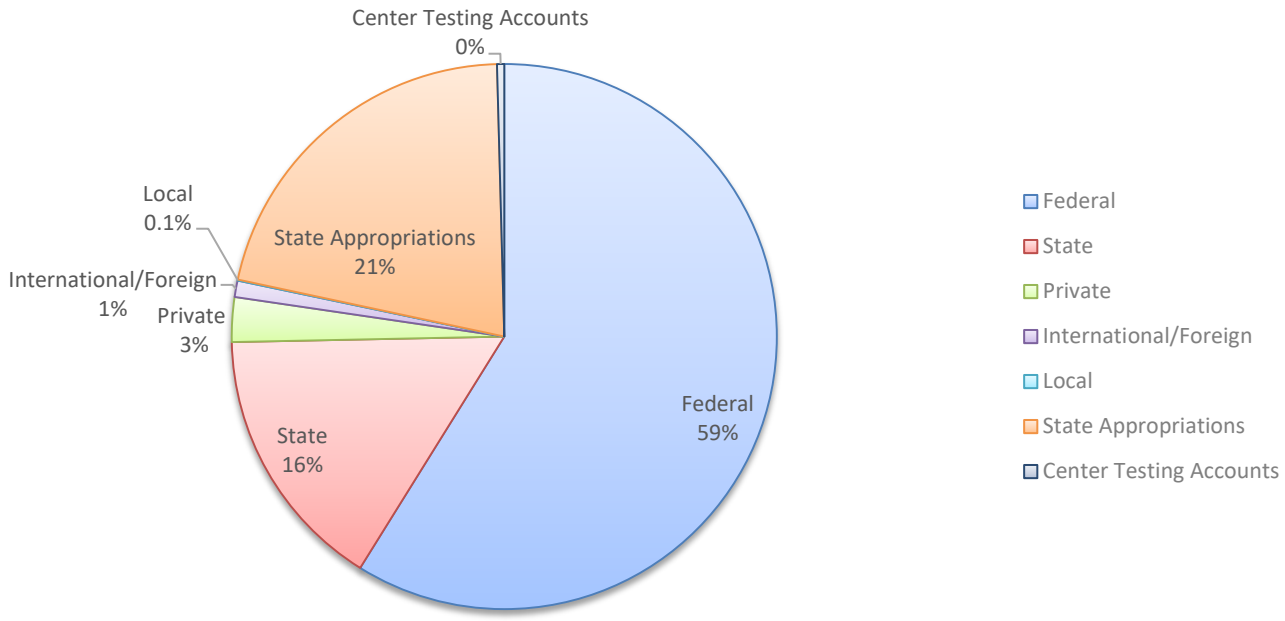

Figure 2
Percentage of Total Activation Amount by Funder Classification

Table V: Federal Activations By Federal Agency*

Federal Agency *Branch agency/office*	*# of Activations*	*Amount Activated*
U.S. Department of Transportation	5	$2,533,466
National Highway Traffic Safety Administration	*3*	*$2,489,466*
Federal Railroad Administration	*1*	*$32,000*
Office of Research and Technology	*1*	*$12,000*
National Science Foundation	22	$2,003,326
U.S. Department of Energy	22	$1,999,348
Office of Energy Efficiency & Renewable Energy	*5*	*$831,079*
Office of Fossil Energy	*2*	*$630,849*
Oak Ridge National Laboratory	*12*	*$322,618*
Office of Science	*3*	*$214,802*
U.S. Department of Defense	11	$1,788,233
Army Tank Automotive Research, Development and Engineering Center	*1*	*$957,444*
Office of Naval Research	*3*	*$379,000*
National Security Agency	*1*	*$256,051*
Army Education Outreach Program	*4*	*$141,038*
Naval Facilities Engineering Command	*1*	*$29,700*
Air Force Research Laboratory	*1*	*$25,000*
U.S. Department of Interior	20	$1,090,050
U.S. Fish and Wildlife Service	*14*	*$965,386*
U.S. Geological Survey	*3*	*$79,995*
National Park Service	*2*	*$23,954*
Bureau of Ocean Energy Management	*1*	*$20,715*
U.S. Department of Education	3	$708,890
Office of Special Education and Rehabilitative Services	*3*	*$708,890*
U.S. Department of Agriculture	4	$604,178
National Resources Conservation Service	*3*	*$585,451*
National Institute of Food and Agriculture	*1*	*$18,727*
U.S. Small Business Administration	3	$421,360
U.S. Department of Health and Human Services	3	$250,718
Center for Disease Control and Prevention	*2*	*$200,000*
National Institutes of Health	*1*	*$50,718*
National Aeronautics and Space Administration	3	$174,855
U.S. Department of Commerce	1	$118,000
U.S. Economic Development Administration	*1*	*$118,000*
Tennessee Valley Authority	1	$111,000
Total	**98**	**$11,803,424**

*Note: Some of these funds come to Tennessee Tech via flow through agencies/entities.

Table VI: Proposals and Activations By Activity

Activity	*# of Proposals*	*Amount Requested*	*# of Activations*	*Amount Activated*
Academic Support	1	$124,990	3	$88,792
Capital Project/Operation/Maintenance	3	280,322	2	$360,000
Instruction	5	$267,236	5	$97,445
Public Service	36	$5,577,275	39	$7,213,406
Research	145	$32,034,435	102	$7,644,644
Student Services/Scholarship/Fellowships	4	$1,832,973	3	$307,000
State Appropriations	---	---	---	$4,254,500
Center Testing Accounts	---	---	---	$85,530
Total	**194**	**$40,117,231**	**154**	**$20,051,317**

*Note: some of these funds come to Tennessee Tech via flow through agencies/entities.

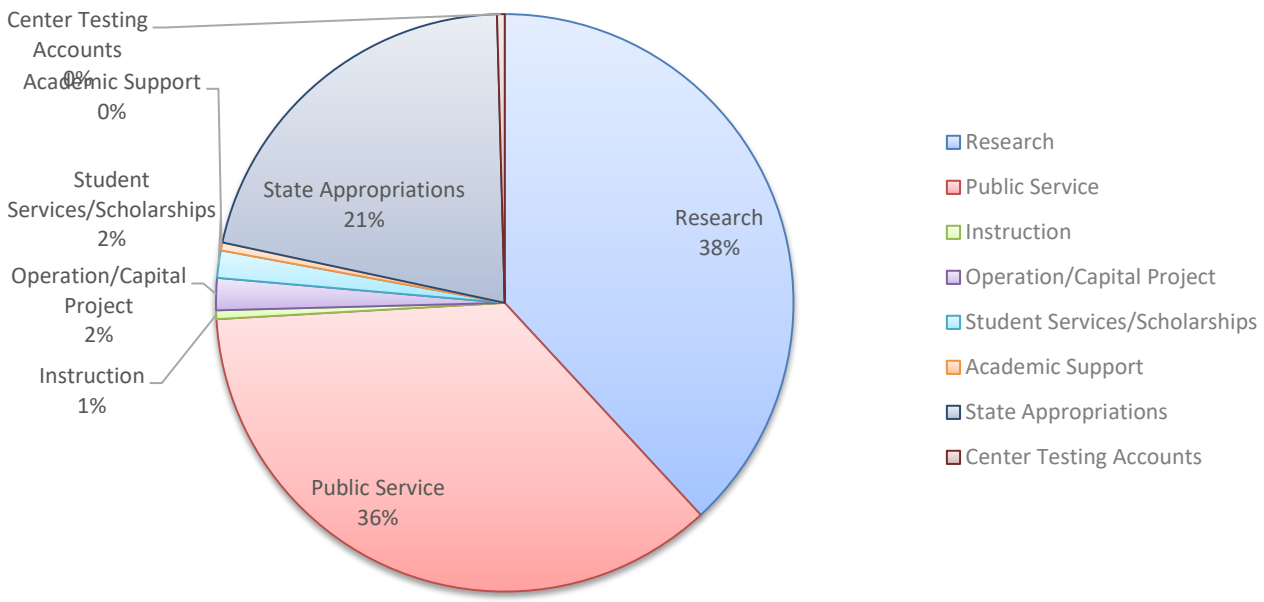

Figure 3
Percentage of Total Activation Amount by Activity

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Table VII: Proposals and Activations: FY 2016 - 2020					
	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Proposals					
Number of proposals submitted	213	198	180	168	194
Number of unique individuals who served as PI on a proposal	104	101	82	94	96
Amount requested	$58,565,666	$48,773,168	$50,570,708	$49,340,424	$40,117,231
Number of unique individuals (PIs and Co-PIs) involved in these proposals	160	147	117	124	137
Funded	95 (45%)	82 (41%)	79 (44%)	96 (57%)	45 (23%)
Not Funded	118 (55%)	116 (59%)	101 (56%)	72 (43%)	149* (77%)
Activations					
Number of project activations**	131	146	162	149	154
Amount of project activations**	$9,438,222	$13,261,077	$12,611,134	$15,934,931	$15,711,287
Number of unique individuals (PIs and Co-PIs) involved in these activated projects	102	94	106	107	108
State Appropriations/Center Testing Accounts	$3,650,139	$3,649,645	$3,760,766	$4,293,174	$4,340,030
Total amount of external funding	$13,088,361	$16,910,722	$16,371,900	$20,228,105	$20,051,317

*For FY 2020, the number included in the Not Funded row includes 141 pending proposals as of 7/2020.

**State appropriation and center testing account numbers and amounts are not included in these rows.

Table VIII: Activation Amounts By Classification FY 2016-20

Fiscal Year	Federal		State		Private		International Foreign*		Local		State Appropriation/Testing Accounts
	#	Activation Amount	#	Activation Amount	#	Activation Amount	#		#	Activation Amount	Activation Amount
2016	91	$7,399,496	22	$1,694,496	15	$320,730			3	$23,500	$3,650,139
2017	88	$8,251,229	40	$4,629,794	17	$373,437			1	$6,617	$3,649,645
2018	100	$9,618,095	40	$2,447,751	22	$545,288			0	$0	$3,760,766
2019	95	$11,757,420	34	$3,073,033	18	$1,023,557			2	$80,921	$4,293,174
2020	98	$11,803,424	27	$3,170,659	21	$530,222	7	$194,929	1	$12,063	$4,340,030

*A separate category for International Foreign was created in 2020. Prior to that activations from international funders were coded as private.

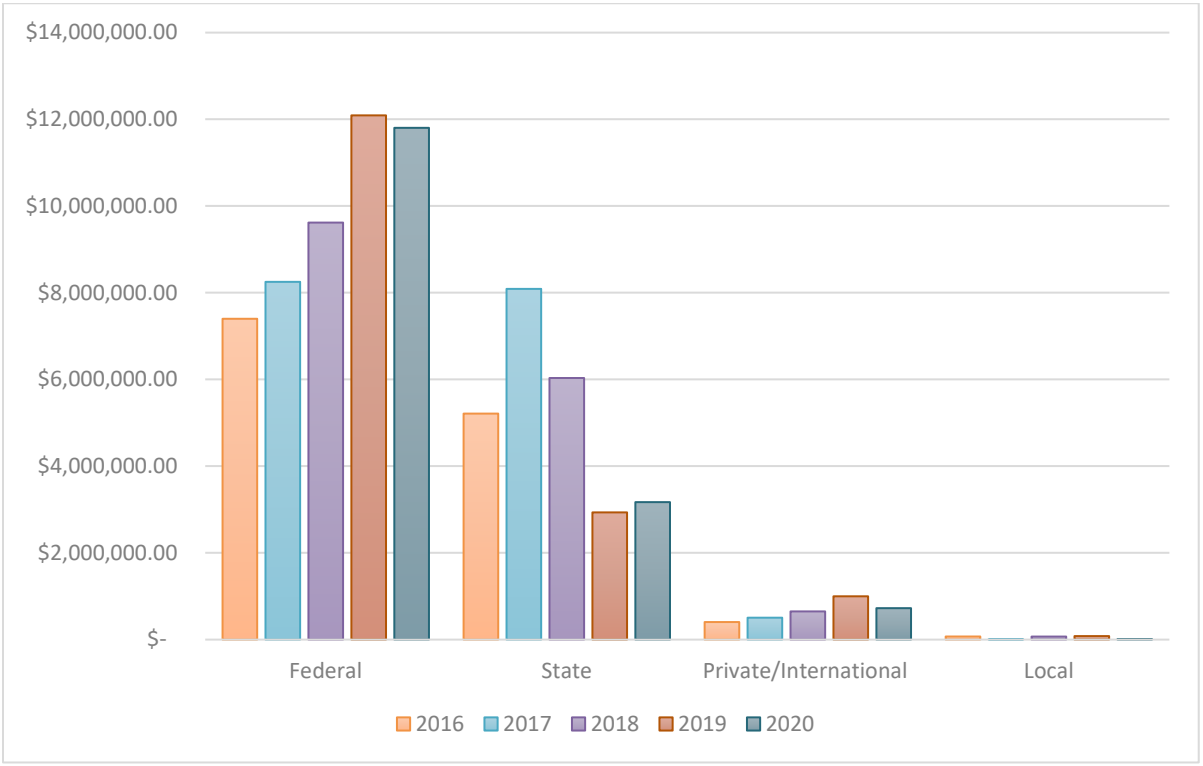

Figure 4
Awards Received by Classification

Table IX: Activation Amounts By Activity Type
FY 2016-20

Fiscal Year	*Research*		*Public Service*		*Instruction*		*Academic Support*		*Fellowships/ Scholarships/ Student Services*		*Capital Project/Operation /Maintenance*		*State Appropriation /Testing Accounts*
	#	*Activation Amount*	*#*	*Activation Amount*	*#*	*Activation Amount*	*#*	*Activation Amount*	*#*	*Activation Amount*	*#*	*Activation Amount*	*Activation Amount*
2016	81	$3,350,100	26	$2,230,963	10	$1,608,639	7	$624,314	2	$54,999	5	$180,467	$3,650,139
2017	91	$4,738,840	30	$3,369,442	8	$1,192,717	4	$209,147	9	$415,033	3	$2,137,847	$3,649,645
2018	105	$8,320,752	35	$4,232,364	11	$1,042,921	4	$217,898	7	$337,709	0	$0	$3,760,766
2019	107	$8,964,146	27	$5,619,292	6	$155,579	2	$501,995	4	$177,000	3	$516,919	$4,293,174
2020	102	$7,644,644	39	$7,213,406	5	$97,445	3	$88,792	3	$307,000	2	$360,000	$4,340,030

RESEARCH COMPLIANCE AND GENERAL COMPLIANCE SUPPORT

Research Compliance

The Office of Research and Economic Development (ORED) is responsible for monitoring compliance with the federal policies that regulate research activities in the following areas: responsible conduct of research, research ethics, human subjects research, the humane care of laboratory animals used in research and experimentation, the management of conflicts of interest in research, research integrity, export laws, and other areas of oversight.

Ultimately, it is the responsibility of the individual investigators, assisted by the ORED, to comply with all applicable federal, state, and funding agency guidelines in implementing their grants and contracts.

General Compliance Support

Several University Standing Committees, as well as other special committees, are regulated federally and must meet certain compliance criteria. These committees are, in general, research-related and are associated with the ORED. The Associate Vice President for Research serves as the Executive Officer for the Institutional Animal Care and Use Committee, the Institutional Review Board for the Protection of Human Subjects, the Intellectual Property Advisory Committee, the Scholar Mentor and the Caplenor Faculty Research Award Committee. The Vice President for Research is the Executive Officer for the Faculty Research Committee and the University Research Advisory Committee. The Annual Report of each of these Committees is on file in the ORED.

INSTITUTIONAL ANIMAL CARE AND USE COMMITTEE (IACUC)

The Institutional Animal Care and Use Committee provides for and protects the welfare of laboratory animals used for research and pedagogy as set forth by the University and in accordance with the Public Health Service Act (PHS Act) mandated by the Health Research Extension Act of 1985, Public Law 99-158, and its amendments from the U.S. Department of Agriculture, 9 CFR 9, Parts 1-3. The committee membership includes faculty, administrators, a veterinarian, and a community representative. The Committee reports to the Administrative Council.

- **Committee Members**

  - Dr. Chris Brown, Biology
  - Mr. Brent Carter, Administrative
  - Dr. Bruce Greene, Agriculture
  - Dr. Steve Hayslette, Biology (Chair)
  - Dr. Tammy Howard, Nursing
  - Dr. Jessica Oswalt, College of Engineering
  - Dr. Tyler Verble, Veterinarian
  - Mr. Joe Weatherly, Ethicist
  - Dr. Kit Wheeler, Biology
  - Dr. Francis Otuonye, Executive Officer

- **Committee Actions**

  - *Laboratory Inspections*
    Inspections of TTU lab facilities housing animals for research or teaching purposes are conducted twice annually, in accordance with national and institutional guidelines. Fall laboratory inspections were conducted on October 25, 2019, and spring laboratory inspections were conducted on March 6, 2020. Inspection of the Shipley Farm will be completed by mid-April 2020, if possible. Reports of these inspections are kept on file in the Office of Research and Economic Development; copies are sent to supervisors of the respective animal laboratories.

- *Research Proposal Evaluation*
  Nine applications to use animals in research have been received, considered, and approved by the committee so far during the 2019-2020 academic year. These are listed below:

  a. Artificial Semen Collection and Insemination in Swine (Dr. Bruce Greene, Agriculture)

  b. Mallard Use of West Tennessee Wetlands (Dr. Brad Cohen and Dr. Dan Combs, Biology)

  c. Comparison of Technologies to Determine Home Range Size of Virginia Opossums (Dr. Rob Kissell, Biology)

  d. Evaluation of Fish Movement in Little Creek (Dr. Kit Wheeler, Biology)

  e. Tennessee Tech Ichthyology Collection: Supplementation and Replacement of Specimens. (Dr. Kit Wheeler – Biology)

  f. Bat Winter Ecology in an Urban Setting in the Southeast U.S. (Dr. Brian Carver – Biology)

  g. Life History Techniques for Longnose Darter (*Percina nasuta*) (Dr. Amanda Rosenberger – Biology, USGS Fisheries Co-op Unit)

  h. Conservation Status of the Striated Darter *(Etheostoma striatulum)* in the Duck River Watershed of Tennessee (Dr. Kit Wheeler, Biology)

  i. Habitat Associations and Genetic Analysis of Blotchside Logperch (*Percina burtoni*) within Little River, Tennessee (Dr. Amanda Rosenberger – Biology, USGS Fisheries Co-op Unit)

- *Tennessee Aquarium Conservation Institute Partnership*
  The Tennessee Tech IACUC is entering into a partnership with the Tennessee Aquarium Conservation Institute (TNACI). The TTU IACUC will evaluate TNACI research proposals, providing an additional level of oversight for research activities at TNACI. Details of this partnership were discussed at Fall 2019 meetings. Representatives of TNACI attended the January 2020 IACUC meeting, and a memo of understanding detailing the partnership between TTU IACUC and TNACI was signed in Spring 2020.

- *IACUC Project Reporting and Modification Forms*
  Two new forms, an Annual Reporting Form and a Project Modification Form, were developed and approved during Spring 2020 meetings. These forms will be used by

project PIs to report annually to the IACUC about their approved projects and to submit proposed project changes to IACUC for approval.

- *Application Submission Deadline*
  At the January 2020 meeting, the IACUC approved a policy by which an application to use animals in research must be submitted to the IACUC at least two weeks prior to a meeting for the application to be considered at the meeting. The Application Form has been modified to include this requirement.

- *TTU IACUC Policy Review*
  TTU's IACUC Policy was reviewed and slightly revised by the committee during the September 2019 meeting.

➢ **Committee Meeting Dates**

- September 19, 2019; October 17, 2019; November 14, 2019; January 16, 2020; February 20, 2020; March 26, 2020 (remote via Zoom)

INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN SUBJECTS

The Tennessee Tech University (TTU) Institutional Review Board for the Protection of Human Subjects (IRB) is a standing University committee operating through the Office of Research and Economic Development and reporting to the Administrative Council.

In accordance with 45CFR46, the TTU IRB is registered with the U.S. Department of Health and Human Services (DHHS)(Federal Wide Assurance #: FWA00011357; IRB Organization #: IRB00005901). It is responsible for reviewing, approving, and providing oversight for research conducted by TTU students, staff, and faculty.

The IRB develops and recommends policy to the University, in synchronization with federal regulations, on matters pertaining to the welfare of human subjects used in research, and implements those policies when approved. The main task of the IRB is to review research proposals involving human subjects, assess potential risks to those subjects, and ensure compliance with federal and TTU regulations regarding the protection of human subjects. Risks may involve physical, psychological, social, economic, or legal consequences, as well as violations of privacy and confidentiality.

Proposals classified as exempt are those that have been determined to pose no more than minimal risk to the participants. A certified Department Reviewer determines whether or not an application requires expedited or full board review or qualifies for exempt status. Exempt proposals are forwarded to and filed in the Office of Research and Economic Development. Proposals eligible for expedited review present some risk to the participants, so subcommittees consisting of three members of the IRB review them. The IRB has formulated standard, uniform guidelines for classifying proposals for expedited review. Proposals that require review by the full IRB present a high level of risk. Each member of the IRB receives and examines a copy of a proposal for full review, and the full IRB deliberates and makes a decision at one of its regular meetings.

- **Committee Members**

  - Dr. Steven Seiler, Department of Sociology and Political Science (Chair)
  - Dr. Melinda Anderson, College of Agriculture and Human Ecology
  - Dr. Meral Anitsal, Department of Economics and Marketing
  - Dr. Andrea Arce-Trigatti, Department of Curriculum and Instruction
  - Dr. Megan Atkinson, Library Archives
  - Dr. Chris Burgin, Department of Counseling and Psychology
  - Mr. Michael Clark, Community Representative
  - Dr. Jann Cupp, Department of Counseling and Psychology
  - Dr. Paula Engelhardt, Department of Physics
  - Dr. Steven Frye, College of Interdisciplinary Studies
  - Dr. Paula Greathouse, Department of Curriculum and Instruction
  - Dr. Susan Piras, Whitson-Hester School of Nursing
  - Dr. Beth Powell, College of Engineering
  - Dr. Chad Rezsnyak, Department of Chemistry
  - Mr. James Rogers, Community Representative
  - Dr. Francis Otuonye, Executive Officer

- **Committee Actions**

  - The committee convened two special meetings to review applications requiring full board review. Those meetings occurred April 24, 2019, and March 2, 2020.
  - Since the last annual report submitted on March 26, 2019, the Office of Research and Economic Development processed 159 applications, of which 126 were approved for Exempt Status, 30 were reviewed and 19 were approved through Expedited Review, and two were reviewed, but neither approved, through the full board review procedures. Additionally, 16 continuation/change applications were reviewed, and 13 were approved.
  - On January 31, 2020, the first application under the ETSU-TTU DNP IRB agreement was submitted. It was approved by ETSU and acknowledged by TTU on February 24, 2020. Dr. Sue Piras is the point-of-contact for has been assigned to review applications from DNP students on the TTU side.
  - The committee approved a new policy regarding online research. The policy clarifies that any online source requiring login credentials is considered private space and requires Informed Consent from all participants within the medium. The IRB Application for Research Involving Human Subjects was subsequently modified to include requests for information regarding any online research.

- Due to an increase in research productivity involving protected populations, the committee approved a full board review schedule in which the board will convene meetings on the first Monday of each month, as needed, to review applications requiring full board review.
- The committee approved a new policy regarding extra credit as incentive for participation in research. The policy clarifies that the PI cannot offer extra credit to students in a course in which they do not have direct authority, and that extra credit can only be provided as an incentive for students to participate in a study if the PI is the instructor-of-record, or evidence of a formal agreement with participating faculty to offer extra credit is included in the application.
- No incidents related to any approved IRB applications have been reported.

➢ **Committee Meeting Dates**

- September 9, 2019; November 4, 2019; and January 27, 2020 (The April 6, 2020, meeting was cancelled due to circumstances surrounding COVID-19.)

INTELLECTUAL PROPERTY ADVISORY COMMITTEE

Tennessee Tech University acknowledges that the faculty and staff may from time to time conceive of an idea or discover a process that could lead to the development of a patent or the production of copyrightable materials. The University encourages such activities by the faculty and staff and recognizes its responsibility to see that ideas and discoveries are administered for the best interest of all parties concerned, including the public. The University has established an Intellectual Property Advisory Committee for the purpose of advising the President on all matters involving patents and copyrights. Membership is composed of faculty and staff experienced in research, innovation, and the production of copyrightable materials. A majority of the membership is from the faculty.

- **Committee Members**

  - Mr. Michael Aikens, I&E director
  - Dr. Michael Allen, Mathematics (Chair)
  - Dr. Sean Alley, Economics, Finance and Marketing
  - Dr. Ali Alouani, Electrical and Computer Engineering
  - Dr. Michael Best, Agriculture
  - Dr. Sherrie Foster, Counseling and Psychology
  - Dr. Steve Frye, Interdisciplinary Studies
  - Ms. Sharon Holderman, Library
  - Dr. Emily Lee, Nursing
  - Mr. Mark Lynam, Administrative
  - Ms. Ann Manginelli, Library
  - Mr. Tristan Pope, Student
  - Dr. Manuel Villalba, Foreign Languages
  - Dr. Francis Otuonye, Executive Officer

- **Committee Actions**

  - Innovation & Entrepreneurship (I & E) assisting with marketing inventions (Director, Michael Aikens)
  - Latest IPAC Policy sent to Academic Council for consideration and approval

- **Committee Meeting Dates**

  - September 3, 2019; November 12, 2019; January 22, 2020; March 24, 2020 (The meeting scheduled for October 1, 2019, was cancelled because of a lack of agenda items and/or invention disclosures. The February 18, 2020, meeting was cancelled due to a conflict with the open forum for one of the Vice President for Research candidates.)

FACULTY RESEARCH COMMITTEE

The Faculty Research Program was established in the fall quarter of 1963 to: (1) stimulate interest in research on the part of the faculty; (2) establish and administer policies and standards in connection with faculty research funds, from which assistance may be provided to faculty members who wish to undertake research projects; and (3) assist in the dissemination of information developed in faculty research projects through the publication of research bulletins and through other appropriate media of information dissemination available to the Committee. The research program provides support for investigations of new research areas for the faculty members involved. It is anticipated that the results of faculty research will filter downward into the classroom, particularly to graduate courses. The Faculty Research Program is coordinated by the Faculty Research Committee. This committee consists of 10 faculty members with the Vice President of Research and Economic Development serving as Executive Officer.

- **Committee Members**

  - Dr. Curtis Armstrong, Decision Sciences and Management
  - Dr. Joseph Biernacki, Chemical Engineering
  - Dr. Stephen Canfield, Mechanical Engineering
  - Dr. Brad Cook, Biology
  - Dr. Allen Driggers, History
  - Dr. Steven Frye, Interdisciplinary Studies
  - Dr. Catherine Godes, Music
  - Dr. Rachel Hall, Nursing (Chair)
  - Dr. Cara Sisk, Human Ecology
  - Dr. Matt Smith, Curriculum and Instruction
  - Dr. Francis Otuonye, Interim Executive Officer

- **Committee Actions**
  - A complete listing of the Faculty Research Awards for 2019-20 is provided in Appendix C.

- **Committee Meeting Dates**

  - October 18, 2019; November 19, 2019; February 21, 2020; March 6, 2020

CAPLENOR FACULTY RESEARCH AWARD COMMITTEE

The Caplenor Faculty Research Award, established in 1984 in honor of the late Dr. Charles Donald Caplenor, former Associate Vice President for Research and Dean of Instructional Development, is awarded annually to one member of the faculty of Tennessee Tech University for outstanding research accomplished while employed at the University.

- **Committee Members**

  - Dr. Deborah Barnard, Foreign Languages
  - Dr. Joe Biernacki, Chemical Engineering (Chair)
  - Dr. Greg Danner, Music
  - Dr. Dennis Duncan, Agriculture
  - Mr. Stuart Gaetjens, Library
  - Dr. Melissa Geist, Nursing
  - Dr. Tor Guimaraes, Decision Sciences and Management/Business
  - Dr. David Hajdik, Environmental Studies
  - Dr. Joseph Ojo, Electrical Engineering
  - Dr. Sandi J. W. Smith-Andrews, Curriculum and Instruction
  - Dr. Francis Otuonye, Executive Officer

- **Committee Actions**

  - The Caplenor Faculty Research Award was awarded to Dr. Ismail Fidan for the 2019-20 fiscal year.

- **Committee Dates**

  - October 3, 2019; March 10, 2020

UNIVERSITY RESEARCH ADVISORY COMMITTEE

The University Research Advisory Committee (URAC) advises the President and Provost on strategies to stimulate growth in research and externally funded scholarly activities within the University community and on the development of a comprehensive structure and network of activities to foster externally funded scholarly activities. The Committee reports directly to either the Academic Council or Administrative Council or both, depending on the matter at hand. In carrying out its function, the Committee will:

A. Identify strengths, weaknesses, opportunities and challenges to research growth and externally funded scholarly activities at TTU.
B. Identify emerging research opportunities anticipated across the academic discipline.
C. Make recommendations regarding intellectual and infrastructure needs required to capitalize on major research opportunities.
D. Develop plans and make recommendations for accessing, supporting and sustaining existing and emerging research thrust areas.
E. Review current practices in research administration and recommend strategies to foster research growth.
F. Make recommendations regarding the commercialization of research and intellectual property issues.

- **Committee Members**

  - Dr. Michael Adduci, Music
  - Dr. Steven Anton, Mechanical Engineering
  - Dr. Debbie Barnard, Foreign Languages
  - Dr. Jason Beach, Curriculum and Instruction
  - Dr. Jeff Boles, Chemistry (Chair)
  - Dr. Sheikh Ghafoor, Computer Science
  - Mr. Craig Harrison, Undergraduate Student
  - Dr. Adam Holley, Physics
  - Dr. Shelia Hurley, Nursing
  - Dr. Brian Leckie, Agriculture
  - Dr. Satish Mahajan, Energy Center
  - Dr. Hayden Mattingly, Environmental Studies
  - Dr. Ramachandran Natarajan, Business

- Ms. Kayla Sims, Graduate Student
- Dr. Mark Stephens, Provost's Office
- Dr. Francis Otuonye, Interim Executive Officer

➢ **Committee Actions**

- *Request to the President's Office to Offset Term Limits of URAC Members:* URAC members each serve three-year terms – the same three-year term, meaning every three years all members were rotating off the committee. Several members volunteered to extend their terms if the President agreed and appointed them to an extension such that staggered terms were formed. This was accomplished in Fall 2019 at the beginning of the semester, and the terms of several were extended by the President (six members to expire at the end of 2021 and three members to expire at the end of 2022).

- *Revising Procedures for the URAC:* URAC reviewed and revised its procedures to make sure that they reflect the strategic goals and align with the priority actions of Tennessee Tech's new Strategic Plan. The revised procedures were submitted to and approved by both the Academic Council and Administrative Council.

- *Building Research Capacity at TTU:* Discussion concerning the President's goal of doubling sponsored research to $40 million by 2025 led to the formation of a subcommittee charged with developing a survey to send to Chairs. The goal of the survey was to determine what, in the opinion of the Chairs, was needed in order to accomplish this goal. The survey was sent out just before Fall Break and analyzed during the last half of the fall semester. The most mentioned common denominator among the 70% of respondents was two-fold: (1) the need for additional faculty and (2) the ability to adjust teaching loads.

- *Cornerstone:* The Cornerstone Government Affairs Group assists in the building of relationships with funding agencies on behalf of TTU. URAC desired to more fully understand this process and how URAC could serve as advocates to help leverage available resources. As a result of this discussion, URAC met with Dr. Marty Fuller, Mr. Will Smith and Mr. Will Todd of Cornerstone (via Zoom) on November 7, 2019. Cornerstone offered a review of their company as well as a summary of the current funding environment. They spoke of the timeline they deal with each year in acquiring funding for their clients. They encouraged submission of white papers via a template provided by the TTU Office of Research and Economic Development. They encouraged cross-disciplinary ideas and would seek funding matches with

federal agencies.

- *Research Awards:* The Annual Scholastic Research Award is given to two faculty (one tenured and one tenured-track). The total amount for each awardee is $1,500, and they are typically recognized at the Spring University Awards Reception. The committee reviewed applications submitted and selected two awardees. One applicant was selected for each award (Dr. Shelly Marasi receives the tenure-track award and Dr. Janet Isbell receives the tenured faculty award). Each has been notified.

- *Data-Driven Assessment:* As a result of the goal of doubling sponsored research to $40 million by 2025, URAC continued its discussions of various campus initiatives used to stimulate endeavors that increase scholarly activity, assessment of those activities and return on investment. A URAC subcommittee will continue discussions in this area over the summer with the goal of drafting recommendations and implementation strategies by the beginning of the Fall 2020 semester.

➢ **Committee Meeting Dates**

- September 5, 2019; October 3, 2019; November 7, 2019; December 12, 2019; February 4, 2020; April 7, 2020; April 28, 2020

APPENDICES

Appendix A gives the total amount of research funds brought into the University from external sources by college/department/Center. The project title, investigator(s), the funding agency, and the amount of funding received are listed for each.

Appendix B summarizes the intellectual property activity in the areas of patents and copyrights.

Appendix C summarizes the Faculty Research Committee Awards.

APPENDIX A

Externally Funded Projects by College/Department/Principal Investigator
Project Title, Funding Agency, Center, Funding Amount, and Co-PIs Listed

College of Agriculture and Human Ecology — Total: $1,066,830

School of Agriculture

Dennis Duncan

- Management of Camp Clements
  Tennessee Dept of Education
  Amount: $234,782

Dennis Fennewald

- Rural Renewal: A Roadmap for Rural America
  Private
  Amount: $8,800

School of Human Ecology

Melinda Anderson

- Tennessee Early Childhood Training Alliance (TECTA) 2019-20
  Tennessee State University
  Amount: $521,248
- Tennessee Early Childhood Training Alliance (TECTA) Scholarships
  Tennessee State University
  Amount: $282,000

Anthony Paradis

- Food for Thought for Student-Athletes: An Online Education Program to Fuel Athletes with Knowledge on Nutrition and Mental Health
  Private
  Amount: $20,000
  Co-PI(s): Samantha Hutson

College of Arts and Sciences — Total: $2,614,457

Biology

Brad Cohen

- Delineation of Harvest Management Units for White-tailed Deer in Tennessee
  Tennessee Wildlife Resources Agency
  Amount: $21,269
  Co-PI(s): Robert Kissell
- Factors Affecting Sanctuary Use by Mallards
  US Fish and Wildlife Service
  Center: Water
  Amount: $27,867
- Mallard Use of Tennessee Westlands
  Tennessee Wildlife Resources Agency
  Center: Water
  Amount: $425,706
  Co-PI(s): Daniel Combs
- Using Structured Decision Making to Develop a Robust Population Model for White-tailed Deer in Tennessee
  Tennessee Wildlife Resources Agency
  Amount: $67,600
  Co-PI(s): Robert Kissell

John Gunderson

- Role of Protozoan Cysts in Protecting Pathogens of the Fresh Produce Industry
  Middle Tennessee State University
  Amount: $18,727
- Trafficking of Two Novel Intracellular Bacteria in Eukaryotic Cells
  Middle Tennessee State University
  Amount: $50,718

Steve Hayslette

- Collection of Biological Data at Deer Check Stations
  Tennessee Wildlife Resources Agency
  Center: Water
  Amount: $2,000

Carla Hurt

- Collaborative Research: SG: Phylogenomics and Diversification of the Snapping Shrimp Genus Alpheus
  National Science Foundation
  Center: Water
  Amount: $69,439

- Environmental DNA (eDNA) Detection of the Endangered Pygmy Madtom *(Noturus stanauli)* in the Upper Clinch River in Virginia
  Virginia Department of Game & Inland Fisheries
  Center: Water
  Amount: $15,000
  Co-PI(s): Robert Paine

Robert Kissell

- Understanding the State of Curl-Leaf Mountain Mahogany *(Cercocarpus Iedifolius)* and Utah juniper *(Juniperus osteosperma)* Cover with a Focus on Bighorn Sheet *(Ovis canadenisi)* Habitat
  National Park Service
  Amount: $8,554

Justin Murdock

- Assessing the Restoration Success of WRP Easements in Tennessee and Kentucky
  The Nature Conservancy
  Center: Water
  Amount: $457,238
  Co-PI(s): Alfred Kalyanapu
- Investigating Factors that Influence Hypoxie and Denitrification in Aquatic Argoecosystems
  US Dept of Agriculture
  Center: Water
  Amount: $10,000
- Tennessee Water Resources Research Center Program
  University of Tennessee
  Center: Water
  Amount: $4,995
  Co-PI(s): Robert Brown (student)

Chemistry

Jeff Boles

- Project Inspire STEM Teacher Residency
  National Science Foundation
  Center: Water
  Amount: $334,356
  Co-PI(s): Jeremy Wendt

Jesse Carrick

- Modular Approaches to "Click" Complexants for Chemoselective Minor Actinide Separation
  US Dept of Energy
  Amount: $94,802
  Co-PI(s): Cory Hawkins

Earth Sciences

Jeanette Wolak

- Shared Services Centers (NSSC) Geologic Mappig and Stratigraphic Analyses of Terraced Fan Deposits
  National Aeronautics and Space Administration
  Amount: $53,760

Physics

Sakir Ayik

- Studies of Heavy-Ion Collisions in Stochastic Mean-Field Approach
  US Dept of Energy
  Amount: $42,000

Adam Holley

- Investigation of Spin Evolution in Magnetic Ultraacold Neutron Bottles Used to Measure the Free Neutron Lifetime
  National Science Foundation
  Amount: $95,000

Mary Kidd

- National Space Grant College and Fellowship Program (SPACE Grant)
  Vanderbilt University
  Center: STEM
  Amount: $37,600
- PIRE: Advanced Germanium Detectros and Technologies for Underground Physics
  University of South Dakota
  Amount: $39,965

Mustafa Rajabali

- MRI: Development of a High-Resolution Neutron Detractor for Decay and Reaction Studies with Exotic Nuclei
  University of Tennessee
  Center: Energy
  Amount: $48,509
- The Structure of Neutron-rich Deformed Nuclei Studied via Beta Decay
  US Dept of Energy
  Center: Energy
  Amount: $78,000

Stephen Robinson

- A Model of Educational Transformation: Developing a Community of Faculty Implementing Next Generation
  Cal State University Auxiliary and Research Services Corp

Amount: $85,443
Co-PI(s): Paula Engelhardt

Sociology and Political Science

Steve Seiler

- Opioid Prevention and Education in Underserved Populations: College Students and Veterinarian Practice
  Private
  Amount: $24,077
  Co-PI(s): Mark Loftis, Gwendolyn Norris

Tennessee Cooperative Fishery Research Unit

Mark Rogers

- Evaluating Sport Fisheries
  Tennessee Wildlife Resources Agency
  Center: Water
  Amount: $40,000
- Evaluating Stocked Fisheries
  Tennessee Wildlife Resources Agency
  Center: Water
  Amount: $66,000
- Evaluation of Asian Carp Populations in the Tennessee and Cumberland Rivers
  Tennessee Wildlife Resources Agency
  Center: Water
  Amount: $139,510
- Fishery Research Unit Base 2016-2021
  Tennessee Wildlife Resources Agency
  Amount: $30,000
  Co-PI(s): Amanda Rosenberger
- United States Fish & Wildlife Service U. S. Explansion
  US Fish and Wildlife Service
  Center: Water
  Amount: $19,304

Amanda Rosenberger

- Analysis of Habitat for Reintroduction of the Blotchside Longperch
  Private
  Center: Water
  Amount: $19,090

- Analysis of Habitat Use and Suitability of Abrams Creek for Reintroduction of the Blotchside Logperch Project

National Park Service
Center: Water
Amount: $15,400

- Cumberland River Aquatic Center (CRAC) Water Quality
  Tennessee Wildlife Resources Agency
  Center: Water
  Amount: $10,000

- Duck River Mussel Surveys
  Tennessee Wildlife Resources Agency
  Center: Water
  Amount: $31,193

- Life History, Habitat Use, and Genetic Uniqueness of the Longnose Darter Percina nasuta (S1) in Missouri
  Missouri Dept of Conservation
  Center: Water
  Amount: $39,435

- Tennessee Heelsplitter (Lasmigona holstonia) Distribution and Habitat Use
  US Geological Survey
  Center: Water
  Amount: $55,000

- Validation and Transferability of Fundamental Niche Models of Mussel Communities and Assessment of Risks to Mussel Pupulation sin Ozark River Drainages
  Missouri Dept of Conservation
  Center: Water
  Amount: $36,900

College of Business Administration — Total: $3,529,883

Dean's Office, College Of Business

Alice Camuti

- Student Engagement Retention and Success Jumpstart! Business Student Success Initiative
  Tennessee Board of Regents
  Amount: $35,000
  Co-PI(s): Yolunda Nabors

Decision Sciences and Management

Tom Timmerman

- Tennessee Small Business Development Center 2020
  Middle Tennessee State University
  Amount: $155,500

- Tennessee Small Business Development Center (TSBDC) Coronavirus Aid, Relief, and Economic Security (CARES) Act Funding 2020
  Middle Tennessee State University
  Amount: $220,000

Susan Wells

- Governor's School for Innovation and Entrepreneurship
  Tennessee Dept of Education
  Amount: $91,772

Economics Finance and Marketing

Ferdinand DiFurio

- Broadband Impact Study
  Private
  Amount: $63,285
  Co-PI(s): Yolunda Nabors

iCube

Kevin Liska

- 2020 Drug Abuse Education Tool, Reality is...app
  Tennessee Dept of Finance and Administration
  Center: iCube
  Amount: $50,000

- Integrated Marketing Communications System
  Tennessee Dept of Safety and Homeland Security
  Center: iCube
  Amount: $1,425,075

- MakerMinded State Expansion
  American Lightweight Materials Manufacturing Innovation Institute (ALMMII)
  Center: iCube
  Amount: $64,000
  Co-PI(s): Julie Brewer

- Motor Vehicle Crash Prevention Services
  Tennessee Department of Health
  Center: iCube
  Amount: $25,000
  Co-PI(s): Edwin Baidoo

- National Digital Car Seat Check Form
  National Safety Council
  Center: iCube
  Amount: $75,000
  Co-PI(s): Julie Erno Brewer, Joseph David Powell

- Virtual Reality Education as a Solution for the Opiod Abuse Epidemic
  Tennessee Department of Health
  Center: iCube
  Amount: $115,000
- TN Traffic Safety Resources and Occupant Protection
  Tennessee Dept of Safety and Homeland Security
  Center: iCube
  Amount: $989,391

Amanda Powell

- Technical Support and Marketing of a Substance Use Treatment Navigator Website
  Tennessee Department of Health
  Center: iCube
  Amount: $175,000
  Co-PI(s): Kevin Liska

Tennessee Small Business Development Center
Angela Denson

- Tennessee Small Business Development Center January - December 2019
  Tennessee Small Business Development Center
  Amount: $45,860

College of Education — Total: $2,177,330

Counseling and Psychology
Chad Luke

- Student Engagement, Retention, and Success TTU Learning Village Wellness and Resilience Project
  Tennessee Board of Regents
  Amount: $35,000

Matthew Zagumny

- Mind Attribution of Social Robots: Examining Anthropomorphic Appearance and Function
  Private
  Amount: $1,450
  Co-PI(s): Sarah Sweezy (student)

Curriculum and Instruction
Andrea Arce-Trigatti

- Student Engagement, Retention and Success STEM Foundry Heritage Fellows Program
  Tennessee Board of Regents
  Center: STEM
  Amount: $25,000
  Co-PI(s): Pedro Arce, Jonathan Sanders, Darek Potter, Stephanie Jorgensen, Carlos Galindo

Martha Howard

- Bridges EIRA (TEIS) Federal funding
  Tennessee Dept of Education
  Amount: $136,890
- Bridges EIRA (TEIS) State funding
  Tennessee Dept of Education
  Amount: $370,110
- Bridges EIRA Assessment Vendor FY20-FY24 Federal funding
  Tennessee Dept of Education
  Amount: $12,000
- Bridges EIRA Assessment Vendor FY20-FY24 State funding
  Tennessee Dept of Education
  Amount: $13,000
- Childcare TN Enhancement Grant
  Private
  Amount: $4,000
- Tennessee Early Childhood Preschool Program FY 19-20
  Putnam County Board of Education
  Amount: $87,537
- Tennessee's Early Intervention System (TEIS) Evaluation Grant Federal funding
  Tennessee Dept of Education
  Amount: $560,000
  Co-PI(s): Kimberly Correll, Amy Callender
- Tennessee's Early Intervention System (TEIS) Eligibility Evaluation Grant State funding
  Tennessee Dept of Education
  Amount: $840,000
  Co-PI(s): Kimberly Correll, Amy Callender

Jennifer Meadows

- Army Education Outreach Program Consortium
  Battelle Memorial Institute
  Center: STEM
  Amount: $38,572

Dean's Office, College of Education

Julie Baker

- Student Engagement Retention and Success HIPSTERS: High Impact Practices in STEM Targeting Engagement, Retention & Success
  Tennessee Board of Regents
  Amount: $24,092
  Co-PI(s): Lisa Zagumny, Darek Potter, Carlos Galindo

STEM Center

Darek Potter

- Hub Operations & Innovative Educator Workshop
  Battelle Memorial Institute
  Center: STEM
  Amount: $29,679

College of Engineering — Total: $6,058,817

Center for Energy Systems Research

Satish Mahajan

- Simulation of HF Inverter Circuits for High-Power Wireless Charging
  Oak Ridge National Laboratory
  Center: Energy
  Amount: $49,473

Charles VanNeste

- Adaptive and Reconfigurable Sensor Elements and Networks for Monitoring Critical Infrastructure and Maneuver Corridors
  Mississippi State University
  Center: Energy
  Amount: $957,444
  Co-PI(s): Satish Mahajan
- EAGER SitS: A Multi-Sensor Probe Network for Continous Monitoring of the Soil Health
  National Science Foundation
  Center: Energy
  Amount: $74,012
  Co-PI(s): Satish Mahajan, Brian Leckie

Center for Manufacturing Research

Ying Zhang

- Development of Corrosion and Erosion Resistant Coatings for Advanced Ultra-Supercritical Materials
  US Dept of Energy
  Center: Manufacturing
  Amount: $580,821
- Electro-codeposition of MCrAlY Coatings for Advanced Gas Turbine Applications
  Private
  Center: Manufacturing
  Amount: $25,000

- US Department of Defense High Performance Laboratory-Scale Gas Atomizer for Materials and Coatings Research
  Office of Naval Research
  Center: Manufacturing
  Amount: $315,000

Chemical Engineering

Laura Arias Chavez

- Mixed Matrix Membranes for Broader Wastewater Reclamation
  National Science Foundation (Graduate Research Fellowship Program)
  Center: Water
  Amount: $46,000
  Student: Haley White

Liqun Zhang

- Novel Endogenous Beta Defensin Based Therapeutics to Treat COVID-19 Patients
  Private
  Center: Energy
  Amount: $8,000

Civil and Environmental Engineering

Tania Datta

- Planning for Watershed-wide Stormwater Management in an Underserved Community of Tennessee Through University-Community Partnership
  Upper Cumberland Development District
  Center: Water
  Amount: $68,757
  Co-PI(s): Alfred Kalyanapu

Alfred Kalyanapu

- Development and Improvement of High-Resolution Flood2D-GPU Modeling for Titan HPC Environment
  Oak Ridge National Laboratory
  Center: Water
  Amount: $148,096
  Co-PI(s): Sheikh Ghafoor

- Evaluation of Nonlinear Interactions Between Tropical Cyclone Storm Surge and Rainfall Runoff
  National Science Foundation (Graduate Research Fellowship Program)
  Center: Water
  Amount: $46,000
  Student: John Brackins

- Development of GIS-Based Watershed Vulnerability Assessment (GAVA) Tool for HUC-12 Level Watersheds in Tennessee
  US Dept of Agriculture

Center: Water
Amount: $118,213
Co-PI(s): Tania Datta

- Tennessee Water Resource Research Center Program - Kalyanapu
  University of Tennessee
  Center: Water
  Amount: $20,000
  Co-PI(s): Tania Datta

Daniel VandenBerge

- Consolidation and Unit Weight Testing of Aeroaggregate
  Private
  Center: Energy
  Amount: $6,000
- US Navy Academic Review and Rewrite of NACFAC-DM 7.02
  Private
  Center: Energy
  Amount: $29,700

Computer Science

Gerald Gannod

- Collaborative Research: Software Engineering Workforce Development in High Performance Computing for Digital Twins
  National Science Foundation
  Center: Energy
  Amount: $42,365
  Co-PI(s): Sheikh Ghafoor
- Implementing a Preference-Based, Person-Centered Communication Tool in Tennessee
  Miami University (Ohio)
  Center: Energy
  Amount: $49,449

Sheikh Ghafoor

- Collaborative Research: CyberTraining: Pilot: Semi-Automatic Assessment of Parallel Programs in Training of Students and Faculty
  National Science Foundation
  Center: Energy
  Amount: $39,881
  Co-PI(s): Ada Haynes
- CyberTraining:CDL:iPDC - Summer Institute for Integrating Parallel and Distributed Computing in Introductor Programming Classes
  National Science Foundation
  Center: Energy

Amount: $179,396
Co-PI(s): Michael Rogers

- Detection and Analysis of Malware in Critical Infrastructure
  Oak Ridge National Laboratory
  Center: Energy
  Amount: $16,285
- From Can't to Can: Attack Prevention & in-situ detection of Advanced Attacks on Controller Area Networks
  Oak Ridge National Laboratory
  Center: Energy
  Amount: $34,805
- Research of Machine-Learning Based Cybersecurity Tools
  Oak Ridge National Laboratory
  Center: Energy
  Amount: $19,704
- Tracking Water Storage in Lakes: Citizens and Satellites Implementation Phase
  University of North Carolina at Chapel Hill
  Center: Energy
  Amount: $83,495

Martha Kosa

- Affiliate Capacity Building Fund
  Private
  Center: CEROC
  Amount: $1,955

Muhammad Ismail

- Enabling Efficient Integration of Electric Vehicles in Qatar's Smart Grid: Planning, Operation, and Cybersecurity
  Private
  Center: Energy
  Amount: $35,005

Cybersecurity Education, Research and Outreach Center

Ambareen Siraj

- CEROC Memorandum of Understanding
  Private
  Center: CEROC
  Amount: $25,000
- Department of Defense National Security Agency CYSP Student Recruitment Proposal
  National Security Agency
  Center: CEROC

Amount: $256,051
Co-PI(s): Eric Brown

- Tennessee Cybercorps: A Hybrid Program in Cybersecurity
  National Science Foundation
  Center: Manufacturing
  Amount: $358,583
  Co-PI(s): Douglas Talbert

- Supplement to Tennessee Cybercorps: A Hybrid Program in Cybersecurity – Community College Inclusion
  National Science Foundation
  Center: Manufacturing
  Amount: $93,154
  Co-PI(s): Douglas Talbert

Dean's Office, College of Engineering

Vahid Motevalli

- Southeastern Transportation, Reserach, Innovation, Development and Education Center
  University of Florida
  Center: Energy
  Amount: $12,000
  Co-PI(s): Darek Potter

Jessica Oswalt

- Tennessee Louis Stokes Alliance for Minority Participation
  Tennessee State University
  Center: Energy
  Amount: $52,200

Joseph Slater

- Board of Architectural and Engineering Examiners Grant 2020
  State of Tennessee Dept of Commerce and Insurance
  Amount: $38,195

Electrical and Computer Engineering

Ali Alouani

- Intelligent Robot for TVA Substation Inspection
  Tennessee Valley Authority
  Center: Manufacturing
  Amount: $111,000

Indranil Bhattacharya

- Investigating Early Transition Metal Dopant Effects in Cobalt Free Lithium Ion Batteries
  Oak Ridge National Laboratory
  Center: Energy
  Amount: $54,255
- REU Site: Immersive Research in Energy Generation, Storage/Conversion, and Power Transmission
  National Science Foundation
  Center: Energy
  Amount: $107,421
  Co-PI(s): Joseph Biernacki

Mohamed Mahmoud

- Efficient Energy Management System with Integrated Cybersecurity Measures in Qatar's Smart Grid
  Private
  Center: Energy
  Amount: $64,316
  Co-PI(s): Muhammad Ismail
- Enabling Efficient Integration of Electric Vehicles in Qatar's Smart Grid: Planning, Operation, and Cybersecurity
  Private
  Center: Energy
  Amount: $30,264
- Hybrid AC/DC Islanded Micro-Grids in Qatar: Planning, Operations, and Cyber Security
  Private
  Center: Energy
  Amount: $10,800
- REU Site: Secure and Privacy-Preserving Cyber Physical Systems: Software and Hardware Approaches
  National Science Foundation
  Center: Manufacturing
  Amount: $129,992
  Co-PI(s): Syed Hasan
- Traffic Optimization System Based on Secured Crowd Sourced Data
  Private
  Center: Manufacturing
  Amount: $44,259

General & Basic Engineering

Christopher Wilson

- Governor's School for Emerging Technologies
  Tennessee Dept of Education
  Amount: $133,973

Manufacturing & Engineering Technology

Ismail Fidan

- Mobile Additive Manufacturing Platform for the 21st Century STEM Workforce Enhancement
  Somerset Community College
  Center: Manufacturing
  Amount: $87,949
- SMART2: Smart Manufacturing for America's Revolutionizing Technological Transformation
  Motlow State Community College
  Center: Manufacturing
  Amount: $73,661

Duckbong Kim

- Development of Metal 3D Printing Material and Process Optimization Technology for Medium and Large-sized Transportation Parts Mold Manufacture
  Private
  Center: Manufacturing
  Amount: $11,437
- Development of Surrogate Machine Learning Models for Anomaly Detection and Classification in Metal Additive Manufacturing Process
  Private
  Center: Manufacturing
  Amount: $46,000

Mechanical Engineering

Mohammad Albakri

- Reference-Free Longitudinal Rail Stress and Neutral Temperature Measurement Utilizing Multidirectional Elastic Waves
  Virginia Polytechnic Institute and State University
  Center: Manufacturing
  Amount: $32,000

Pingen Chen

- Developing an EV Demonstration Testbed in the Upper Cumberland Region of Tennessee, an Economy Distressed Rural Region
  US Dept of Energy
  Center: Manufacturing
  Amount: $476,703
  Co-PI(s): Stephen Canfield, Joseph Ojo, Indranil Bhattacharya, Vahid Motevalli
- Project-based Learning for Educating Next-Generation Automotive Engineers at Tennessee Tech
  Private
  Center: Manufacturing
  Amount: $45,000
  Co-PI(s): Stephen Canfield, Mohan Rao, Vahid Motevalli

Glenn Cunningham

- Public-Private Partnership to Promote Efficient Manufacturing and Workforce Development
  US Dept of Energy
  Center: Manufacturing
  Amount: $315,462
  Co-PI(s): Ethan Languri

Ethan Languri

- Demonstrate Enhancement of Heat Transfer in Important Components of Grid Operations
  Private
  Center: Energy
  Amount: $196,544
- Southeast Combined Heat & Power Technical Assistance Partnership (CHP TAP)
  North Carolina State University
  Center: Manufacturing
  Amount: $38,914
  Co-PI(s): Glenn Cunningham

Andrew Pardue

- Student Capstone Design Projects - ME
  Private
  Amount: $10,000
- U.S. Air Force Research Laboratory University Design Challenge
  Private
  Center: Manufacturing
  Amount: $25,000

Sally Pardue

- Army Education Outreach Program Consortium
  Battelle Memorial Institute
  Center: STEM
  Amount: $102,466

Ahmadreza Vaselbehagh

- Advanced WAke Loss Modeling for Large Wind Farms with Variable Wind Speed and Direction
  University of Delaware
  Center: Energy
  Amount: $20,715
- Application of Artificial Intelligence for Air Pollution Monitoring and Remediation using Neural Network and Deep Learning
  Private
  Center: Energy
  Amount: $10,619

Jiahong Zhu

- Development and Validation of Low-Cost, Highly-Durable, Spinel-Based Contact Materials for SOFC Cathode-Side Contact Application
  US Dept of Energy
  Center: Manufacturing
  Amount: $50,028

College of Fine Arts — Total: $21,980

Craft Center Workshops

Gail Gentry

- Empowering 5th-12th Grade Art Educators to Design and Implement Hands-On Craft Activities
  Private
  Center: Craft Center
  Amount: $10,000
  Co-PI(s): Jeremy Blair
- Focus on Fine Craft Program for High School Students
  Tennessee Arts Commission
  Center: Craft Center
  Amount: $6,230
- Twenty Second Annual Celebration of Craft Touring Grant (TOUR)
  Tennessee Arts Commission
  Center: Craft Center
  Amount: $1,500

Music

Daniel Allcott

- National String Project Site
  Private
  Amount: $4,250
  Co-PI(s): Mia Haggerty

College of Interdisciplinary Studies — Total: $101,937

Environmental Studies

Hayden Mattingly

- AEDC Bat-Related Aquatic Resources STudy 2018-Evaluation of Aquatic Resources to Support Bat Foraging Habitat at AEDC
  US Fish and Wildlife Service
  Center: Water
  Amount: $65,809
  Co-PI(s): William Gibbs, Justin Murdock, Christopher Wheeler
- Life History Study of Brawley's Fork Crayfish
  Tennessee Wildlife Resources Agency
  Center: Water
  Amount: $15,000
- Range-wide Population for the Striated Darter
  Tennessee Wildlife Resources Agency
  Center: Water
  Amount: $21,128
  Co-PI(s): Christopher Wheeler

Office of the President — Total: $10,000

Communications & Marketing

Karen Lykins

- Office of Criminal Justice Programs Complete Count Census Project
  Dept of Finance and Administration
  Amount: $10,000

Research & Economic Development — Total: $118,000

Tennessee Center for Rural Innovation

Michael Aikens

- Economic Development Administration - Tennessee Center for Rural Innovation (TCRI)
  US Dept of Commerce
  Amount: $118,000

Whitson Hester School of Nursing — Total: $12,053

Nursing Instruction

Susan Piras

- Nursing Research Collaboration
  Cookeville Regional Medical Center
  Amount: $12,053

State Appropriations/Center Testing Accounts

Center for Energy Systems Research

- State Appropriation: $970,600
- Center Testing Account: $13,017

Center for Manufacturing Research

- State Appropriation: $1,576,400
- Center Testing Account: $3,203

Center for the Management, Utilization and Protection of Water Resources

- State Appropriation: $1,207,500
- Center Testing Account: $69,310

Cybersecurity Education, Research and Outreach Center

- State Appropriation: $500,000

APPENDIX B

Intellectual Property Activity 2019-20

Invention disclosures received

- Electrical Field Shaping – Dr. Charles Van Neste, Tanner Mingen, Whitney Kirby
- Skin-to-Skin Simulator for Micro-Preemies and Unstable Premature Infants in the NICU – Dr. Melissa Geist, Dr. Andy Pardue, Erin Guenther, Taylor Hornback
- The Supportive Incontinence Protection Pad (SIP Pad) – Dr. Melissa Geist, Dr. Robby Sanders, Amy Tribble, JP Nelms, Anna Webster
- RevoluTion – Jordan Barnett, Cody Bowerman, Shelley Edwards, Stephen Shepherd
- Endotracheal Tubing Suction-enabled Stylet – Elizabeth Baldwin, Daniel Hines, Annie King, William Byington

Provisional patent applications filed

- Electric Field Shaping and confining Wireless Power Transfer System – Dr. Charles Van Neste, Tanner Mingen, Whitney Kirby
- Skin-to-Skin Simulator for Micro-Preemies and Unstable Premature Infants in the NICU – Dr. Melissa Geist, Dr. Andy Purdue, Erin Guenther, Taylor Hornback
- The Supportive Incontinence Protection Pad (SIP Pad) – Dr. Melissa Geist, Dr. Robby Sanders, Amy Tribble, JP Nelms, Anna Webster.
- RevoluTion – Jordan Burnett, Cody Bowerman, Shelley Edwards, Stephen Shepherd
- Endotracheal Tubing Suction-enabled Stylet – Elizabeth Baldwin, Daniel Hines, Annie King, William Byington.

Non-provisional patent applications filed

- Apparatus used for Producing Coatings – Dr. Ying Zhang
- Advanced Selectivity Gas Permeable Anode Flow Field Design – Dr. Cynthia Rice
- Omnidirectional, Electric Near-field Distance Sensing – Dr. Charles Van Neste

Provisional applications recommended for conversion to utility patents

- Reduced Temperature Sintering of Spinal-type Coatings – Dr. Jiahong Zhu
- Modifying Hydrogels – Dr. Pedro Arce and Dr. Robby Sanders
- Pipet Stabilization Attachment – Dr. Robby Sanders

Provisional patents to be provided to license brokers

- Tech Bot – Dr. Ismail Fidan
- Electrical Field Shaping – Dr. Charles Van Neste, Tanner Mingen, Whitney Kirby
- Wound Vac – Dr. Ann Hellman

Abandon/return to inventor

- Medical Boot – Dr. Ismail Fidan
- Fidan – Bottle Opener – Dr. Ismail Fidan
- Compressed Gas Flow Meter – Dr. Glenn Cunningham
- Block-Aide – Coach Zelenock
- Electrical Element Stacking – Dr. Charles Van Neste

APPENDIX C

Faculty Research Committee Awards 2019-20

Track I

Author(s)	Title	Dept.	Amount
Kathryn Kozak	Principals' Perceptions of the School Counselor's Role	Counseling & Psych	$3,000
Emily Lee	Bridging the Rural Healthcare Gap with FNP Clinical Preparatory Training	Nursing	$3,000
Michael Adduci	Quantifying Relationships Between Intraoral Pressure and Sound Pressure during Performance of Wind Instruments	Music	$3,000
Greg Danner	Recording of Original Compositions for Concert Band	Music	$3,000
Stephanie Kazanas	Improving Geology and Engineering Through Historical Case Studies	Counseling & Psych	$3,000
Total Track I			$15,000

Track II

Author(s)	Title	Dept.	Amount
Jennifer Mabry	The Effect of Pre-clinical Preparation on Graduate Nursing Student's Readiness for Practice in the Central Appalachian Region using Simulation	Nursing	$10,000
Mohammad Albakri	Elastic Meta-structures with Localized Stress-fields for Low-frequency Bandgaps	Mechanical Engineering	$10,000
Alfred Kalyanapu	Development and Deployment of Rapid Deployable Flood (RDF) Gages for Rural Tennessee	Civil and Enviro Engineering	$10,000
Pedro Arce and Andrea Arce-Trigatti	Leveraging the Foundry to Develop the Facilitator of Learning for a Holistic-Style STEM Professional	Chemical Eng and C&I	$10,000
Syed Rafay Hasan	Optimizing Dynamic Distribution of Intelligence for Node Level Edge Devices Based Edge Intelligence (ND-EI)	ECE	$10,000
Indranil Bhattacharya	Investigating Optical Characteristics, Current Matching and Carrier Transport Mechanisms in High-Efficiency Perovskite Multijunction Solar Cells	ECE	$10,000
Susmit Shannigrahi	Integrating Cloud Resources into Genomics Workflows using Next-generation Networking	Computer Sci	$10,000
Maanak Gupta	Secure Cloud Assisted Smart Farming Ecosystem	Computer Sci	$10,000
Pingen Chen	Developing an Open-Access Control System for Advanced Centralized Control of an Integrated Diesel Engine and Aftertreatment System	Mechanical Eng	$10,000
Total Track II			$90,000