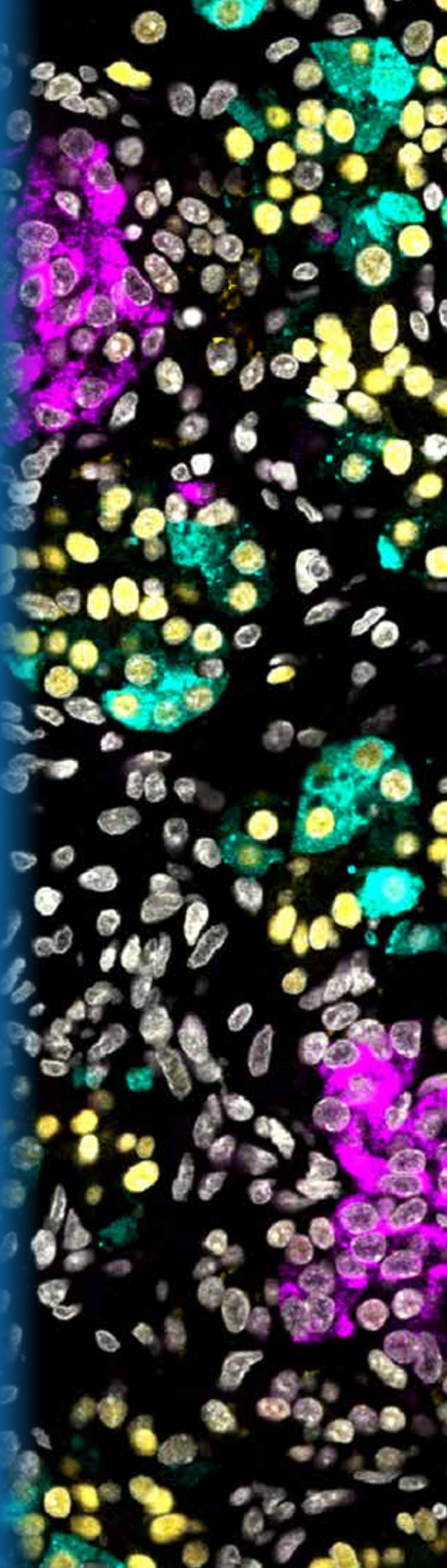
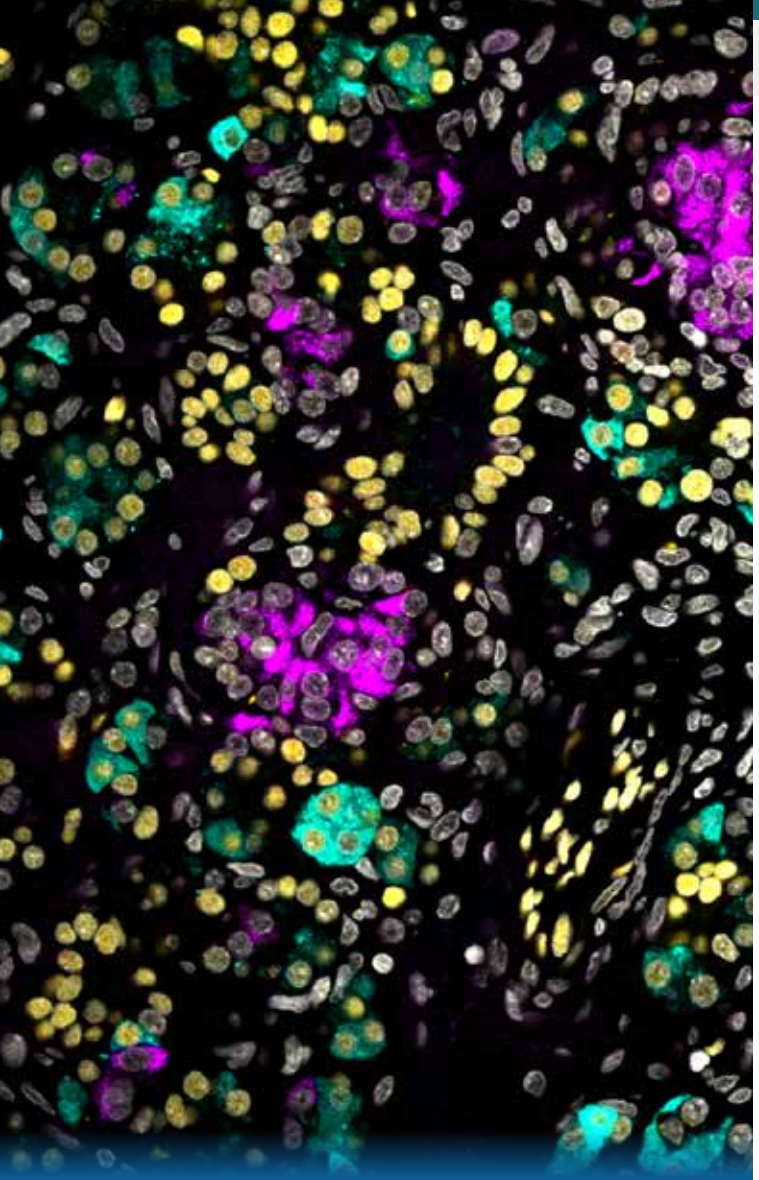
INDIANA BIOSCIENCES RESEARCH INSTITUTE

2017 Annual Report

CREATING CONNECTIONS, DELIVERING **VALUE**





Just as these cells depend on each other to maintain good health, creating connections across industry, academia and government is the pulse of the IBRI. In this way, we advance research that improves human health and patient outcomes.

More about the cover image on page 16.

The IBRI's Mission, Vision and Values

Mission

Become the leading independent, industry-inspired, applied research institute in the discovery and development of innovative solutions to improve health, targeting diabetes, metabolic health and nutrition.

Vision

Build a world-class organization of researchers, engineers and business professionals that catalyze activities across the life sciences community in Indiana and beyond.

Values

Scientific excellence, an entrepreneurial mindset and a collaborative nature.

The IBRI is Unique

We catalyze

The IBRI occupies a unique position to bridge academic and industry research.

We collaborate

The IBRI creates a synergistic network of research partners within the robust life sciences and IT ecosystems.

We complement

The IBRI expands the current life sciences and IT ecosystems by adding complementary capabilities.

We convene

The IBRI assembles diverse, cross-functional and cross-institutional research teams who "play bigger" together.

We connect

The IBRI creates connections and linkages across public and private partnerships to foster more coordinated innovation and entrepreneurship.

The Challenge

Indiana's life sciences industry has built nearly 1,700 companies, employing more than 55,000 with annual wages of more than $90,000 per person, and with a $78 billion annual impact.

The challenge is the need for a larger "research bench" beyond industry walls, at a time of rising stakes and more daunting diagnostic and therapeutic targets that all require "bigger science" and more scientists from multiple disciplines working together.

Historically, relatively little of the $7 billion in industry-sponsored basic and applied annual research has been placed with Indiana-based universities, and the universities have excelled in research areas often outside the state's life sciences industry.

The leading academic researchers and practitioners working with industry therefore usually live elsewhere, and as a practical consequence, industry sponsors find and fund their academic colleagues beyond Indiana's borders.

The Solution

The IBRI was created in 2013 by key industry and academic partners to address this challenge and opportunity by connecting and bridging Indiana's life sciences industry and university research, using world-class researchers already working with industry, and who will continue to do so if they are living and working in Indiana.

The IBRI model of better linking the state's world-class industry and university assets will have major implications far beyond Indiana's borders.

The IBRI will become a worldwide destination for accelerated translational research and collaborative innovation in selected fields, such as metabolic diseases, nutrition and health data analytics—all interests shared by the original industry sponsors, but also driving priorities across the global life science and academic sectors.

The IBRI is not only strengthening Indiana's existing life sciences industry, but is bringing new industry partners and talent to the table thus taking advantage of the IBRI's unique collaborative operating model.

The IBRI's Unique Funding Model

Grant funding includes public-sector grants, such as those from the National Institutes of Health, potentially in collaboration with research university faculty, and grants from private research foundations.

Corporate research includes sponsored research grants from life sciences and IT companies. Such grants help ensure the relevance of the IBRI's applied research and collaborative focus.

The IBRI endowment ensures that research remains sustainable over funding cycles, as well as attracting talent and enabling sponsored research funding.

> The IBRI's unique funding model consists of public and private foundation grants, sponsored research and the institute's endowment, with each source envisioned to provide roughly one-third of the overall funding. This innovation-enhancing model supports translational research and bridges the gap between research universities and industry.

Rainer Fischer, Ph.D.
Chief Executive Officer,
Chief Scientific and Innovation Officer

Dear IBRI Stakeholders,

The year 2017 saw significant progress and change for the Indiana Biosciences Research Institute (IBRI). We advanced our mission of becoming the leading independent, industry-inspired applied research institute in the Unites States, focusing on the discovery and development of innovative solutions to improve health, targeting diabetes, metabolic disease and poor nutrition.

In terms of research and development outcomes, we made exciting progress in each of our three current core competencies, as summarized below and discussed in more detail in the following pages.

> In our Regenerative Medicine and Metabolic Biology Group, Dr. Teresa Mastracci continued to build her laboratory facilities and research team, including the zebrafish core laboratory which plays an instrumental role in her research to develop treatments for both type 1 and type 2 diabetes. Dr. Mastracci's $750,000 grant from the Juvenile Diabetes Research Foundation (JDRF), the leading global organization funding type 1 diabetes research, was renewed for another year. She continues to apply for additional research funding, and to identify collaboration opportunities with other academic and industrial researchers.

> In our Single Cell Analytics Center, Dr. Michael Pugia made remarkable progress in the development of new analytical capabilities, in addition to genomic testing, focusing on mass spectrometry for the analysis of genes, proteins, metabolites and lipids in healthy and diseased cells, coupled with microfluidics to allow the handling of small liquid samples. This research will yield new techniques for point-of-care diagnostics. Dr. Pugia filed eight patent disclosures and is working to prioritize and file additional patent applications, while seeking opportunities for further external funding and collaboration.

> Finally, in our Applied Data Sciences Center, Dr. Daniel Robertson (a loaned executive from Eli Lilly and Company) choose to permanently join the IBRI full-time to advance his research projects in digital phenotyping and toxicogenomics. Digital phenotyping looks at health and disease by identifying patterns in population-level data, whereas toxicogenomics is the analysis of changes in gene expression in response to drugs and toxic substances. Dr. Robertson is also collaborating with state and industry stakeholders to use real-word data from patient records in the fight against type 2 diabetes, and associated diseases.

In terms of collaborations, the IBRI completed a memorandum of understanding (MOU) with four Indiana universities – Ball State University, Indiana University, Purdue University and the University of Notre Dame – to license the intellectual property needed to advance our life sciences research. This provides a rapid and secure path for us to access and utilize technologies developed by Indiana's prestigious research universities. The IBRI was granted its first licenses under this MOU for two technologies from Purdue University. They will be used in combination with IBRI technologies to improve the Rare Cell Analyzer platform developed by Dr. Pugia. We are working with Indiana's research universities to create a collaborative research agreement that will enable us to use our collective infrastructure and capabilities to conduct more ambitious and far-reaching research.

In terms of funding, in 2017 the IBRI received the first $5 million tranche of the $20 million grant generously set aside by the Eli Lilly and Company Foundation in 2016. These funds were added to the IBRI's endowment, which at year-end 2017 stood at approximately $108 million. Also during 2017, the State of Indiana earmarked another $20 million for the IBRI. An agreement reflecting the milestones for this funding was finalized with the Indiana Economic Development Corporation (IEDC) in early 2018. The funds will be disbursed to the IBRI as the milestones for additional industry-sponsored contract research, private donations and university technology licensing agreements are achieved.

In terms of leadership, the IBRI's first Chief Executive Officer, David Broecker, resigned in 2017 to pursue his own bioscience company interests. David raised more than $100

million in funding to establish the IBRI and was instrumental in finding and establishing our current laboratories and offices in Indianapolis. I was honored to be named as the new CEO in addition to my role as the IBRI's Chief Scientific and Innovation Officer. We were also very excited that Dr. Jay McGill accepted the role of Chief Operating Officer after retiring from Eli Lilly and Company, bringing his life science knowledge and industry insights to our institute.

One of our key developments in 2017 was the completion of the IBRI's five-year strategic plan, which was approved by the Board of Directors in early 2018. The plan builds a foundation for future research by not only expanding the three current core competencies but also founding new ones including, Human Antibodies and Vaccines, and Synthetic Biology and Protein Engineering. During the period covered by the strategic plan, the IBRI is expected to grow from 20 full-time employees at the end of 2017 to more than 80 at the end of 2022.

In terms of facilities, the IBRI worked diligently with Browning Investments to help plan the development of the 16 Tech Innovation Community, a major Indianapolis public-private redevelopment project on the city's near-westside which is envisioned as a regional hub for multi-sector entrepreneurship and innovation, attracting existing and new talent to the region. The IBRI will be the anchor tenant in the first new building, which is slated for completion in mid-2020. This innovative IBRI building will provide both research and incubator space for entrepreneurial scientists, as described later in this report.

As we reflect on 2017, we are excited and optimistic about the momentum we have gained, and we anticipate significant further progress in 2018. I also want to wholeheartedly thank our talented employees who are responsible for our progress and growth, which was also made possible by the support and guidance of our Scientific Advisory Board and the Board of Directors (listed later in this report). I also want to especially thank those who donated and contributed to the IBRI in 2017. We are grateful for your interest and commitment, which helps us improve human and animal health on a local and global scale.

Just as human, plant and animal health depends on correct connections and balanced communication between cells, we know that the IBRI's success in better linking our world-class industry, university and governmental resources will eventually have a major impact far beyond Indiana's borders. Our goal is to create and nurture those connections and to build a sustainable and successful operation with our partners and stakeholders in Indiana's life sciences ecosystem.

Yours sincerely,

Rainer Fischer, Ph.D.
Chief Executive Officer,
Chief Scientific and Innovation Officer

Rainer Fischer, Ph.D.

Chief Executive Officer, Chief Scientific and Innovation Officer

Dr. Fischer joined the IBRI in April 2017 as the Chief Scientific and Innovation Officer. In October of the same year, he was also named as the new Chief Executive Officer. Dr. Fischer spent 19 years building and leading the Fraunhofer Institute for Molecular Biology and Applied Ecology (IME) at six locations in Germany (Aachen, Schmallenberg, Muenster, Giessen, Frankfurt and Hamburg) as well as its subsidiaries in Newark, Del. USA, and Santiago, Chile. The Fraunhofer-Gesellschaft is the largest applied science research organization in Europe, focusing on applied research in health, security, production technology, energy, materials, and the environment.

During Dr. Fischer's time at the IME, the institute grew from 40 to 680 employees. He and his team raised nearly one billion euros in extramural research funding and established international collaborations with academic and industrial partners in more than 25 countries. Those collaborations include many of the leading global companies in the biotechnology, pharmaceutical, agriculture, food and chemical industries.

Dr. Fischer also served as Department Head of the Institute for Molecular Biotechnology at RWTH Aachen University where he was awarded a Distinguished Professorship in 2015. He created the department, co-establishing both undergraduate and graduate programs that have matriculated more than 500 students including 130 graduated Ph.D. students.

Dr. Fischer is a prolific author, having published more than 350 peer-reviewed scientific articles that have been cited more than 18,000 times. In addition to his academic and leadership experience, he has co-founded five biotechnology startups, holds more than 60 issued patents and has more than 120 patent applications pending. Dr. Fischer also holds a second Professorship at Maastricht University, Netherlands, where he co-founded the Aachen-Maastricht Institute of Biobased Materials (AMIBM) in 2015. He was also named a President's Fellow in Life Sciences by Purdue University in April 2018.

The IBRI's Current and Future Research Focus

The IBRI was established with a focus on metabolic and cardiovascular health, diabetes and nutrition and supports three core competencies: regenerative medicine and metabolic biology, single-cell analytics, and advanced data science and analytics.

The resulting scientific programs were enabled by the expertise and leadership of the IBRI's three current principal investigators and their research groups, namely the Regenerative Medicine and Metabolic Biology Group led by Teresa Mastracci, the Single Cell Analytics Center led by Michael Pugia and the Applied Data Sciences Center led by Daniel Robertson.

The IBRI's five-year strategic plan builds the basis for future research by not only expanding the three current core competencies but also founding new ones, including Human Antibodies and Vaccines, and Synthetic Biology and Protein Engineering.

During the period covered by the strategic plan, the IBRI is expected to grow from 20 full-time employees at the end of 2017 to more than 80 at the end of 2022.

The IBRI was founded to attract talent and foster collaboration. The key to achieving these aims is to understand the needs of the stakeholders who have been actively engaged with the IBRI since inception. In addition, there is recognition that even an organization of 200 researchers may lack the critical mass to conduct effective and meaningful research if spread too thinly.

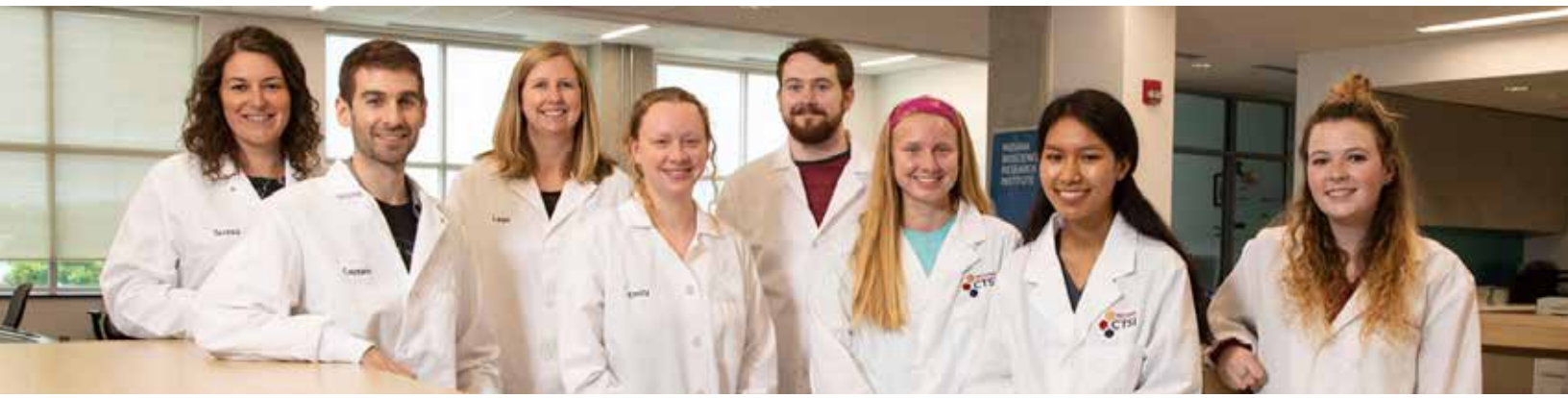
$78 BILLION

ALL TOLD, INDIANA'S LIFE SCIENCES HUB CONTRIBUTED A $78 BILLION ECONOMIC IMPACT TO THE STATE OF INDIANA IN 2017. SOURCE: BIOCROSSROADS

In 2014, the IBRI engaged its Scientific Advisory Board (see page 14 and 15) in a series of conversations to better understand the needs of the stakeholders, and to assess whether there was a meaningful alignment of interest that could be used to guide early recruitment and investment, thus building critical mass and operations.

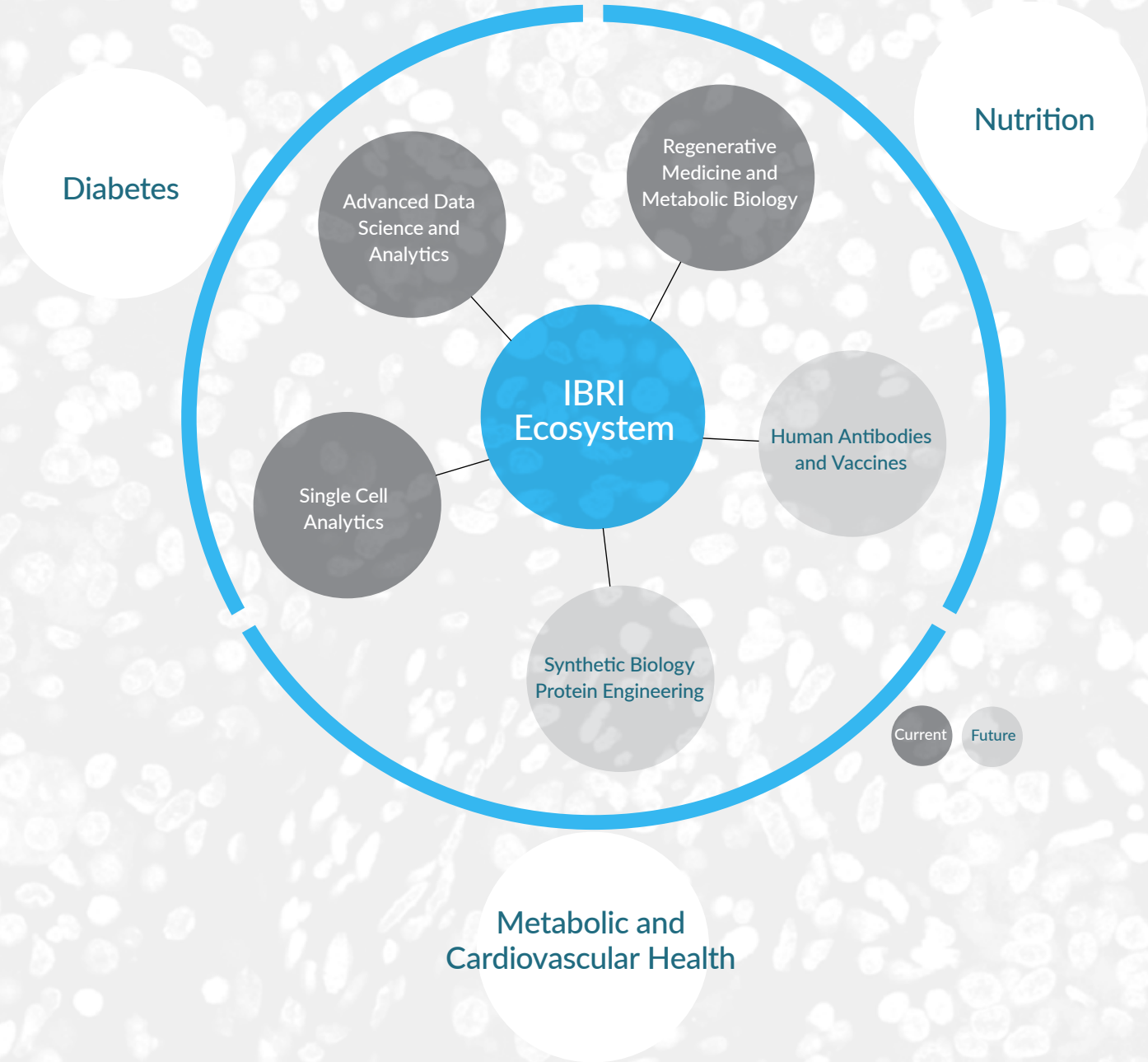
This effort resulted in two formative ideas: The first was the identification of several areas of scientific capability such as big data, the microbiome, synthetic biology and tissue engineering. The second was the identification of cardio-metabolic disease, diabetes and poor nutrition as common areas of therapeutic interest.

Although representing different business segments and interests, all stakeholders could see themselves engaging with the IBRI around these therapeutic areas and capabilities in ways that align with the stakeholders' purposes – an essential element of long-term engagement and success.



The IBRI's Regenerative Medicine and Metabolic Biology (RMMB) research team: From left: Teresa Mastracci, Morgan Robertson, Leah Padgett, Emily Anderson-Baucum, Craig Connors, Jane Hirschman, Thang Cin Uap and Samantha O'Dell. The RMMB team is one of three teams at the IBRI conducting research to improve human health.

The IBRI's Current and Future Research Focus



The IBRI's five-year strategic plan builds the basis for future research by not only expanding the three current core competencies but also founding new ones, including Human Antibodies and Vaccines, and Synthetic Biology and Protein Engineering.

Dr. Mastracci joined the IBRI as the first independent investigator to commence innovative scientific research at the institute in the spring of 2016. She is a molecular and developmental biologist who came to the IBRI from the Indiana University School of Medicine where she was an Assistant Research Professor in the Department of Pediatrics, and the Center for Diabetes and Metabolic Diseases.

Dr. Mastracci completed her post-secondary education in Canada, earning her Bachelor of Science degree from the University of Guelph, and her Ph.D. from the University of Toronto at the Lunenfeld-Tanenbaum Research Institute.

Before her recruitment to Indianapolis, she also completed a Postdoctoral Fellowship at Columbia University and the Naomi Berrie Diabetes Center.

Regenerative Medicine and Metabolic Biology Group

Teresa Mastracci, Ph.D., Senior Scientist, leads the IBRI's Regenerative Medicine and Metabolic Biology Group

The prevalence of both type 1 and type 2 diabetes continues to increase globally, but particularly in developed countries such as the United States. To address this challenge, research in the Regenerative Medicine and Metabolic Biology (RMMB) Group focuses on understanding the disease with the eventual goal to develop new therapeutics that not only manage the disease and its complications but also prevent the onset of diabetes all together.

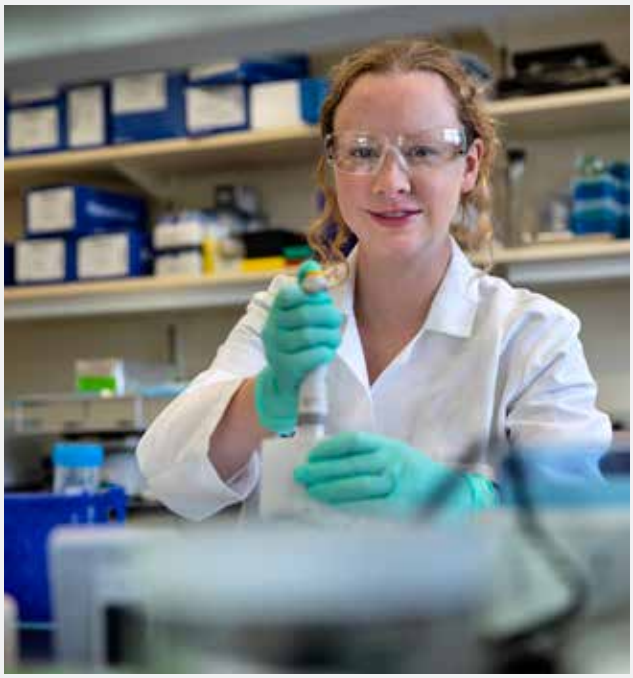
The RMMB Group made significant progress during 2017, in terms of personnel recruitment, research breakthroughs and the development of new funding opportunities and collaborations. Key scientists were recruited to the group with expertise in metabolism, cellular and molecular biology, and zebrafish colony management. The addition of these personnel enhances the scientific capability and productivity of the RMMB Group and has enabled the expansion of a number of discovery-based projects.

One great success in 2017 was the completion of a long-term collaborative study with investigators from the Center for Diabetes and Metabolic Diseases at Indiana University School of Medicine and the Center for Diabetes Research at Université Libre de Bruxelles (Belgium). This was the culmination of five years of work involving the comparative analysis of human donor islets from individuals with type 1 diabetes and healthy controls.

The goal of the study was to identify changes in gene expression resulting from having the disease for either a short or a long period of time. The study also demonstrated a proof of concept that measuring changes in gene expression as the disease progresses in humans can identify factors specific to the disease that can be targeted with drugs to prevent or slow its progression.

The study identified multiple targets that were not previously linked with the progression of diabetes, and therapeutic intervention against one of these targets reduced the incidence of diabetes in mice. Work on the other targets will follow, offering hope for diabetes patients all over the world. The results from this successful collaborative study will be published in the prestigious journal, *Diabetes, Obesity and Metabolism*.

Another resounding success in 2017 was the renewal of Dr. Mastracci's Juvenile Diabetes Research Foundation (JDRF) Career Development Award for a second year. The research funded by this award of $750,000 over five years focuses on understanding the regeneration



Dr. Emily Anderson-Baucum, Staff Scientist

Dr. Anderson-Baucum joined the RMMB Group in January 2017 after training for eight years in prominent diabetes research groups at Vanderbilt University and the Indiana University School of Medicine. Before joining the IBRI, she studied how adipose cells (fat cells) and the immune system contribute to obesity, weight loss and weight cycling, as well as the onset and progression of diabetes.

Postdoctoral Fellowship – Center for Diabetes and Metabolic Diseases, Indiana University School of Medicine, Indianapolis, Ind.

Ph.D. in Molecular Physiology and Biophysics – Vanderbilt University, Nashville, Tenn.

B.S. in Biochemistry and Molecular Biology (Magna Cum Laude) – Centre College, Danville, Ky.

She was prolific throughout her Ph.D. and postdoctoral training, presenting her work at national and international meetings as well as contributing to 11 peer-reviewed published articles, four as first author. She also submitted successful funding proposals, including support for a graduate fellowship from the American Heart Association and two postdoctoral fellowships from the National Institutes of Health (T32) and the Ruth L. Kirschstein National Research Service Award (NRSA).

Dr. Anderson-Baucum is interested in the development of novel therapeutics for the treatment and prevention of metabolic diseases, including diabetes. At the IBRI, she is currently helping to create and describe multiple mouse models with genetic defects, which will provide insight into the onset of diabetes and the factors that contribute to the development and function of the pancreas. These studies will determine the factors that regulate the growth and function of insulin-producing beta cells, and will identify targets that can be manipulated to maintain or restore proper whole-body metabolism.

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potential of insulin-producing pancreatic beta cells, whose destruction plays a major role in diabetes. This grant also provides funding for the development of a mutant mouse model to study the switch from prediabetes to diabetes.

The RMMB Group forged new academic collaborations in 2017, launched the zebrafish facility, organized new human tissue resources for research, and presented work at national and international scientific meetings. As we move into 2018, our goals are to expand our available resources and disseminate our achievements as widely as possible in order to drive research that generates discoveries which can be translated into new therapeutics for diabetes.

$621 MILLION

AMOUNT INDIANA'S RESEARCH UNIVERSITIES CONDUCTED IN BIOSCIENCE-RELATED R&D IN FY 2016. SOURCE: TECONOMY/BIO 2018

Dr. Pugia spent 30 years in the biomedical *in vitro* diagnostics industry where he contributed to more than 20 new product launches for Bayer and Siemens. He spent 15 years as a Director of Research and Development working on next-generation analytical and diagnostic technologies in collaboration with leading institutions and companies. Dr. Pugia's primary research interest is the development of single-cell bioanalytical technology for proteomic biomarkers discovery in the fields of endocrinology and oncology.

Dr. Pugia holds 367 U.S. and foreign patents, has 72 pending patents and has published 55 articles, 13 book chapters and hundreds of conference papers and lectures covering a wide variety of chemistry disciplines. He earned his Ph.D. in chemistry from Texas Tech University, Lubbock, Tex., and his Bachelor of Science degree in chemistry from Clarkson University, Potsdam, N.Y. While working in industry, Dr. Pugia held adjunct positions as a Visiting Scholar at the University of Notre Dame, Notre Dame, Ind., and as a Clinical Research Professor at the University of Louisville Medical School, Louisville, Ky.

Single Cell Analytics Center

Michael Pugia, Ph.D., Research Fellow and Director of the Single Cell Analytics Center

Current methods for the diagnosis of disease are often cumbersome, time-consuming and imprecise because the assays (analyses) lack specificity and sensitivity. This means that patients can be misdiagnosed or diagnosed at a late stage when therapeutic options are limited. In the IBRI's Single Cell Analytics Center (SCAC), we aim to address this problem by developing a broad range of assays for the analysis of molecules (DNA, RNA, proteins and key metabolites) and cellular structures.

Ultimately, we would like to achieve single-cell sensitivity (such as the detection of a single cancer cell, immune cell or bacterial pathogen in a blood sample), as well as multiplexing and miniaturization (allowing high-throughput analysis and deployment at the point of care rather than centralized laboratories). This combination can be achieved by using microfluidic platforms, mass spectrometry and electrochemical analysis.

The SCAC made substantial progress in 2017 in terms of recruitment, technology development and new collaborations. We enrolled four postdoctoral fellows with expertise in microfluidics, cell biology, electrochemical materials and analytical chemistry. We also took on four undergraduates, two each from Purdue University and Indiana University-Purdue University Indianapolis (IUPUI) as well as one Project SEED high school student to learn skills in diagnostics technology.

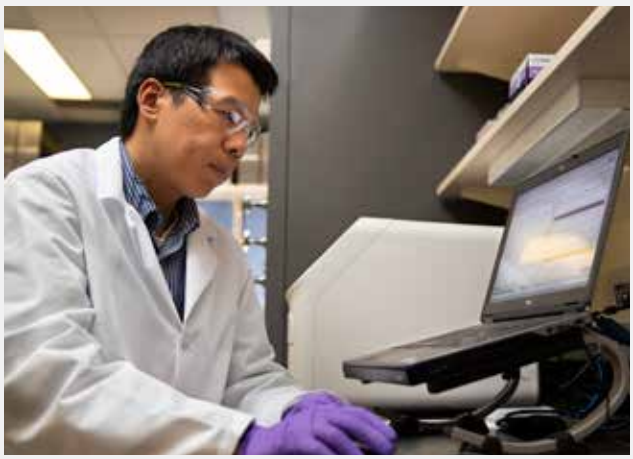
Our technological achievements in 2017 included the first working diagnostic assays based on our proprietary signal ion emission reactive release amplification (SIERRA) microfluidic and nanoparticle technology. This next-generation diagnostic platform can now detect as few as 50 cells in a sample, which is a 1,000-fold improvement over current immunoassay methods.

We have put this technology to work by developing the first antibodies to measure small cellular changes in the fight against chronic and acute infection and inflammation in diabetes. We are using samples from 1,800 patients with type 2 diabetes and cardiovascular disease (collected 10 years ago by the Fairbanks Institute) to improve diagnosis and to address the complex process leading to poor patient outcomes.

In terms of new collaborations, we broadened our network of partners during 2017 to develop the Rare Cell Analyzer as a next-generation diagnostics platform.

A multi-disciplinary team was established, including key technology leaders at Indiana University, Purdue University, the University of Notre Dame and IUPUI, to develop new concepts for diagnostics research using the SIERRA platform. This team has submitted funding proposals to develop the Rare Cell Analyzer as a platform for the detection of bacteria in military, public health, chronic disease and food safety settings.

We have also started looking in detail at the inflammatory process that affects the pancreatic islets in type 1 diabetes. The clinical samples provided by the Juvenile Diabetes Research Foundation (JDRF) and the Indiana University School of Medicine, allow us to use these new tools to monitor changes in genes, proteins and cell membranes, helping us to understand the mechanisms of disease progression. We look forward to pursuing these projects further in 2018 and to developing additional applications for the Rare Cell Analyzer platform.



Dr. Zehui Cao, Senior Staff Scientist

Dr. Cao joined the IBRI's Single Cell Analytics Center in April 2017 after serving as a Research Scientist at KWS Gateway Research in St. Louis, Mo., and as Associate Research and Development Manager and Senior Chemist at Dow AgroSciences in Indianapolis, Ind. He was also a Post-Doctoral Associate at the University of Illinois, Urbana, Ill, and at the University of Florida, Gainesville, Fla.

At the IBRI, he is working on new diagnostic tools for rare cell analysis based on genetic characteristics. Rare cells include those that may cause diseases and those that arise as the result of diseases, such as cancer cells and drug-resistant bacteria. Rare cells often possess unique molecular markers, which can be used reliably to detect and predict the corresponding diseases. For example, cancer cells often carry particular mutations and express certain genes in an abnormal manner. Similarly, drug-resistant bacteria often carry mutations or complete genes that help to remove or degrade antibiotic drugs.

> Ph.D. in Analytical Chemistry - University of Florida, Gainesville, Fla.
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> M.S. in Analytical Chemistry - University of Florida, Gainesville, Fla.
>
> B.S. in Organic Chemistry - Nanjing University, Nanjing, China

The goal of Dr. Cao's research at the IBRI is to develop novel molecular assays for the rapid, sensitive and reliable detection of rare cells by looking for the presence of rare genes, mutations and gene expression profiles. The ability to detect rare cells when only a few are present in the sample will allow earlier disease diagnosis and prediction, which is necessary to improve patient outcomes.

In the longer term, the research carried out by Dr. Cao will help us integrate our assays with other diagnostic tools, such as the detection of protein markers to further improve the robustness of rare cell analysis. In addition, these assays are being built into high-throughput and/or portable devices to meet the demands of diverse applications and to broaden the applicability of rare cell analysis in different clinical settings.

Dr. Robertson originally joined the IBRI in mid-2015 as a loaned executive from Eli Lilly and Company, but in mid-2017 he accepted a permanent position to drive innovative research among multiple life sciences companies, academic institutions and technology companies to develop solutions for critical problems. He earned his Bachelor of Science degree in chemistry, graduating *summa cum laude* from Florida Southern College in 1986 and obtained his Ph.D. in physical chemistry from Florida State University in 1990.

After earning his Ph.D., he served as an NRC/NRL Postdoctoral Research Associate at the Naval Research Laboratory in Washington, D.C., and then held several positions at Indiana University-Purdue University Indianapolis (IUPUI) from 1993 through 2000. In 2000, he joined Lilly as a computational research scientist. During his 17-year career there, he moved through many leadership positions, including Director of the Global Computational Chemistry and Structural Biology, and most recently, serving as Senior Director of Research IT, leading the global efforts supporting all the research IT systems and informatics in Lilly's early drug discovery research efforts.

Applied Data Sciences Center

Daniel H. Robertson, Ph.D., Vice President of Digital Technology and Director of the Applied Data Sciences Center

In our information-rich world, massive amounts of data are generated every day. Where this information concerns health, the merging of biological research data, clinical trials data and 'real-world' data such as electronic medical records, wearable devices and even social media records, offers new opportunities for research, innovation and the development of personalized diagnostics and therapies.

In the Applied Data Sciences Center (ADSC), we are using our unique position and network of partners to drive multi-organization and cross-discipline collaborations exploring how to access, integrate and analyze data to better understand and improve human health.

In 2017, we made significant progress in our diverse collaborative projects. Our ongoing collaboration with Eli Lilly and Company and Roche Diabetes Care, using real-world data from our research partners at the Regenstrief Institute (more than 1.2 billion records across 2.3 million patients), allowed us to develop a better understanding of the progression of type 2 diabetes and its complications.

Our colleagues at Roche were able to validate a machine learning model that predicts the likelihood of specific complications occurring within three years of initial diagnosis, and a research article describing this model has been submitted for publication. The collaboration has been renewed for 2018 and we are expanding our focus to include the use of machine learning and artificial intelligence to answer new questions in human health.

Our collaboration with Dow AgroSciences and Lilly aims to improve safety predictions for newly discovered molecules. Here, we delivered a prototype toxicogenomics platform, which makes the advanced analytical methods more broadly available. This collaboration has been renewed for an additional 18 months to allow further development, to promote adoption by the broader research community, and ultimately to launch the platform in the public domain to drive research faster.

We also made substantial progress with our digital biomarker platform, which was created in partnership with a local technology company, MavenSphere LLC. This platform allows data to be collected directly from patients, but replaces subjective data provided by

Pam Bilo Thomas, Graduate Student

Ph.D. Candidate in Computer Science - University of Notre Dame, Notre Dame, Ind.

M.S. in Computer Science - Indiana University, Bloomington, Ind.

B.A. in Mathematics and Political Science - Indiana University, Bloomington, Ind.

As part of our mission to integrate with regional universities and develop talent for future careers within the life sciences industry, the Applied Data Sciences Center initiated an agreement with the University of Notre Dame in early 2017 to fund at least two years of Pam Thomas's graduate career as a designated IBRI Scholar. She is currently on leave from Eli Lilly and Company to pursue her Ph.D. with Professor Nitesh Chawla, a Visiting Research Fellow at the IBRI, and she wishes to return to a non-academic position, providing an example of the future talent needed to operate and innovate in a world that relies increasingly on digital information.

As part of the agreement, Ms. Thomas regularly visits and works at the IBRI and participates as part of the type 2 diabetes project team in addition to pursuing her own research interests.

Recently, Ms. Thomas was selected to participate in the University of Notre Dame's LASER (Leadership Advancing Socially Engaged Research) program for 2018–2019, where she will work on a community project devoted to improving the health of underserved residents in the city of South Bend, Ind.

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patients as written reports with more objective digital data that can be collected remotely at any time via smartphone. In 2018, we anticipate using this platform to collect patient data directly in multiple research and clinical settings.

$8.2
BILLION

INDIANA RANKED 2ND-HIGHEST FOR LIFE SCIENCES EXPORTS IN 2017. SOURCE: BIOCROSSROADS

Having achieved a critical transition in 2017 from a conceptual group (with the potential to drive research at the interfaces of organizations and data sources) to an active group with five ongoing collaborative research projects, we look forward to launching new collaborations in 2018 as well as continuing with the current projects. Two of the projects, which accomplished their initial milestones in 2017, have already been renewed and we will continue to develop these projects and drive value from the analysis and integration of diverse sources of data.

16 Tech Innovation Community

The 16 Tech innovation community is a major public-private redevelopment project in the heart of Indianapolis, where creative thinkers, doers and makers in technology, life sciences, advanced engineering, computing and the arts will connect, collaborate and innovate. The IBRI and 16 Tech are separate but related entities dependent on each other's success.

16 Tech is the transformation of a 60-acre site on the near-westside of Indianapolis that stretches from 10th Street and Fall Creek, near Indiana University School of Medicine and Indiana University-Purdue University Indianapolis (IUPUI), to 16th Street, and which is bordered on the west by the White River. The community is expected to attract world-class talent.

Just as human health depends on connections and communication between cells, the IBRI will serve as the nucleus for the first major connection in 16 Tech by becoming the primary tenant of the first multi-story building that serves as the innovation community's anchor facility. The IBRI's presence will lead to future connections in 16 Tech.

The 120,000-square-foot building (architectural rendering above) will be the IBRI's home and will include open laboratory and office space for additional tenants. The IBRI will also serve as an accelerator for life science and IT startups. The IBRI's 68,000-square-foot share of the building represents a $33 million investment over 15 years. Building construction is expected to begin in late 2018 and the first personnel will move in by mid-2020.

Progress for 16 Tech has been made possible by the 16 Tech Community Corporation Inc. (the not-for-profit entity overseeing the innovation district), the City of Indianapolis (which in 2015 approved $75 million in tax-increment financing for infrastructure improvements), the Health and Hospital Corporation of Marion County, the Central Indiana Corporate Partnership, the State of Indiana, Indiana University, IU Health, The Lilly Endowment Inc. (which provided a $38 million grant for the project's first phase in early 2018), the Richard M. Fairbanks Foundation, the Citizens Energy Group, and neighborhood organizations.

The 16 Tech innovation community will include:

> The design and construction of a signature new bridge spanning Fall Creek and connecting 16 Tech with IUPUI, the IU School of Medicine and hospital campuses along West 10th Street. The bridge will accommodate pedestrian, bicycle and vehicular traffic and will be built as an iconic gateway to 16 Tech with ample gathering space and interactions with Fall Creek.

> A multi-use pedestrian and cycling path that connects 16 Tech with a future extension of the Indianapolis Cultural Trail.

> The development of public art in and around 16 Tech.

More information at 16tech.com

16 Tech will have central green space that serves as a destination within the innovation community, the focal point for many of the buildings, and open space for events and gatherings.

55,000

INDIANA'S LIFE SCIENCES INDUSTRY EMPLOYED 55,000 PEOPLE IN 2017 ACROSS 1,689 BUSINESSES. SOURCE: BIOCROSSROADS

1,689

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(As of July, 2017)

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THE IBRI 2017 ANNUAL REPORT

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Settimi Creative

Cover image provided by Teresa Mastracci

Printing

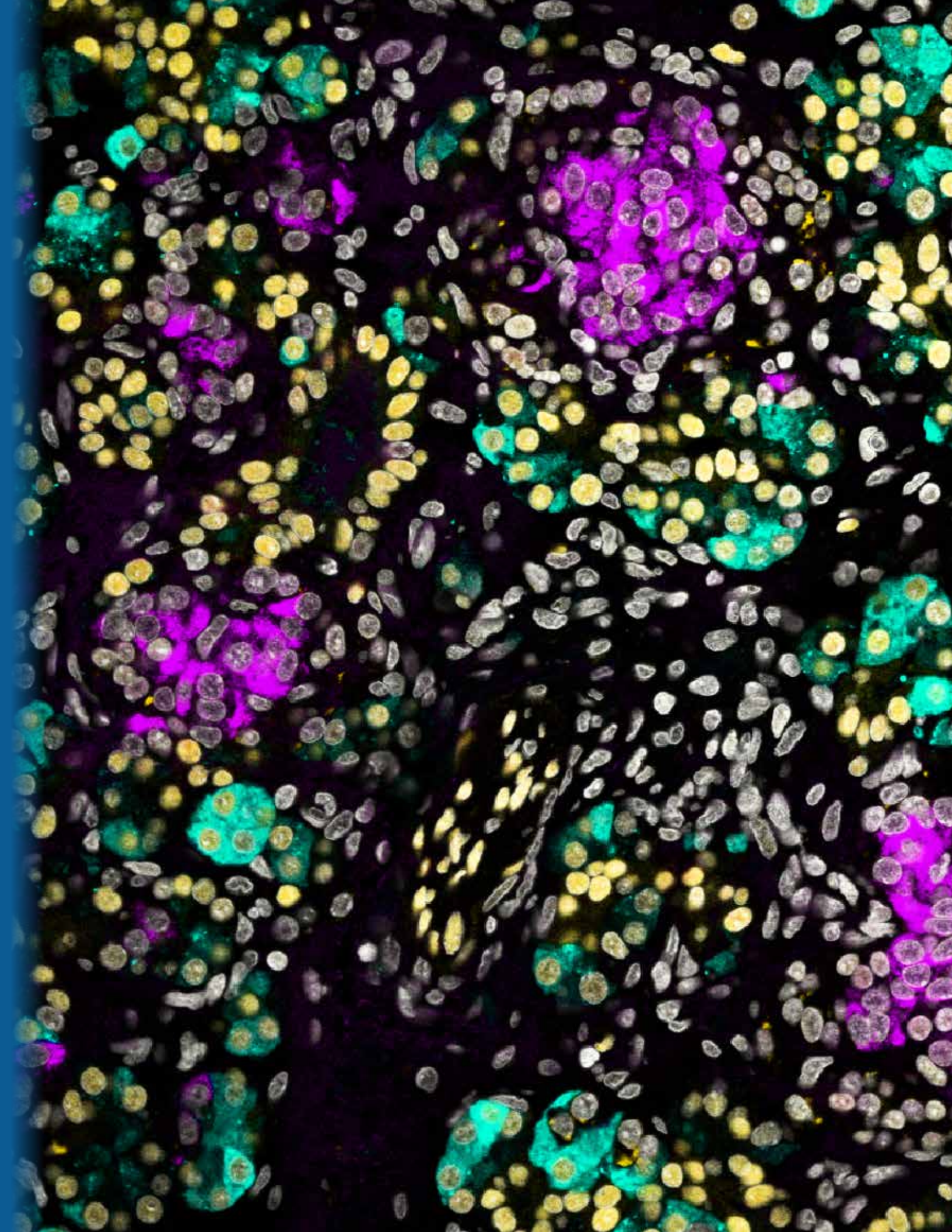
Miles Press

The microscopic image shows a slice of human pancreas tissue stained with fluorescent markers to highlight the cells that figure prominently in diabetes. Finding alternative therapies that slow or cure diabetes is a key focus of research at the IBRI. The pancreas is composed of exocrine and endocrine cells, which have distinct but interdependent functions.

All cells in the pancreas, regardless of function, contain a nucleus (gray or white). Exocrine cells (blue-green) make and secrete enzymes that facilitate digestion. These digestive enzymes are transported to the intestine via the ducts (yellow), which are tubes that link the pancreas to the intestine.

Endocrine cells make and secrete hormones, such as insulin, that help to regulate blood sugar levels. Within the pancreas the hormone-producing endocrine cells are organized into structures called “islets of Langerhans” and the insulin-producing beta cells (pink) are one cell type found in these islets.

Diabetes occurs when beta cells become dysfunctional or die. Although exocrine and endocrine cells have distinct functions, no cell in the pancreas can exist in isolation – they require contact and interaction with other cells for the organ to function properly.



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