



Putting the Wyss pedal to the diagnostics metal

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Wyss Institute Core Faculty



By now we have all seen the benefits of being able to test ourselves at home for COVID-19 using rapid antigen tests. The availability of these new diagnostic tests has been transformative. But putting diagnostics into the hands of consumers is only a small part of the diagnostics story that needs to be rewritten. There are a seemingly infinite number of diagnostics needs that remain unmet — early detection of devastating diseases such as Parkinson’s, Alzheimer’s, and cancer; rapid identification of infections like Lyme Disease; tools to measure and adjust drug levels at home for patients with chronic conditions; predicting when newborns will need antibiotics against sepsis to avoid unnecessarily disrupting their emerging microbiome; scalable and affordable tuberculosis tests for low-income countries. These are only a few examples where we need new diagnostics capabilities to benefit both clinicians and patients.

The Wyss Diagnostics Accelerator (DxA) was created in 2021 to address many of these unmet needs. We have established a formal relationship with

Brigham and Women’s Hospital to facilitate collaborations with clinicians and enable Wyss technologies to be validated in real-world clinical labs. In just over a year, these initiatives have attracted significant commercial interest through a robust Industrial Participants Program composed of several dozen diagnostics companies, and we have also set up a Biomarker Discovery Laboratory, whose mission is to find new, informative disease biomarkers for diagnostics to target. Our feature story in this issue describes these programs in greater detail.

We all know the Wyss as a cradle of innovative technology. Our goal with the DxA is to catalyze the translation of Wyss technologies to the clinic in a much shorter timeframe than typical diagnostics development, positively transforming health outcomes for patients suffering from nearly any disease.

Alex Li

IN THIS ISSUE

- Spotlight: Diagnostics
- Team Spotlight: MyoExo
- Startup Opportunities
- Collaboration Opportunities
- What’s Happening

GET IN TOUCH WITH OUR BUSINESS DEVELOPMENT TEAM

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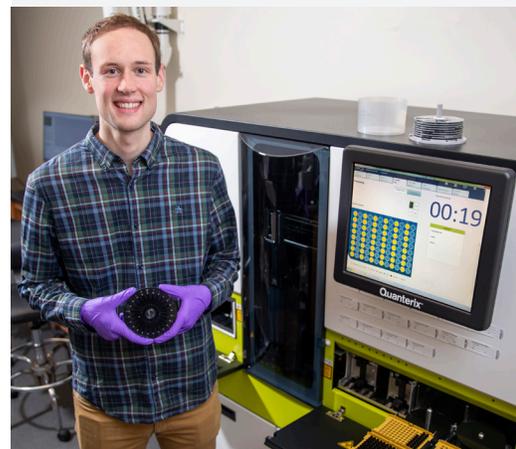
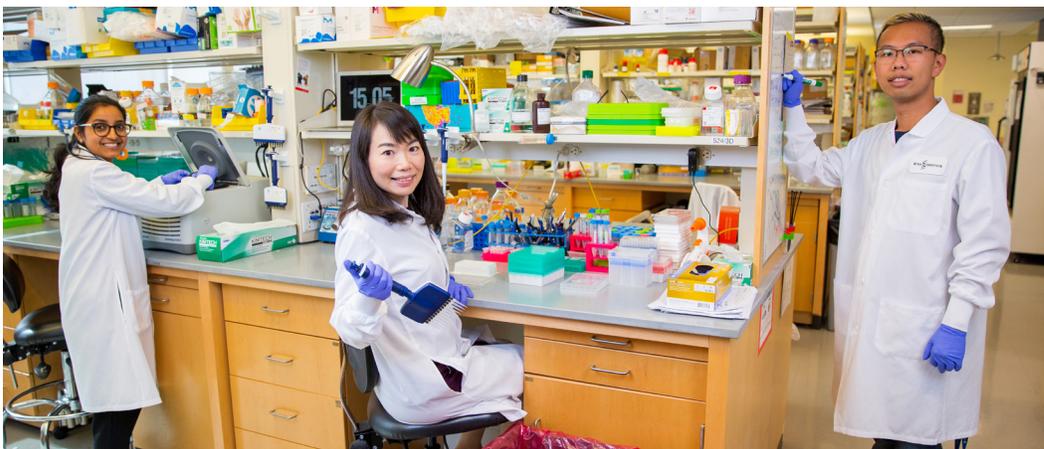
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The Wyss DxA

Diagnostics Accelerator (DxA) bridges the clinic and the lab to bring sorely needed diagnostics to market, fast

The COVID-19 pandemic thrust into the spotlight the problematic disparity between the urgent need for new diagnostic tests and the typically long timelines it takes to develop them. But [David Walt](#) had been thinking about that for years, based on his first-hand experience of translating technologies from academia to the private sector. “Most technologies are first developed and commercialized for use in research, and it takes many years before they find a clinical application - often because they weren’t designed for use in medicine,” said Walt.

“I wanted to find a way to invert that process by starting with a clearly defined medical problem and crafting a solution tailor-made to solve it.”

David Walt
Faculty Lead, Wyss DxA

In 2021 that vision became reality with the launch of the [Wyss Diagnostics Accelerator \(DxA\)](#), a joint venture between Brigham and Women’s Hospital and the Wyss Institute designed to compress the timeframe of new diagnostics development. The process starts with clinicians at the Brigham, who identify unmet diagnostic needs that affect their ability to provide

optimal care to patients. These needs are then presented to the scientists and engineers at the Wyss Institute, who determine if any of their technologies could help meet that need. When a technology is matched with a need, both parties collaborate directly to ensure that the resulting diagnostic meets clinical requirements. Experimental diagnostics are tested in the Brigham’s CLIA lab on real patient samples, providing critical real-world evidence throughout the process.

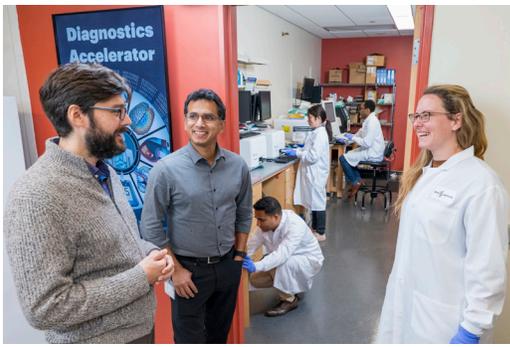
“Since we started the DxA program, clinicians from the Brigham have submitted more than 60 unmet clinical needs, which underscores just how much patient care could be improved by better diagnostic tests,” said [Rushdy Ahmad](#), Ph.D., who leads the DxA at the Wyss. “We are initially focusing on solutions for Lyme disease, blood clots, COPD, and asthma, and more programs are in the pipeline. We’re very excited to see how this program continues to evolve.”

But performing well in clinical labs is only half the battle for new diagnostics: they also have to be easy to produce at a large scale to succeed on the market. To address this essential commercialization piece, the DxA team created the [Industrial Participant Program \(IPP\)](#) later that same year. The IPP serves as a collaboration hub linking diagnostics companies to

scientists and clinicians within the Wyss Institute and its affiliates. The initial cohort included 27 industry participants and the second cohort, including a majority of the members from the first year, launched last month.

Doubling down on diagnostics

We are thrilled to have recently welcomed three new members of the Wyss Community who have deep experience in diagnostics and MedTech to help us continue to grow our portfolio of successful startups in this exciting area. [Jackie Lemaitre](#), M.B.A., Vice President of Market Development at Torus Biosystems and [Mouris Saghir](#), Ph.D., Vice President and General Manager of Cardiovascular, Metabolic & Endocrinology at Quest Diagnostics are the newest members of the Wyss Mentor Hive. Jackie and Mouris will be advising our entrepreneurial researchers on navigating startup formation and developing a market strategy. [Gretchen Fougere](#), Ph.D., formerly the Senior Director of Research Development at the Roux Institute at Northeastern University, has been hired as Business Development Director - Healthcare. Gretchen brings her passion for commercializing new technologies and will bridge the academic and industrial worlds to translate diagnostics and MedTech technologies from the Wyss into the marketplace.



IPP members connect with each other and with experts across fields to explore collaboration opportunities and identify key opportunities and challenges in the diagnostics industry. Given its first-year success, the IPP has moved beyond the pilot phase and is now

an official program of the Wyss Institute.

“For new diagnostics technologies to reach patients around the world, the involvement of the private sector is critical,” said Trey Toombs, Ph.D., a Program Director at the Brigham Research Institute who co-manages the IPP. “With the IPP, we’re building a bridge between academia and industry that allows companies access to the clinical and technological expertise of the Harvard community and provides avenues for innovative technologies to reach the marketplace.”

The newest facet of the DxA is the [Biomarker Discovery Laboratory \(BDL\)](#), which launched in 2022. Under the co-direction of proteomics expert [Bogdan Budnik](#), Ph.D., the BDL is taking on the Herculean task of identifying new biomarkers that can indicate the presence of diseases that currently lack effective diagnostics. Some of these biomarkers also have the potential to serve as novel targets for drugs, and Budnik is working closely with several other groups at the Wyss Institute to help advance the development of new therapeutics as well.

PARTNERSHIP OPPORTUNITY

Wyss Biomarker Discovery Laboratory

Every diagnostic test needs a biomarker: a signal it’s designed to detect that indicates the presence of a disease. Some biomarkers are easy to spot, like the irregular moles of skin cancer or the yellowed skin and eyes of jaundice. But many diseases’ hallmarks are much more subtle, and require the detection of specific molecules in the body for diagnosis. Despite the recent boom in molecular diagnostics, there are still many more diseases than there are reliable molecular biomarkers - a fact that spurred Rushdy Ahmad to start a program at the Wyss Institute to find more of them.

To help him launch this effort, he reached out to Bogdan Budnik, who was then the Director of the Proteomics Laboratory at Harvard University, and invited him to move across the Charles River to the Wyss Institute. Budnik is now the leader of the Wyss Biomarker Discovery Laboratory (BDL), which uses proteomics approaches to identify new biomarkers for diseases. Less than a year later, Budnik is already working on many projects with several Wyss faculty members, and more are on the horizon.

“Many diagnostics companies are good at making tests very cheap and very sensitive. But the key question is,

‘Sensitive to what?’ Basically, they’re missing the discovery piece, and that’s what I’m helping to bring to the Wyss Institute,” said Budnik. “Right now we have two major types of proteomics efforts: broad approaches that can analyze the whole proteome in large samples to identify proteins that could be biomarkers for diseases, and highly sensitive approaches that can detect a specific protein in a very small amount of sample material.”

In its initial trials, the BDL has already found a biomarker for endometrial cancer, and is working on mesothelioma, necrotizing enterocolitis (NEC), and infectious diseases, as well as earlier detection of cancer and neurodegenerative diseases. Budnik is also contributing to efforts to determine the mechanism of action of novel drugs developed at the Wyss Institute.

In some ways, it’s no surprise that Budnik can barely keep up with requests for collaborations: he is one of the world’s leading experts in proteomics. Earlier this year, he and his colleague Nikolai Slavov, Ph.D., were named as recipients of the [2022 Discovery in Proteomic Sciences Award](#) from the Human Proteome Organization (HUPO) for their work in single-cell proteomics. The limiting factor of his work at the Wyss isn’t



time, however, but access to equipment, some of which he currently has to borrow from neighboring institutions. “We are well set up to discover new biomarkers here, but in order to validate one, we have to test it on hundreds of samples before we can submit it as a diagnostic to the FDA, and we don’t have the capacity to do that,” said Budnik.

“We know what to do, we know how to do it, we just need the right machines, and then we can make real progress.”

Bogdan Budnik
Director, Wyss Biomarker Discovery Laboratory (BDL)

Support the Wyss BDL

Please get in touch with [Bob Cunningham](#) if you are interested in supporting the BDL’s acquisition of this machinery or collaborating on biomarker discovery projects.

MyoExo

Bringing roboticists and physical therapists together to improve Parkinson's diagnosis and management

Wyss Associate Professors [Conor Walsh](#), Ph.D. and [Rob Wood](#), Ph.D. invent robots. But not the kind that can vacuum your floor or run like a cheetah - they build robots that are designed to interact unobtrusively with the world, so we barely notice they're robots at all. [Walsh's Biodesign Laboratory](#) specializes in wearable robots, and [Wood's Microrobotics Laboratory](#) focuses on tiny robots that can go places most others can't. The two labs have incorporated the best of their worlds to create [MyoExo](#), a novel medical device that is poised to become the next robotics startup to spin out from the Wyss Institute.

The MyoExo team is led by [Seun Araromi](#), Ph.D., a Postdoctoral Fellow at the Wyss Institute who is co-mentored by both Walsh and Wood. He first used his background in physics and materials science to help develop a soft robotic exosuit to assist wearers with overhead manufacturing tasks as part of an industrial collaboration with Tata Group and Jaguar Land Rover. During that project, he worked on crafting sensors that were as soft, strong, and flexible as the fabric to gather data about how the wearer's body was moving.

“Right now, Parkinson's disease is diagnosed based on a doctor's subjective evaluation of a patient's neurological functions, and monitoring of a patient's condition consists largely of in-office visits as infrequently as once a year. Being able to detect subtle changes in the shape of people's muscles as they move could provide doctors with a quantifiable way to diagnose Parkinson's, and patients with a way to monitor and report their symptoms at home more frequently, improving our understanding of disease progression.”

Seun Araromi
Team Lead, MyoExo

Araromi and his teammates [invented a super-sensitive sensor](#) that could detect how much a wearer's muscles were bulging, at sensitivities orders of magnitude higher than traditional sensors. In conversations with the Wyss Institute's Business Development team, they realized that while that level of detail was probably overkill for typical workers wearing the exosuits, it had the potential to help another population: patients with Parkinson's disease.

The MyoExo team has developed a wearable, sleeve-like medical device that does just that. Supported by the [Wyss Institute Validation Project](#) and [Harvard iLab Venture Programs](#) since 2020, the device has gone through various prototyping stages and a clinical pilot in which it was tested on eleven patients with Parkinson's disease to study its efficacy. The team includes clinical collaborators [Terry Ellis](#), Ph.D. and [Nick Wendel](#), D.P.T. from Boston University's Center for Neurorehabilitation, who help identify patients who would be a good fit for the MyoExo study, oversee clinical testing, and provide subject matter expertise.

“Clinical research in Parkinson's disease has been moving towards earlier diagnosis, and the potential of these sensors to aid in that process is very exciting. If patients can be diagnosed earlier, it allows them to receive treatments like medication and exercise that can improve their quality of life,” said Wendel.

The team is currently analyzing the data they collected from their clinical pilot and building a more mature prototype that physical therapists, pharmaceutical partners, and patients can test in non-lab settings to see if the technology works equally well in the real world. They are also working to expand its capabilities to track other common symptoms of Parkinson's disease such as tremor and bradykinesia (slowed movements).

MyoExo is seeking partners who are interested in funding the project - both for near-term prototype development and trial needs and for longer-term financing of a future startup.

MyoExo

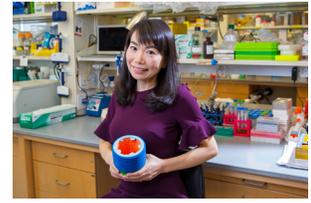
A fabric-based device for monitoring the primary signs of Parkinson's from home.



DoriVac: A new vaccine for cancers and infectious diseases

Team Lead Yang Claire Zeng
Faculty Lead William Shih
Contact [Ally Chang](#)

DoriVac, short for “DNA Origami Vaccine,” aims to be the next generation of vaccine technology by using DNA as a vaccine delivery platform, rather than as the therapy itself.



The technology consists of long ribbons of DNA that are folded into nanoparticles using a method known as DNA origami. Antigens and adjuvants can then be attached to the nanoparticle to stimulate and amplify specific immune responses against both cancers and infectious diseases.

DoriVac has demonstrated efficacy in treating mouse models of melanoma and lymphoma, as well as SARS-CoV-2, HIV, and Ebola in healthy mice. The team has established a low-cost, large-scale manufacturing method, and plans to test their technology next on a human lymph node model and humanized mouse models.

Ultimately, they plan to launch a startup company to commercialize DoriVac, and are seeking investors who are interested in funding opportunities.



3D-printed tissues for breast reconstruction and beyond

Team Lead Luba Perry
Faculty Leads Jennifer Lewis,
 Chris Chen
Contact [Gretchen Fougere](#)

It’s Breast Cancer Awareness Month, but one aspect of breast cancer that doesn’t get much attention is reconstruction after surgery. Synthetic breast implants don’t recreate the look or feel of natural breast tissue, can rupture and get infected, and some have even been linked to cancer.



A team at the Wyss is building [implantable, fully vascularized human tissue](#) that can integrate into a woman’s body after a mastectomy. This technology was selected as a Validation Project in 2020 and 2021, and the team plans to launch a startup to bring living breast tissue, and eventually whole implantable organs, to patients. They are seeking investors and funders to help accelerate its development.

Tough gel adhesives: a better Band-Aid®, inspired by slug slime

Team Lead Benjamin Freedman
Faculty Lead Dave Mooney
Contact [Paul Resnick](#)

Anyone who has had surgery has likely dealt with staples, sutures, glues, and other methods for closing wounds. Despite recent advances in surgical glues and patches, 30-50% of surgeries still cause bleeding-related complications.

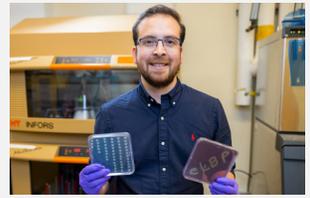


Wyss researchers have developed a [stretchable, hydrogel-based adhesive](#) to revolutionize wound treatment inside and outside the body. Our biodegradable material, inspired by the sticky slime of slugs, strongly and rapidly adheres to wet tissue surfaces 10-100x stronger than competitors. This patent-protected platform technology can be used in multiple indications including soft tissue reinforcement and local drug delivery. Wyss startup [Limax Biosciences](#), which launched to commercialize the technology, won the 2022 Harvard President’s Innovation Challenge and Medical Innovation Award and is currently seeking seed funding.

eLBP: protecting “good” bugs from antibiotics

Team Lead Andrés Cubillos-Ruiz
Faculty Lead Jim Collins
Contact [Alex Li](#)

Antibiotics not only kill “bad” disease-causing bacteria, but indiscriminately wreak havoc on the trillions of “good” bacteria making up the human microbiome. Known as “dysbiosis,” this disruption can take months to resolve and in some patients causes a host of autoimmune, metabolic, and neurological diseases. Our [engineered Living Biotherapeutic Product \(eLBP\) therapy](#) can help prevent antibiotic-induced dysbiosis when administered along with a class of commonly used antibiotics known as β -lactams. The eLBP has been engineered to safely produce an enzyme called β -lactamase that inactivates the antibiotic in the digestive tract, protecting its microbial community from the drug. Crucially, eLBP does not change the concentration of antibiotics in the bloodstream, allowing them to effectively treat their target infections elsewhere in the body. The eLBP team is seeking collaborators and investors to further develop this technology into a clinical product.

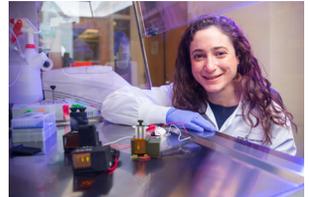


COLLABORATION OPPORTUNITIES

Project Sparkle: Instant biosensors for faster insights

Team Leads Helena de Puig,
Isaac Han,
Erkin Kuru
Faculty Leads George Church
Jim Collins
Contact [Bill Bedell](#)

Project Sparkle is a novel biosensor platform technology leveraging recent advances in synthetic biology and synthetic chemistry to detect any molecule of interest, instantly. The technology is based on novel, conditionally fluorescent molecules inspired by the protein that makes jellyfish glow. These molecules fluoresce in direct response to molecular binding events without the need for washing steps, producing results in minutes that previously required days. Applications include instant diagnostics and pathology tools, as well as new paradigms to accelerate biomanufacturing. The team is currently a [Wyss Validation Project](#), and would love to connect with potential industrial partners to assist with further development.



eRapid: Portable, sensitive, cheap diagnostics for nearly anything

Team Lead Pawan Jolly
Faculty Lead Don Ingber
Contact [Alex Li](#)

Electronic sensors offer many advantages over other diagnostic methods, like low cost, portability, and the ability to interface with computers. But translating a chemical event (like the binding of two molecules) into an electrical signal has proven challenging. [eRapid](#) solves this problem via a proprietary electrode coating onto which probes for nearly any biomolecule can be attached. Thanks to its scalable multiplexing, eRapid enables simultaneous, extremely sensitive detection of multiple target biomarkers in a single device within minutes. It is also cheap and easy to manufacture, and has been [successfully licensed as a diagnostic](#) for nephrological, neurological, and cardiovascular diseases. The team is seeking collaborators who are interested in developing eRapid for additional medical and industrial applications.



Crisscross Nanoseed Detection: Diagnosing infectious diseases with the power of DNA nanotechnology

Team Lead Dionis Minev
Faculty Lead William Shih
Contact [Ally Chang](#)

The pandemic has taught us that PCR tests are much more accurate than rapid antigen tests. But they're more expensive, take longer to produce results, and can't be done at home. [Crisscross Nanoseed Detection](#) aims to solve these problems using enzyme-free DNA nanotechnology. DNA is programmed to automatically self-assemble into long “ribbons” when a target molecule is present. These ribbons can then easily be detected using low-cost methods such as lateral flow devices or colorimetric readouts. The system gives results in 60 minutes without expensive equipment. The team is exploring this technology for diagnosing a wide variety of infectious diseases, and is seeking partners for sponsored research agreements, joint funding applications, in-kind contributions, and other forms of investment.



What's happening...

WYSS STARTUP NEWS

PionEar has received a Phase I NIH Grant to support its development of improved ear tubes for better ear infection recovery.

Manifold Bio raised a \$40 million series A round to expand its in vivo biologics design platform.

i2o Therapeutics raised a total of \$33.5 million from 17 investors in an equity round to support development of its ionic-liquid technology for oral delivery of biologics.

EnPlusOne Biosciences raised a \$12 million in seed funding to launch its enzymatic RNA synthesis platform.

Metalmark Innovations participated in the 2022 Cambridge Science Festival, teaching children and adults about how the company is using butterfly-inspired nanoarchitecture for better air purification.

FitBiomics signed five-time Olympic swimming gold medalist Nathan Adrian as spokesperson for its next-gen probiotic Nella.

Desktop Health recently opened up a new R&D lab space in Schrafft's City Center in Charlestown, Boston, MA to drive development of its PhonoGraft™ device for repairing chronically perforated eardrums.

Verve Therapeutics has dosed its first patient with its in vivo CRISPR-based gene editing therapy, a potential treatment for Heterozygous Familial Hypercholesterolemia (HeFH).

Ultivue signed a collaborative agreement with the University of Bern's Translational Research Unit to promote the use of next-generation tissue microarrays for scientific, clinical, and translational research.

Prapela won first place and \$50,000 in the MedTech Innovator/Children's National Pediatric Innovation Challenge for its device that prevents sleep apnea in pre-term infants.

LICENSING AGREEMENTS

Sherlock Biosciences licensed the Wyss Institute's ambient-temperature nucleic acid amplification technology to develop simple-to-use, portable and ultra-sensitive diagnostics for infectious disease detection in low-resource settings.

Unravel Biosciences licensed a drug discovery platform technology invented at the Wyss Institute to accelerate the development of new and more effective therapies for complex diseases, starting with Rett syndrome.

Spear Bio licensed a protein-detection technology platform from the Wyss Institute to develop an ultra-sensitive assay that can accurately measure levels of neutralizing antibodies (NABs) against SARS-CoV-2.

3EO Health licensed the rights to commercialize a portable, ultrasensitive, PCR-grade nucleic acid detection technology to build a digital self-testing diagnostic platform for COVID-19 and other illnesses.

AWARDS & RECOGNITION

Seven Wyss faculty members were named to the **2022 BIOS Beaker List**, which honors the top 50 serial academic life science entrepreneurs.



We're moving!

In 2023 the Wyss Institute will be relocating to a new space at 201 Brookline in the Fenway neighborhood of Boston.

Stay tuned for more updates in our next issue, or get in touch with [Bob Cunningham](#) for details.

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