When gene sequencing suddenly became affordable, researchers were confronted with an enormous opportunity – and an enormous problem.

For the first time, scientists could map out the genetic instructions that dictate how a person’s body works, and could see how mistakes in those instructions relate to disease. But the genetic data was so vast that no one could analyze it efficiently.

BRI responded by launching a program in bioinformatics – a cutting-edge field that merges computer science and biology. The institute hired expert bioinformaticians and built a state-of-the-art computer infrastructure. Now BRI’s eight-person bioinformaticians team uses big data tools to rapidly analyze sequencing data, fueling discoveries about everything from type 1 diabetes to food allergies.

“BRI sequences thousands of blood samples a month, and each sample yields tens of thousands of pieces of genetic data,” says Peter Linsley, PhD. “Bioinformatics helps us find patterns in that data, so we can understand which genes contribute to disease and move closer to new therapies.”

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ANALYTICAL MUSCLE

When Hannah DeBerg, PhD, was a graduate student, she wrote computer code that helped her analyze complex chemical structures. Part biologist, part computer whiz, she came to BRI because she wanted to make a difference in people’s lives.

“Just about everyone has a friend, family member or coworker with an autoimmune disease,” Dr. DeBerg says. “My goal is to help answer key questions about those diseases and, hopefully, find better treatments.”

Dr. DeBerg and her colleagues in BRI’s Bioinformatics Department provide analytical muscle to the institute’s researchers. For example, BRI scientists constantly analyze blood samples from people who...
MEET THE DOG WHO’S A WEAPON AGAINST IBD

Jenn White has a secret weapon for coping with inflammatory bowel disease (IBD) – a French bulldog-Boston terrier mix, named after a rock legend: Jagger.

Jagger is more than Jenn’s emotional support animal, he’s a kindred spirit who also suffers from IBD.

IBD strikes when the immune system attacks the intestines, causing inflammation, abdominal pain, and bleeding. While many different types of IBD have been found in different animals, it has two main forms in people: Crohn’s disease and ulcerative colitis.

Jagger and Jenn have been fighting IBD together since February 2015, when she adopted him as a puppy. Jagger was malnourished and struggling with everything from incontinence to a high white blood cell count.

“I knew he had tummy issues, and I knew I could handle it,” she says.

**ROAD TO RECOVERY**

Jagger’s road to recovery included a probiotic diet and anti-diarrheal medication. Once he felt better, Jenn decided to register him as an emotional support animal. She worked with a trainer for a year, and they motivated Jagger with treats and taught him the commands required for certification: “sit,” “stay,” “lay” and understanding his name.

“Jagger learned it all, and when he needs to go to the bathroom, he knows to wait at my door;” she says. “He only has accidents when he’s flaring and can’t hold his bowels.”

When Jagger is sick, Jenn draws upon her personal experience with IBD. If she notices signs of a flare, like vomiting, she changes Jagger’s diet. She does this all while managing her own, sometimes similar, symptoms.

“I’d say the biggest difference between our IBD experiences would be that Jagger rarely ever has fatigue,” she says. “He’s always ready to play!”

**ENDURING A FLARE**

Another key difference between Jenn and Jagger is that her IBD treatment is a lot more complicated. Jenn’s treatment has included several immunotherapy drugs and bowel surgery, and she chooses to follow a specialized diet. Her treatment is guided by James Lord, MD, PhD, a Virginia Mason gastroenterologist and BRI principal investigator who leads several IBD studies.

Jenn, who works as a buyer for Nordstrom Rack, said Jagger senses when she’s not feeling well – and responds by being more attentive. During the summer of 2016, Jenn was hospitalized four times when she suffered an extreme flare. She made bathroom trips over 10 times a day – but each time, Jagger waited for her behind the door.

“I was so depressed, but Jagger’s sweet face brought me joy,” she says. “And because I have to take him outside, he keeps me on a schedule, which is super important to managing chronic illness.”

**SUPPORTING IBD PATIENTS**

Jenn, who is currently in remission, volunteers for the Crohn’s and Colitis Foundation, and sits on its Northwest Board of Trustees. She likes to bring pictures of Jagger to Camp Oasis, the Foundation’s summer program for children with IBD. Jenn says it brightens kids’ spirits when they see a dog who’s like them, and she also brings Jagger when she visits friends hospitalized for IBD.

One of her friends “absolutely lit up when Jagger walked in the hospital room,” she says.

*BRI and Virginia Mason are involved in numerous studies to help us understand IBD and explore new treatments. Get the latest on our studies at BenaroyaResearch.org/IBDStudies. If you have IBD, join our Clinical Research Registry to get connected with studies at BenaroyaResearch.org/CRR.*
have autoimmune disease and compare them to samples from healthy people. This includes using a high-tech sequencing system called the HiSeq 2500 to pinpoint which bits of RNA – proteins that communicate genetic instructions – are in each sample. Each sample is home to anywhere from several thousand to several million pieces of RNA.

The bioinformatics team uses Amazon cloud computing tools to search through thousands of genes to see where each piece of RNA came from. The same tools help count the RNA pieces to understand which genes are especially active in people with a specific disease.

“There are around 20,000 human protein-coding genes, so this is something you could never do on paper – it takes an immense amount of computing power,” says Matt Dufort, PhD.

The bioinformatics team also uses programming languages, such as Python and R, to write algorithms that compare patients and reveal which genes they have in common.

“If certain genes are more active in people with diseases, it provides clues about what is driving the disease – so we work with researchers to figure out what those genes are doing,” Dr. Dufort says.

IMPROVING DIABETES TREATMENT

BRI’s bioinformaticians are fueling insights that could improve treatment for diseases like type 1 diabetes.

For example, Dr. Dufort and his colleagues help Dr. Linsley’s lab study immunotherapies that slow down type 1 diabetes by extending the body’s ability to make insulin. The bioinformatics team analyzes blood sample data from patients who respond to drugs, looking for clues about why they’re different from patients who don’t. The bioinformatics work includes designing the analysis to yield the most accurate results, and then using other data or statistical tests to confirm those results.

“This could lead to a test that lets doctors predict whether the drugs will work for a particular individual,” Dr. Dufort says.

It’s also a step toward a day when doctors can tailor autoimmune disease treatment to individual patients.

“Someday, we want to be able to evaluate patients with type 1 diabetes and say, ‘you have this particular strain of the disease, and we know exactly which treatments can help,’” Dr. Dufort says.

PURSUING CURES

As gene sequencing becomes integral to BRI’s research, the bioinformatics team is being confronted by more and more data, and more opportunities to fuel discoveries.

“It definitely gives us job security,” Dr. DeBerg says with a laugh, “but hopefully we’ll make so much progress against these diseases that we put ourselves out of business.”

Find out more about how bioinformatics is accelerating BRI’s progress at BenaroyaResearch.org/Bioinformatics.
When Gary Kerr and Tom Bonorden first met over a round of golf, it led to a life-changing friendship that has had a lasting impact on the Boeing Classic golf tournament and its chief beneficiary, BRI.

Since 2007, either Gary or Tom has been co-chair of the Boeing Classic volunteers. There are more than 850 volunteers who make the Boeing Classic successful by doing everything from staffing the practice facility to keeping score on the golf course.

Gary and Tom spend hundreds of hours a year managing these volunteers – a dedication that’s driven by a shared passion to help BRI eliminate autoimmune diseases.

“My parents, grandparents, all of my aunts and uncles, and two of my siblings all suffered from type 1 diabetes,” Tom says. “Volunteering to help BRI is a good way to spend my time, so that people after us won’t have to experience the same thing.”

Gary’s wife, Sandy, was diagnosed with multiple sclerosis (MS) in 2014. Then, in 2017, Gary was diagnosed with rheumatoid arthritis.

“The hours I spend helping raise money for BRI,” Gary says, “is the best way to spend my time because I know it’s going to directly benefit their medical research – and in a few years, of course, us.”

Learn how the Boeing Classic makes a difference for BRI at BoeingClassic.com.
MOVING CLOSER TO PREVENTING DIABETES

Marika Bogdani, MD, PhD, has an idea for research that could transform our understanding of how type 1 diabetes develops – and open the door to preventing the disease. And she’s using an innovative approach to raise money to prove her research has legs: crowdfunding.

With help from the Diabetes Research Connection, Dr. Bogdani filmed a video that explains how she aims to study the extracellular matrix (ECM) – a layer of goo that surrounds all cells, including the pancreatic islet cells that come under attack in type 1 diabetes.

Dr. Bogdani discovered that, in type 1 diabetes patients, the islet ECM contains unusually high amounts of a chemical that changes how the immune system reacts. She thinks that unraveling when – and why – the ECM changes could reveal clues about diabetes and lead to therapies that stop the disease.

The Diabetes Research Connection will use Dr. Bogdani’s video as part of a crowdfunding campaign on its website. The goal is to raise $50,000 – enough money to help her get the data she needs to apply for large federal grants.

“I’m hopeful we’ll better understand how type 1 diabetes develops, because that could lead to better treatments,” Dr. Bogdani says.

Watch a video of Dr. Bogdani explaining her work at DiabetesResearchConnection.org/Support.

DISCOVERING A NEW “ATTACKER” CELL IN TYPE 1 DIABETES

Karen Cerosaletti, PhD, and Peter Linsley, PhD, recently discovered that a unique set of T cells grows and multiplies in patients with type 1 diabetes, increasing the army of cells that attack the pancreas and destroy its ability to produce insulin.

“Scientists have known for many years that T cells are some of the ‘bad guy’ immune cells in type 1 diabetes,” she says. “Now we’re making progress in decoding the bad cells and finding out what makes them tick.”

The unique T cells that Dr. Cerosaletti discovered are rare in healthy individuals, but exist in significant numbers in patients with type 1 diabetes. She and her team are now working to understand when these unique T cells appear.

“We may be able to use these cells to predict or monitor diabetes in each individual,” Dr. Cerosaletti says. “Even more importantly, we may be able to target these bad cells through treatment to disarm or destroy them.”

Watch a video about T cells that drive type 1 diabetes at BenaroyaResearch.org/CerosalettiLab.
WALK TO END LUPUS NOW
What: Help end lupus by supporting the Lupus Foundation of America, which is the only national force devoted to solving the mystery of lupus.
When: Saturday, Sept. 22 at Gas Works Park
Learn More: www.lupus.org

SAVE THE DATE: ILLUMINATIONS LUNCHEON
What: Learn about BRI’s latest breakthrough research. Attend as a guest, host or table sponsor, or become an event sponsor.
When: Friday, Nov. 2 at the Sheraton Downtown Seattle
Learn More: Events@VirginiaMason.org

JINGLE BELL RUN TO END ARTHRITIS
What: Be part of the longest-running, holiday-themed 5K race series anywhere – and help conquer arthritis!
When: Sunday, Dec. 9 at Westlake Center
Learn More: www.arthritis.org