Thomas Jefferson University:
Making precision medicine a reality

Better understanding of disease and wellness at the individual patient level, using the newest, most valuable resource: data

IBM

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What if medicine and research were practiced in a radically different way?

Would the impact be great enough to impact an individual patient?

"The human body is proving to be far more complex than we had originally thought."

— Isidore Rigoutsos, PhD
Founding Director, Computational Medicine Center
Richard W. Hevner Professor in Computational Medicine
Thomas Jefferson University

Introduction

Harnessing big data is within reach for those that generate large amounts through countless experiments. The swift growth of private and public repositories of biological and clinical datasets creates new opportunities for data-driven science and breakthrough discoveries in biology and medicine. At the same time, the volume of these repositories puts increased demands on managing the data and orchestrating the rapidly evolving frameworks and applications.

A formidable medical research team from the Computational Medicine Center at Thomas Jefferson University is mining and analyzing large public pools of biomedical datasets with high-performance computing to generate unprecedented advances in precision medicine. The Computational Medicine Center uses big data to guide their basic research work into disease disparities. The team has generated strong evidence that the *who we are* aspect affects our predisposition for disease, disease progression and severity, therapeutic options and other important factors. Specifically, they have shown that a person's sex, race, ethnicity and geographic origin affect the abundances of potent regulatory molecules and of the proteins these molecules control.

The team's efforts are laying the groundwork for revolutionary and powerful diagnostic techniques and new therapies. Using a high-performance data architecture as the catalyst has allowed this team to deliver groundbreaking research and generate invaluable insights that will boost precision medicine efforts.

Let's explore how the Computational Medicine Center is redefining humanly possible through data-driven research.

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"When you let the data lead the way, you can be less constrained and can entertain bolder journeys that are not limited by what is already known."

— Isidore Rigoutsos, PhD
Founding Director
Computational Medicine Center
Thomas Jefferson University

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The intersection of data and medicine

"We're all the same, but we're unique as well. In that uniqueness lies all of the answers. At Jefferson, we're investing in great medicine, treatment and research, but we're also investing in knowing you, at levels never seen before."

— Mark Tykocinski, MD
  Provost, Executive Vice President for Academic Affairs
  Thomas Jefferson University

Tailored healthcare is based on the understanding that each person is unique. Reconsidering how to treat patients as individuals allows treatment research to grow at levels that have never been experienced before. Researchers are now able to dramatically improve the understanding of disease by analyzing huge amounts of biological data with the help of high-performance computing, which leads to significant discoveries, development of new therapies and improvement in healthcare and public health.

In the field of precision medicine, Dr. Rigoutsos and his team trust the data. They recognize the importance of computational medicine and feel that it is of great benefit to combine data, science and medicine—a practice that can shape scientific and medical discoveries for years to come.

See how Thomas Jefferson University is generating new insights toward understanding the human body.

▶ **Video 1: We see you**

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Treating the patient as an individual

"When it comes to disease, we all like to simplify things down to one reason or a few specific reasons. But the reality of it is that in health and disease you have the push and pull of many regulatory molecules."

— Isidore Rigoutsos, PhD
   Founding Director
   Computational Medicine Center
   Thomas Jefferson University

Data plays a key role in research and intervention and can accelerate progress in disease prevention. Deepening the understanding of disease enables radically new approaches to diagnosis and treatment. Research institutes collect vast amounts of data coming from various multiple sources and bring data analysts, clinical researchers and data scientists together so that diagnosis and treatments are based on accumulated knowledge.

The Computational Medicine Center takes into consideration the diversity and the uniqueness of each individual—like sex, race, ethnicity and geographic origin at the cellular level. Research into molecular data that is associated with an individual's attributes provides opportunities to improve patient health outcomes.

Learn how the research team is challenging the traditional approach to diagnosis and treatment.

▶ **Video 2: Redefining humanly possible**

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Medical research powered by data

"We now have the ability to generate tons of data in a guided way from a cell, a tissue or an organism. So, the question is, can we figure out what the data is telling us?"

— Isidore Rigoutsos, PhD
Founding Director
Computational Medicine Center
Thomas Jefferson University

The Computational Medicine Center has a different view on human disease. Dr. Rigoutsos and his team perform groundbreaking work that is more knowledge-precise medicine, driven by data. It is bold new research that aims to target disease more precisely to help with treatment specific to the individual—helping deliver higher-quality personalized patient care, based on data.

The team combines high-performance computing, data-driven hypothesis generation and wet laboratory work to unravel the biogenesis and function of newly-discovered molecules. The findings expose an unprecedented level of detailed knowledge that is now being linked to previously unsuspected events that underlie various diseases. These findings are made

possible by the availability of and the ability to mine data and would not have been possible even 10 years ago.

Learn more about the bold new approach from The Computational Medicine Center that led to surprising findings, even to them.

▶ **Video 3: Driven by data**

Supporting precision medicine research and protecting data with technology

"In a relatively short time, we recovered years' worth of data, which had been generated by dozens of people in the Center. And, before long, we were again able to shift our attention back to our research work."

— Isidore Rigoutsos, PhD
   Founding Director
   Computational Medicine Center
   Thomas Jefferson University
   Speaking about avoiding a disaster

Tackling the complexity of disease by analyzing biomedical datasets requires powerful technology to support the valuable data. And just as anything that is valuable, it must be stored securely, it must be protected against loss and it must be readily accessible. The Computational Medicine Center partnered with IBM to design a high-performance computing architecture that can ingest copious amounts of raw data.

The high-performance systems enable the Computational Medicine Center to help increase efficiency. Such systems can turn precision medicine into mainstream activities in healthcare—much sooner than once anticipated.

Learn more about the data architecture that is keeping Thomas Jefferson University at the forefront of transforming biomedical research and advancing precision medicine.

▶ **Video 4: Behind the scenes of precision medicine at Thomas Jefferson University**

Advancing healthcare methods to improve healthcare practices

"Let's let the data tell us what's important in a cell...we're discovering the data is telling us that there are more variables and more things to consider. This is precisely what we do — we take all of these new variables into account as we try to understand the onset and progression of disease."

— Isidore Rigoutsos, PhD
Founding Director
Computational Medicine Center
Thomas Jefferson University

It is well known that the healthcare industry generates large amounts of data that need to be captured, stored, cleaned, analyzed and archived. Dr. Rigoutsos sees this data as an opportunity. His team is adopting technologies that are designed to analyze huge amounts of data. As he explains in this interview, everyone on the team — from students to the faculty — realizes the importance of what they're doing: unravelling the complexities of science and medicine to better understand the diversity and the uniqueness of each individual and help support the next phase of personalized care.

The team is able to use the new high-throughput sequencing technologies to see exactly what is going on inside the cell with greater resolution.

Hear more about the team's approach to processing massive quantities of large, complex datasets generated from multiple sources to target disease more precisely.

▶ **Video 5: Deepening the understanding of disease**

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Meet the team that is making precision medicine a reality at Thomas Jefferson University

"It's not about my work, it's about the people who are behind the work."

— Isidore Rigoutsos, PhD
Founding Director
Computational Medicine Center
Thomas Jefferson University

There's a commonality among this passionate team — to learn more to get more accurate answers — faster. This team challenges each other and traditional medicine. Each member plays a significant role in the team's effort to study diseases. In this interview, you hear how the team at the Computational Medicine Center uses the large amounts of data that is made available to them to pinpoint medical issues and to get to more clinical insights.

This team is able to exploit data and design extremely complex and creative experiments, based on diverse biomedical datasets. It is this kind of dedication that drives Jefferson's pioneers to challenge traditional approaches to diagnosis and treatment.

Learn how this team translates data into knowledge and combines it with lab experiments to advance science — making them a strong team that is armed with additional information to make real clinical impact.

▶ **Video 6: The people behind the work**

Why we are investing in our future and the future of medicine

"At a time when data was becoming a commodity, data interpretation was going to be king."

— Mark Tykocinski, MD
   Provost, Executive Vice President for Academic Affairs
   Thomas Jefferson University

Making sense of data is key to facilitating research and accelerating time to insights. The Computational Medicine Center looks at where medicine is headed and develops new and more effective diagnostics, treatments and disease prevention for the benefit of patients.

With tons of data at their fingertips, the team can achieve levels of personalization that have never been seen before. For this team, data is currency. By using high performance computing systems, the researchers can gather and analyze data with high speed, cost-effective processing in a fraction of the time as before.

Just as important, researchers feel confident in the storage and backup of valuable data with the stable infrastructure. The stable infrastructure also allows them maximum collaboration—everyone can find the exact data that they need easily and quickly, when and where they need it.

Hear how the center trains and cultivates students in computational biology and medicine for the advancement of precision medicine.

▶ **Video 7: Investing in the future**

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Investing in you

"When we partner with the industry like IBM or others, we're investing in you.

We're investing in you the patient, you the student, you the community — because it's going to take those kinds of creative partnerships to really have you be healthier."

— Steve Klasko, MD, MDA
   President of Thomas Jefferson University
   Chief Executive Officer of Jefferson Health

In a world where healthcare is going through unprecedented changes driven by disruptive forces, humanity relies on visionary market leaders that embrace those transformational changes and help shape the future of the whole industry.

Thomas Jefferson University is reimagining health, education and discovery to help improve lives and create unparalleled value for 21st century students. The prescription for success that is keeping them at the forefront of precision medicine is their revolutionary data-driven research, melded with emerging technologies like augmented intelligence and the integration of man and machine working together.

Dr. Klasko describes the research conducted by the Computational Medicine Center at Thomas Jefferson University as a game changer—one that can have a significant impact on people's health and help lead the way to truly personalized medicine.

[Learn more](#) how you, as an individual, can benefit from the extraordinary precision medicine efforts led by Thomas Jefferson University.

▶ **Video 8: Investing in you**

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Conclusion

Looking at disease through a different lens, pushing the boundaries of knowledge, supporting the development of diagnostics and removing barriers to scientific exploration through data-driven research is advancing healthcare and helping patients.

By letting data lead the way, the Computational Medicine Center at Thomas Jefferson University enables radically new approaches to diagnosis and treatment with their groundbreaking research.
Read the case study to learn more.

For more information, visit:
Data storage for healthcare

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Getting your data ready for precision medicine

IBM Storage solutions are positioned to help healthcare organizations of all sizes modernize and transform their current capabilities to support the acceleration of discoveries, the advance of personalized care and the optimization of healthcare services.

Our high performance data architecture is powering world-class organizations across the globe, including 9 of top 10 healthcare companies, delivering AI capable of understanding all of your data and building rock-solid foundations for cognitive health.

Start your transformation journey today and be the next extraordinary story.

Watch the full video series

Video 1: We see you

Video 2: Redefining humanly possible
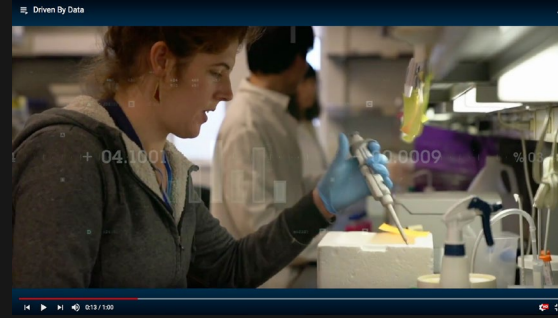
Video 3: Driven by data

Video 4: Behind the scenes of precision medicine at Thomas Jefferson University

Video 5: Deepening the understanding of disease
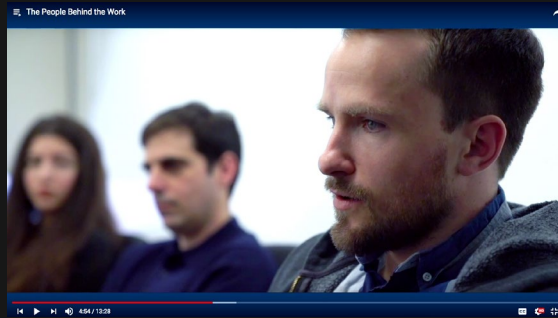
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