



PHOTO ILLUSTRATION: KRYSTINA SULATYCKI

IN THE PALM OF YOUR HAND The human metabolome has been cracked, and will soon be in a searchable database.

U of A's Metabolome Project shows us what we're made of

Researchers first to draft a complete map of the chemicals in the human body

RAMIN OSTAD
News Staff

Seven years after the mapping of the human genome, researchers at the University of Alberta have announced the first successful draft of the complete chemical makeup of the human body.

It's called the human metabolome, derived from the word metabolism, the chemical processes that occur within a living organism in order to maintain life. The metabolome is a collection of all the small molecule chemicals (or metabolites) found in an organism. The U of A's Dr David Wishart explained that it's the chemical equivalent of the human genome—which contains the hereditary information and DNA makeup of all human beings.

"If you were to think of life as sort of a pyramid, at the base is the genes or the genome, in the middle are the proteins or proteome and at the top is the metabolome," Wishart explained.

"People sequenced the genome seven years ago, and by doing that they determined a fair bit about the proteome. But we really didn't have a good picture of what the metabolome was, and so that's what we were trying to do, trying to finish off the pyramid."

Wishart is also project leader for the \$7.5 million Human Metabolome Project (HMP), a two-and-a-half year undertaking—consisting of 50 researchers from both the U of A and University of Calgary, and funding from Genome Canada—intent on

compiling a list of all known metabolites and compounds in the human body. After completion of their first draft, the HMP database includes 2500 metabolites, 1500 drugs and 3500 food compounds. These metabolites and compounds are used in the process of metabolism, the ongoing series of chemical interactions taking place in the body in order to provide us with the energy and nutrients we need.

"That's what we've done: we've developed a Rosetta stone to help translate."

**DR DAVID WISHART,
PROJECT LEADER,
HUMAN METABOLOME PROJECT**

"Some [compounds] are superfluous, some of them are essential," Wishart elaborated. "ATP is a metabolite that, without it, we die. And metabolites include things like cholesterol, things like vitamins and minerals, urea and urine, and they are critical to stay alive. There are a lot of other ones that we're not sure why they're there."

While many others are working on decoding the human metabolism, Wishart believes that the U of A is the most suitable place for this type of research. With several metabolomics centers on campus, and many spin-off companies that focus on metabolomics, the U of A was felt as the best facility to house the metabolome database.

"The U of A is quite unique in terms of this collective of ideas and abilities. So, arguably Alberta beats the rest of the world [when it comes to] metabolomics. I think a lot of it has to do with the fact that there are great facilities, great researchers, and the luck of having all of these people at the same place at the right time," he said.

The HMP is also aimed at giving doctors and clinicians the ability to better diagnose and treat diseases by testing chemical reactions, measuring compounds, validating them and recording them in a certain order. There are only eight main compounds being tested during current blood and urine testing, but Wishart believes that this will change dramatically with the creation of the HMP database.

"We have spectral fingerprints for each of the chemicals that are in our body, so that people can reference these fingerprints to identify what's in you. That makes it much easier and much faster to do chemical read-outs in the body," Wishart said.

As a comparison, sequencing of the human genome allowed for easy ways to administer genetic tests that can show predispositions to a variety of illnesses, including breast cancer, cystic fibrosis, liver diseases and many others.

"The dream is, couldn't we just have a machine that could do the chemistry to see what's in there? But they didn't have a sort of Rosetta stone to translate what the result was to what the compound was," he said. "That's what we've done: we've developed a Rosetta stone to help translate."

HUMAN METABOLITE LIBRARY

The Human Metabolome project was funded by Genome Canada, a non-for-profit organization that receives supports from the federal government to the tune of \$600 million a year.

As with the HMP's better known predecessor, the Human Genome Project, the hope is to have an electronic, searchable database containing

all of the compounds and metabolites in the human body. The database will be freely accessible to researchers worldwide.

The library, which so far has compiled over 1400 metabolites, contains detailed information about each compound, including a description of its purpose inside the body, as well as its location. The chemical structures,

and even 3D images of that individual compounds are available for the solutions already identified and classified.

Eventually, researchers will be able to order select metabolites from the database, making easier it get the materials for medical research.

A incomplete version of the database is available from Genome Canada's website, www.hmdb.com.



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