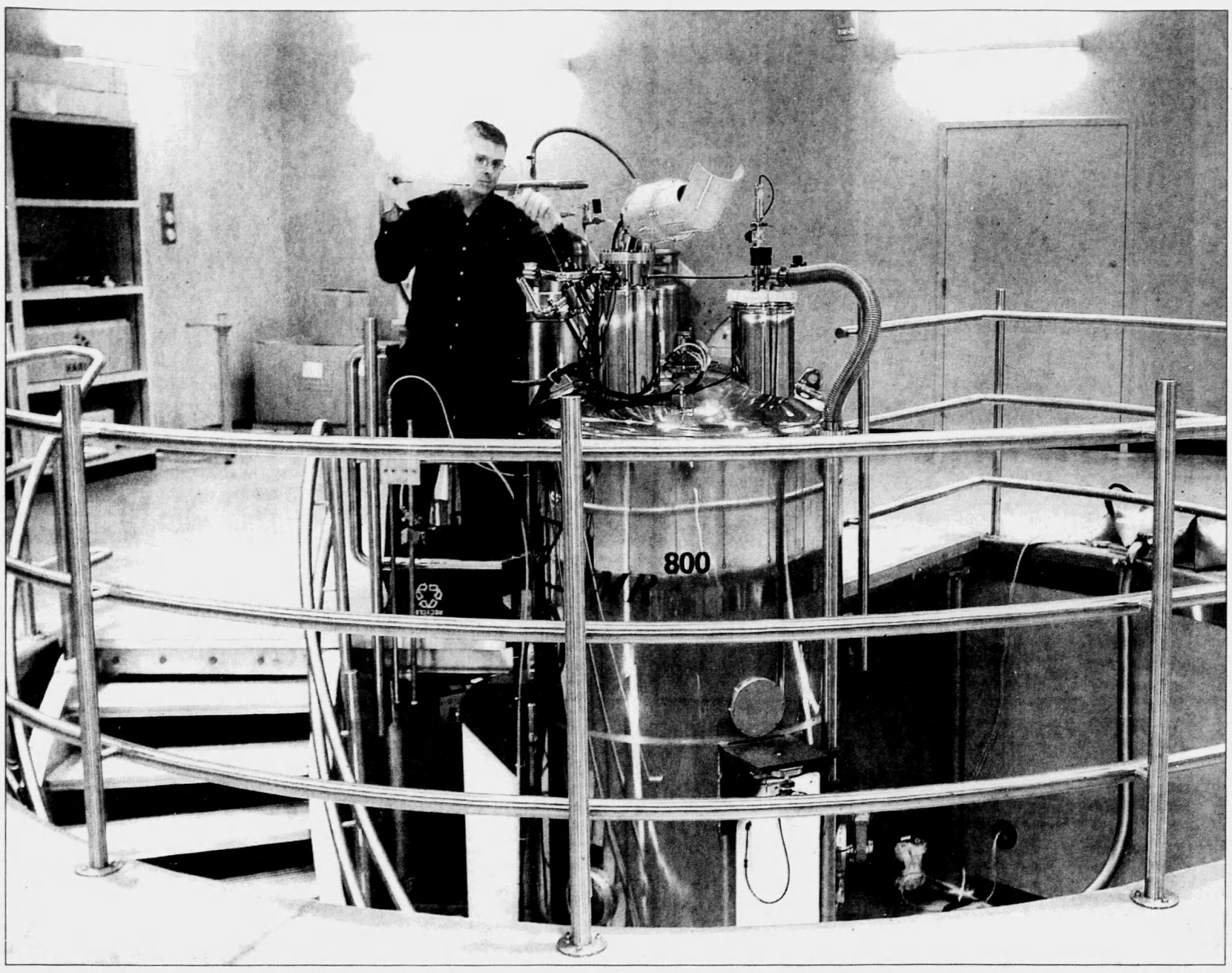

ED KAISER, THE JOURNAL

Technologist Deryck Webb fills the reservoir of a nuclear magnetic resonance spectrometer with –259 C liquid helium on Tuesday. The equipment at the University of Alberta was used to catalogue and characterize 2,500 metabolites, 1,200 drugs and 3,500 food components found in the human body.

Project deciphers chemical recipes for human diseases

JODIE SINNEMA
Journal Health Writer
EDMONTON

Breakthrough research at the University of Alberta should soon lead to quicker and better detection of diseases, even those that are rare and difficult to diagnose.

The U of A research, which vastly expands the identification of chemicals in the human body, should help doctors within three to five years to more routinely determine which diseases their patients have.

Abnormal levels or combinations of certain metabolites — chemicals such as cholesterol, blood glucose or testosterone — may signal a patient has diabetes, Alzheimer's or a particular cancer.

While the technology needs to be developed, doctors or even the general public could eventually carry hand-held devices that could test their blood or urine for the 2,500 chemicals or metabolites now identified through the Human Metabolome Project.

"I would go so far as to say that *Star Trek* medicine is upon us today," said Bill McBlain, senior vice-president of research at the U of A. "This project has — and I'm not exaggerating — the potential to totally revolutionize the diagnosis, the understanding and the treatment of disease and other related health issues."

David Wishart, the leader of the $7.5-million Human Metabolome Project, began the undertaking in 2004 and has since detected 2,500 metabolites in the human body — more than three times the 700 previously identified.

> "This could increase the speed, the sensitivity, the specificity of medical diagnosis by 100-fold. It could also allow many new or hard-to-diagnose diseases to be detected far earlier and at significantly reduced costs."
>
> David Wishart, leader of the $7.5- million Human Metabolome Project

Using huge machines called nuclear magnetic resonance spectrometers (the chemical equivalent to an MRI machine for humans), Wishart and his team also found 1,200 drugs and 3,500 food components that appear in humans naturally and from the food they eat, the drugs they take or the air they breathe.

Salt, vitamins and steroids are all metabolites.

"Knowing this information, we can start associating different diseases with different combinations or concentrations of metabolites," said Wishart, a biological sciences and computing science professor at the U of A.

"This could increase the speed, the sensitivity, the specificity of medical diagnosis by 100-fold. It could also allow many new or hard-to-diagnose diseases to be detected far earlier and at significantly reduced costs."

Currently, common urine or blood tests test for between eight and 20 different metabolites in the blood, Wishart said. A person with diabetes may be identified by sugar in the urine, yet many other metabolite markers may also help the doctor determine what's going on.

Without seeing all the ingredients, those tests will miss a lot and proper diagnoses won't be made, Wishart said.

He became interested in figuring out the body's metabolite soup after a relative of his went undiagnosed with fanconi syndrome for 15 years. The syndrome made it difficult for her kidney to properly absorb and distribute sugars, amino acids and other compounds to the blood.

When Wishart analyzed the metabolite recipe in her body, he discovered extremely high concentrations of some chemicals.

"If we had the way of identifying that particular pattern, my relative would have been diagnosed within minutes instead of 15 years," he said, noting that companies in Canada, the United States, the Netherlands and Germany are already using the information in Wishart's metabolome database to develop diagnostic tests.

Wishart and his research team have laid out the chemical recipes for 150 diseases, including rare ones such as cystinuria, which creates kidney and bladder stones, or glycerol kinase deficiency, which causes bone fractures and physical and mental retardation.

Now, he said it's up to physicians to determine the metabolite recipes of other diseases.

The dean of medicine at the U of A is testing blood from patients with pneumonia, hoping to determine how metabolite signatures can quickly alert doctors to viral versus bacterial pneumonia. Such a distinction is difficult to make, Wishart said, so patient conditions sometimes worsen while they wait for a clear diagnosis.

"It's not only diagnostic, it could be prognostic," said Wishart, noting that a certain blood cocktail or spike in metabolites could predict the later onset of a disease. "It's also very useful for monitoring."

Martin Godbout, president and chief executive officer of Genome Canada, said Wishart's metabolome project is key in understanding the human body.

"It is as important as the genome project," Godbout said, referring to the mapping of the human gene first announced in 2000.

He said humans are made of four main components: genes, proteins, metabolites and regulatory elements such as puberty. Scientists have yet to fully map the human protein as they first did the gene and now the metabolome.

"You need the four legs of the stool to see how it works. Every leg is as important as the other."

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Aussie fights off shark that gulped his head

NICK SQUIRES
The Daily Telegraph
SYDNEY, AUSTRALIA

An Australian diver fought his way out of the jaws of a great white shark Tuesday after the creature "swallowed" his head and upper body.

In a rare escape from one of the ocean's deadliest predators, Eric Nerhus frantically hit the three-metre shark in the head as its bite crushed his face mask and broke his nose.

The man-eater then took a second bite, clamping its jaws around Nerhus's body and leaving deep cuts on his torso as he struggled to break free.

"He was actually bitten by the head downwards — the shark swallowed his head," said Dennis Luobikis, 53, a friend and fellow diver. "Eric is a tough boy, he's super-fit. But I would say that it would test anyone's resolve, being a fish lunch."

Nerhus, 41, was diving for abalone, a shellfish which is plentiful in Australia's temperate waters and highly prized in Asia. He fought off the shark with a heavy metal chisel used to dislodge abalone from rocks.

He was with his son and a group of friends off Cape Howe, on a sparsely populated stretch of coast between Victoria and New South Wales.

"The brunt of the bite was taken by his lead-weight vest. Eric said to me at the wharf that his vest saved him," Luobikis said. "He said he was a very lucky man. He pushed his abalone chisel into its head while it was biting and it let him go and swam away."

Nerhus, an experienced diver, struggled to the surface despite his injuries and was hauled aboard his fishing boat by his son.

"He … was going, 'Help, help there's a shark, there's a shark,' " said Mark Nerhus, 25. "I went over and there was a big pool of red blood and I pulled him out of the water and he was going: 'Just get me to shore, get me to shore.' "

A nearby boat radioed for help and the injured diver was taken by helicopter to a hospital in the coastal city of Wollongong, 110 kilometres miles south of Sydney, where he was to undergo surgery today.

Hospital staff said that he was in a serious but stable condition, suffering from extreme shock and loss of blood.

Attacks by great whites, sometimes nicknamed "white death," are usually fatal because of the size and aggression of the creatures. They are a protected species under Australian law.

Unusually cold sea temperatures along the eastern seaboard may have lured great whites from their traditional hunting grounds along Australia's south coast, fishermen said.

Diving for abalone is highly lucrative but potentially dangerous, with divers routinely encountering large sharks as they spend hours underwater, breathing through hoses attached to boats.

Ten people have been killed by sharks in Australia since 2000. The most recent fatality was in January 2006, when a 21-year-old woman was attacked by three sharks at a popular tourist beach at North Stradbroke Island, Queensland.

In another lucky escape earlier this month, off-duty policeman Jeff Tanswell survived an attack by a 3.6-metre-long saltwater crocodile while snorkelling in the Torres Strait of northern Queensland.

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