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Ottawa's Brain gain; The University of Ottawa Institute of Mental Health Research spent two years wooing Dr. Georg Northoff, who 'hit the road running' and, after only a month, has recruited 12 other scientists to work with him in decoding the brain, writes Andrew Duffy

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In his soon-to-be published novel, The Search Warrant for the Ego, neuroscientist, psychiatrist, philo-sopher and writer Georg **Northoff** seeks to unravel some fundamental human mysteries.

Does consciousness, a self, really exist? Does our ability to think and feel give us a soul? Is free will -- the ability to choose between various courses of action -- just an illusion of a limited mind? Dr. **Northoff's** "neurophilosophical mystery novel" employs two detectives, a brain researcher and philosopher, to solve the case of our enigmatic grey matter. In pursuit of answers, his cerebral gumshoes break down walls between the two schools devoted to the brain: philosophy and neuroscience.

Their unconventional sleuthing mirrors the real-life work of **Northoff**, a star recruit to the University of Ottawa Institute of Mental Health Research.

The German scientist arrived in Ottawa last month to launch new brain investigations as the institute's research director.

"It is a coup at two levels," says institute chief executive officer Zul Merali, who led the two-year recruitment campaign.

"He's one of the top psychiatry researchers in the world, and secondly, we've been losing people to the U.S. because they're investing a lot more in research than we are: this is an example of reverse brain drain." **Northoff**, 46, now has the distinction of holding two prestigious Canadian research chairs simultaneously.

He has recently been awarded the Canada Research Chair in Mind, Brain Imaging and Neuroethics, and the ELJB-CIHR Michael Smith Chair in Neurosciences and Mental Health.

The chairs carry with them more than $3 million in funding over the next seven years.

The human brain has been called the most complex object in the history of human inquiry.

Indeed, even though scientists have made huge strides during the past two decades in understanding how the brain functions, few new tools have been developed for treating mental illness.

"We are getting more and more insight into the brain, but we don't yet know what our findings mean," said **Northoff** in a recent interview, his first since moving into gleaming new offices on the Carling Avenue campus of the Institute of Mental Health Research.

The research centre is part of the Royal Ottawa Health Care Group.

Northoff, who left the University of Magdeburg to come to Ottawa, has already published more than 100 scientific papers and several books, including Philosophy of the Brain: The Brain Problem.

His work is renowned for its use of brain imaging, a technology that has fascinated **Northoff** since its introduction in the early 1990s. He equates its development with other transformational scientific events, such as the mapping of the human genome or the publication of Albert Einstein's theory of relativity.

"Brain imaging allowed you some access to what happens in the brain while you're conscious," he says. "And that, of course, was the ideal playground for someone like me." **Northoff** holds doctorates in both neuroscience and philosophy, one discipline grounded in verifiable fact, the other in abstract concepts.

Brain imaging bridged those two worlds.

The technology gave neuroscientists a place in philosophical discussions about what it means to be conscious. Scientists could, for the first time, see inside the brain as it pondered a graphic image, a lover, a song, God -- and map the neural activity each inspired.

The imaging machines, which measure changes in oxygenation and blood flow in the brain, also opened vast new research fields in psychiatry.

Northoff, for instance, was the lead researcher on a scientific team that used functional magnetic resonance imaging (fMRI) -- the equipment allows scientists to examine brain activity in real time -- to show that pedophiles have an unusual neural response to adult pornography. Among pedophiles, the hypothalamus, a part of the brain involved in sexual arousal, was less active than in other volunteers, the team found in its 2007 study.

The journal Biological Psychiatry called it the first real-time evidence of differences in thought patterns.

The study was one of thousands this decade to highlight the potential of brain scan technology.

The hope is that psychiatrists will one day be able to better diagnose their patients by using scans to identify brain activity associated with specific illnesses, such as schizophrenia or depression.

Mental illnesses are now diagnosed through interview-based assessments. But an accurate diagnosis can take many months, sometimes years.

Treatment, too, can be subject to trial and error since drugs act differently on each individual.

In Ottawa, **Northoff** plans to use brain scans and other tools, such as magnetic resonance spectroscopy, to analyze the biochemical changes that take place in the brains of depressive and schizophrenic patients as they're treated with prescription drugs. His work could eventually lead to drug treatments -- and psychotherapy -- better tailored to individual brains.

"I want to rely less on the clinical intuition of the doctor and more on the patient's own brain," says **Northoff**.

Northoff grew up in Hamburg, Germany, the son of a medical doctor. His father wanted him to become a bank accountant, but young **Northoff** was taken with philosophy, a field marked by German luminaries such as Kant, Hegel, Schopenhauer and Nietzsche.

"But philosophy itself was for me too abstract, so I wanted to combine it with a more concrete science." **Northoff** focused on biology, particularly the physiology of the brain, which led him toward the study of medicine. He obtained his medical degree, then trained and practiced as a psychiatrist and psychotherapist.

He earned one PhD in psychiatry and neuroscience, another in philosophy and neurophilosophy, before teaching for three years at Harvard University's department of neurology.

"People were constantly saying to me, you have to decide on one direction: either go for this or go for that," he says. "Career-wise, that was certainly true, but I could never make up my mind. I stayed ambivalent." The product of that ambivalence is a broad understanding of the biological brain and its relationship to its thinking self, the mind. The relationship between the two compels him.

How is it that the brain -- this complex collection of cells -- can bring forth human consciousness? Why is it that every morning you can wake up knowing exactly who you are as a human being, without ever having a sense of your own brain? Can the

patterned thinking of a mind possibly understand the complexities of the brain? They are the kind of neurophilosophical questions that inform all of **Northoff's** work. He believes strongly that the brain can only be understood through experiments that seek to encompass its complexity.

By way of example, he points to the work of one of his students, who conducted an experiment in which he sought to stimulate patients in a vegetative state by speaking their own name. Brain scans repeatedly picked up significant activity in the brain's auditory cortex and midline regions, a finding that raises deeply philosophical questions about self-awareness.

"It suggests," he says, "that even at the sensory level, some degree of self, or subjectivity, is already present." In other words, consciousness may be more embedded in human beings than we know.

Northoff has already recruited 12 other scientists to the University of Ottawa Institute of Mental Health Research. He has also established collaborations with researchers around the world, in cities such as Toronto, Montreal, Newcastle, Milan, Shanghai, Beijing and Zurich.

The influx of scientists has presented challenges to the institute.

"This is really very unusual: I've never seen so much interest in such a short period of time," said institute CEO Dr. Merali. "He's hit the road running: he's creating issues for us because all of a sudden we have all these people showing up at the door." A world map in **Northoff's** office is marked with pushpins and pictures of his international colleagues. He aims to build a 20-person research unit.

The research institute's integration with the Royal Ottawa Mental Health Centre was a key selling point for **Northoff**. It means that he can work with a clinical director, who will be able to recruit patients for research studies and suggest important avenues for investigation.

In his new position, **Northoff** expects to devote most of his energy to research. He works, many nights until 10 p.m., in pursuit of the brain's secrets. It is an investigation, he says, into the essence of the human experience, into identity.

"This is part of yourself, and even more, it's a part of society: it shapes your image of yourself and ourselves as humans." The size and shape of the human brain have remained relatively constant for the past 50,000 years. A hunter-gatherer who lived in a cave and carved tools from bone enjoyed the same essential mass of grey matter that today informs the ideas of neuroscientists like **Northoff**.

That fact, he says, supports his belief that the brain is a "neuro-social organ," one that changes in relation to its surroundings. It means, **Northoff** contends, that the brain -- and our concept of it -- will continue to evolve along with society.

"I'm looking forward to it," he says. "What kind of concept of the brain will we have in 100 years?"

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Colour Photo: Bruno Schlumberger, The Ottawa Citizen; A Beautiful Mind - Dr. Georg **Northoff** will use brain scans to analyze the biochemical changes that occur in the brains of depressive and schizophrenic patients as they're treated with drugs, in an effort toward better tailored individual treatment. ;
Photo: Bruno Schlumberger, The Ottawa Citizen; A world map in Dr. Georg **Northoff's** office, marked with pushpins and pictures of his international colleagues, illustrates his global reach as a brain researcher. He has already recruited 12 scientists to the University of Ottawa Institute of Mental Health Research and has established collaborations with others around the globe. ;

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