AMAZING NEUROSCIENCE.

Prof. Dr. Dirk Pleiter and the Jülich Supercomputing Centre are bringing together the computational and data analytics power necessary to simulate, and ultimately understand, the human brain.

Understanding how the human brain works will take more than brains. Along with the planet's smartest scientific minds, it will take never-before-achieved computing capabilities.

The science and technology required to decode the human brain is a scientific final frontier... and Professor Dr. Dirk Pleiter is on the front lines. The theoretical physics professor and research group leader at the Jülich Supercomputing Centre (JSC) is part of the Human Brain Project (HBP), a 10-year-long European research initiative tasked with creating a working simulation of the brain.

"Understanding the human brain is one of the greatest challenges facing 21st century science," states the HBP's report to the European Commission. "If we can rise to the challenge, we can gain fundamental insights into what it means to be human, develop new treatments for brain diseases, and build revolutionary new information and communications technologies.

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This ambitious project requires a leap in scientific research and technological capabilities beyond what exists today. It demands bringing together high-performance computing and data analysis as tools in neuroscience — an effort that Pleiter describes as "pioneering."

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Computationally speaking, the task has diverse requirements. Modeling the human brain starts as a simulation challenge and quickly turns into a big data challenge. Neuroscience supercomputers will have to scale and handle data volumes surpassing what they do today. "We'll need tens of petabytes of memory if researchers want to be able to scale their models to the size of the human brain," he says.

Dr. Pleiter and the JSC team are hard at work on it, developing the data-intensive supercomputing infrastructure that will allow researchers to make advancements in neuroscience, brain-related medicine and even computing. Step one is pilot systems. Cray delivered its first one to JSC, and the team is using it to develop and test simulation and analysis techniques. Ultimately, scientists will need to be able to interactively visualize and control large-scale simulations.

The project's future applications are vast. Along with making inroads into neuroscience and treating brain disease, scientists expect this research could power tomorrow's technologies — from our computers to artificial intelligence (AI).

Says Pleiter: "This true combining of big data problems and HPC… it will help us go in new directions and push science forward."

JÜLICH SUPERCOMPUTING CENTRE

The Jülich Supercomputing Centre provides high-performance computing to researchers across Europe. A key player in the Human Brain Project, Jülich has installed pilot systems to evaluate technologies in support of neuroscience applications. The Cray system "JULIA" addresses HBP's triple demand for dense memory integration, scalable visualization and dynamic resource management.

SYSTEM DETAILS

- Intel® Xeon Phi™-based compute nodes
- Cray® DataWarp® applications I/O accelerator
- 100 Gbps network technology (Omni-Path)
- Nonvolatile memory technologies
- Software stacks supporting data analytics and deep learning
- 35,712 cores
- 3 PB Cray® Sonexion® capacity