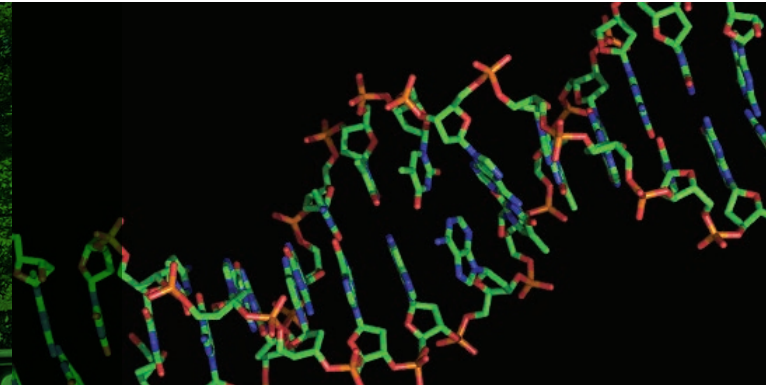


University of Zurich Boosts Delivery of Ground-Breaking Research with SGI®



The University of Zurich was founded in 1833 and is regarded as one of the world's best research institutes. Many notable laureates are alumni. Its Institute of Evolutionary Biology and Environmental Studies in particular is highly regarded for its study of living organisms.

Research Success

In 2014, a team mainly composed by researchers from the Institute of Evolutionary Biology and Environmental Studies at the University of Zurich completed the initial phase of ground-breaking research into cooperative behaviors within microbial colonies, which will revolutionize the understanding of how:

- Bacteria become resistant against antibiotics
- Medical treatments could be developed that specifically target social traits involved with virulence in chronic diseases such as Cystic Fibrosis
- Bacterial cooperation could be used to make bio-fuels

Dr. Akos Dobay is a post-doctoral researcher for the Institute of Evolutionary Biology and Environmental Studies at the University of Zurich and headed up the project.

"The study of microbiology can quickly become complicated, even the simplest of microbes are complex and manipulating them isn't always straightforward," stated Dr. Dobay. "Our research set out to study how bacteria interact and work together in microcolonies under various constraints and how this contributes to the overall fitness of the colony. We studied four different variables in order to get a significant baseline understanding of how these impact the dynamic of a colony."

"In microbiology even four variables can be hugely complicated and time consuming to study and it would have been near impossible for us to undertake this research using traditional methods so we developed a specialist program which digitally simulated how microbes interact," Dr. Dobay continued.

"Whilst this program makes it more feasible to conduct studies of microbial interaction it comes with its own challenges, as the program requires tremendous compute power in order to run realistic simulations."

Overcoming Latency

When Dr. Dobay and his colleagues were first planning their research they considered using the University of Zurich's Schrödinger system, a large high performance computing (HPC) cluster built by Sun® Microsystems with 13.5 terabytes of memory.

While Schrödinger could fulfill the compute power requirements for the specialist research program which had been developed, it posed some significant problems.

"The nodes on Schrödinger are connected using quadruple data-rate InfiniBand. When we were planning how to conduct our research project the InfiniBand was causing a lot of issues for some of my colleagues. Adding to this, Schrödinger was apparently suffering from latency problems so we didn't feel confident running our program on something which wasn't 100 percent reliable," said Dr. Dobay.



However the research team had another option, a new SGI® UV™ system called Hydra. In 2010, the University of Zurich was looking to find a new system which could provide research teams with additional computing capabilities. They turned to SGI, installing Hydra, an SGI UV 2000 large-memory multiprocessor system that has been upgraded in 2013 with 4 terabytes of shared memory and 96 CPU cores (originally with 48 cores and 512 gigabytes of memory).

Although the University of Zurich implementation was small, the latest SGI UV product family can scale a single system image (SSI) to a maximum of 64 terabytes of memory and 2,048 cores (4,096 threads), because of its innovative NUMalink® interconnect. SGI UV supports the latest Intel® Xeon® processor E5-4600 product family, and can operate unmodified versions of Linux - SUSE® Linux Enterprise Server and Red Hat® Enterprise Linux®. SGI UV is the only solution that currently leverages the power of Intel's latest CPU beyond 4 sockets and 1.5TB memory per system.

Dr. Dobay's research heavily utilized the Hydra SGI system, running the team's unique simulation program across all 96 cores non-stop for three months.

"I've been really impressed with the reliability of the SGI UV system. This is the first time we have run a research project of this scale across it and it ran consistently during our study under a heavy workload with no failures and no need for a system shut down," stated Dr. Dobay.

Ground breaking results

The research conducted by the team at the University of Zurich has revolutionized the scientific understanding of bacteria. "It's already understood that microbes display social behavior similar to that of human social groups by sharing public goods at the group level," stated Dr. Dobay. "Our research set out to explain the dilemma of the interest of the group (joint cooperation) and the interest of the individual (exploit cooperation). In other words, how can cooperation be maintained among producer cells that invest in beneficial public goods and support both the group and themselves in the presence of 'cheaters' that only support themselves."

About SGI

SGI is a global leader in high performance solutions for compute, data analytics and data management that enable customers to accelerate time to discovery, innovation, and profitability. Visit sgi.com for more information.

Using their specially developed program across SGI UV, Dr Dobay and his colleagues at the University of Zurich identified key factors tipping the balance in favor of cooperation or cheating. Their insights have consequences for real-world applications. For example, the spread of cheating is desirable when cooperation is involved with virulence and antibiotic resistance, whereas the maintenance of cooperation is crucial when bacteria are used for bioremediation and biofuel production.

Dr. Dobay concluded, "Our team ran 98 percent of our research on the Hydra SGI system installed at the University, there's no doubt that without it we wouldn't have been able to conduct our study, especially in three months, which is a very short period of time for a research project and on such a large scale. We've already started working on an extension to our research results examining more independent variables for the bacteria, we're utilizing our SGI UV for this too and the machines are working brilliantly."

About the University of Zurich

With its 26,000 enrolled students, the University of Zurich (UZH) is Switzerland's largest university. Founded in the year 1833, UZH was Europe's first university to be established by a democratic political system. Today, the UZH is one of the foremost universities in the German-speaking world. Made up of seven faculties covering some 100 different subject areas, the University offers a wide variety of Bachelor's, Master's and PhD programs.

Please visit www.uzh.ch for more information.

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