NTNU is Norway's leading science and engineering university, located in Trondheim at 63º north. We may work at Europe's outer edge – but our research is cutting edge. Here's one example:

How do you store a lifetime of memories?

In 2005, scientists at NTNU's Kavli Institute took the first step in answering that question: They discovered a biological GPS deep in your brain that keeps track of where you are and where you have been. These ingenious GPS cells measure distances, figure out how far you've gone, and compare where you are to a mental map that was made the last time you were there. Understanding the way the brain stores these memories in neural networks is critical to figuring out what happens when things go wrong, as with Alzheimer's disease and other memory-related afflictions.

The brain's approach to locating itself in space even has applications beyond human health. The robotics industry recently asked Kavli researchers for help creating new navigation algorithms.

We're not sure where our Kavli scientists are headed next. But you can bet they will find their way.

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Cooling a warming world

Capturing carbon dioxide (CO_2) is a little like catching fish: there are many different ways of doing it. The tough part is figuring out the best technology for catching the stuff, and what to do with it once you've captured it.

For more than a decade, NTNU scientists have been at work developing different technologies for CO_2 capture. Since 1996, more than 10 million tonnes of carbon dioxide have been pumped into a geological reservoir deep under the chilly North Sea, in the only full-scale test of undersea carbon storage in the world.

Norway's pioneering efforts have helped transform the city of Trondheim into a European hotbed for CO_2-related science, with an annual research budget topping 20 million euros. In fact, NTNU is involved in ten EU CO_2 capture and storage projects that could help cool a warming world.

Some said CO_2 capture and storage was impossible. But all that CO_2 locked away under the ocean says otherwise.

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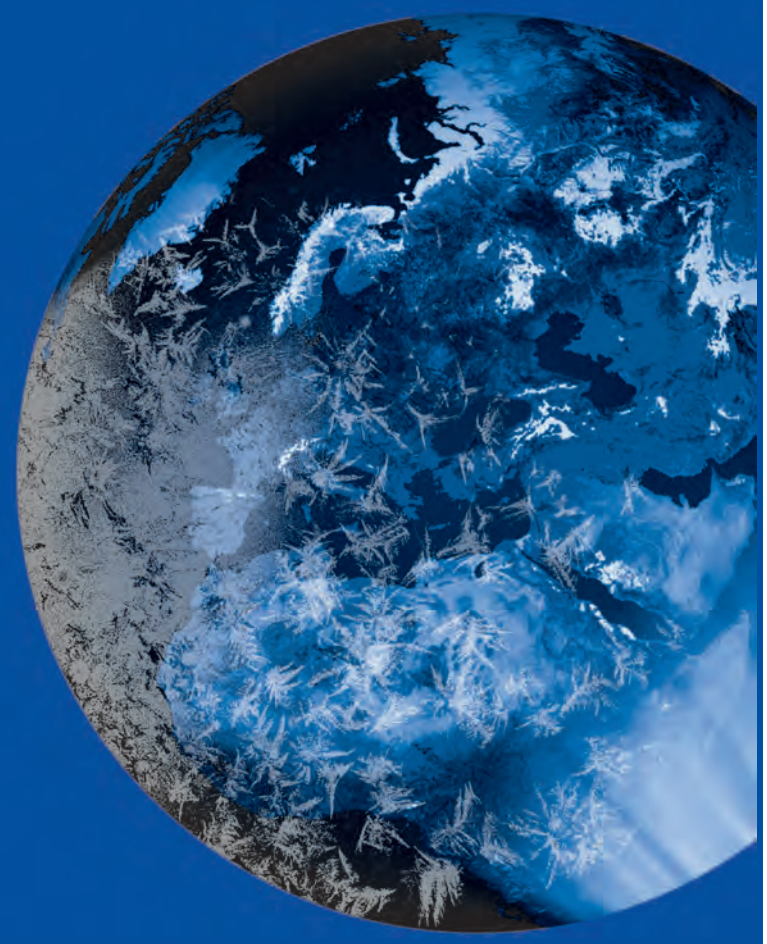

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A small revolution.

Tailor-made medicines, renewable energy sources, the future's communication technologies: Nanotechnology will change society in ways as fundamental as the industrial revolution.

NTNU's researchers are probing the boundaries of this tiny revolution. They've engineered new solar cells that trap more of the sun's energy with every square nanometre. They're making fundamental discoveries in spintronics, a way of harnessing an electron's spin to further miniaturize the computer chips that are at the heart of our information society. And they're changing everyday products in small but important ways, like creating a sleek, hard paint using carbon nanotubes to increase a ship's efficiency by 10 per cent.

All this is facilitated by NTNU's new, ultra-clean, vibration-free laboratory, where chemists, physicists, biologists and engineers can work together and exchange ideas and inspiration. This new revolution may be small, but it could change your world.

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Invisible security

The millions of bits of information we send across the Internet every day carry vital information: medical records, a visa application, or maybe even your latest tax payment.

This information has to be fast and easy to send and receive. It also has to be safe. The trick is finding the balance between fast enough and safe enough.

That's where NTNU researchers come in. They've developed a new way to transform your information into small secret packages that just you and your recipient's computers can encrypt and decode. One approach is 10,000 faster than current techniques for decoding information, and 17,000 times faster in encrypting it. Another program is being considered by the US government as a possible hashing standard to provide secure digital signatures strong enough to thwart the most determined computer hacker.

The funny thing is, the better our NTNU researchers do their job, the less likely you are to know they're doing it. That's how it's supposed to be: fast and secret.

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Bullets that save lives

They're round, of perfectly equal size, microscopic, and kind of strange... but they could save your life.

The creation of tiny monosized polymer beads — so small that 25 of them could line up across a human hair — has long been the holy grail for polymer scientists. NTNU Professor John Ugelstad took up the challenge — and concocted a batch in his laboratory.

These perfectly uniform microscopic beads have enormous medical applications. Doctors use them to treat cancer, diagnose HIV, and reduce the likelihood that transplant patients will reject their new organs.

Now Ugelstad beads are moving from medical technology into nanotechnology. NTNU researchers are continually finding new ways to put the beads to work. Flat-screen TVs and computer monitors are a first step, with other applications soon to come. Ugelstad beads may not be magic bullets — but they're a good start.

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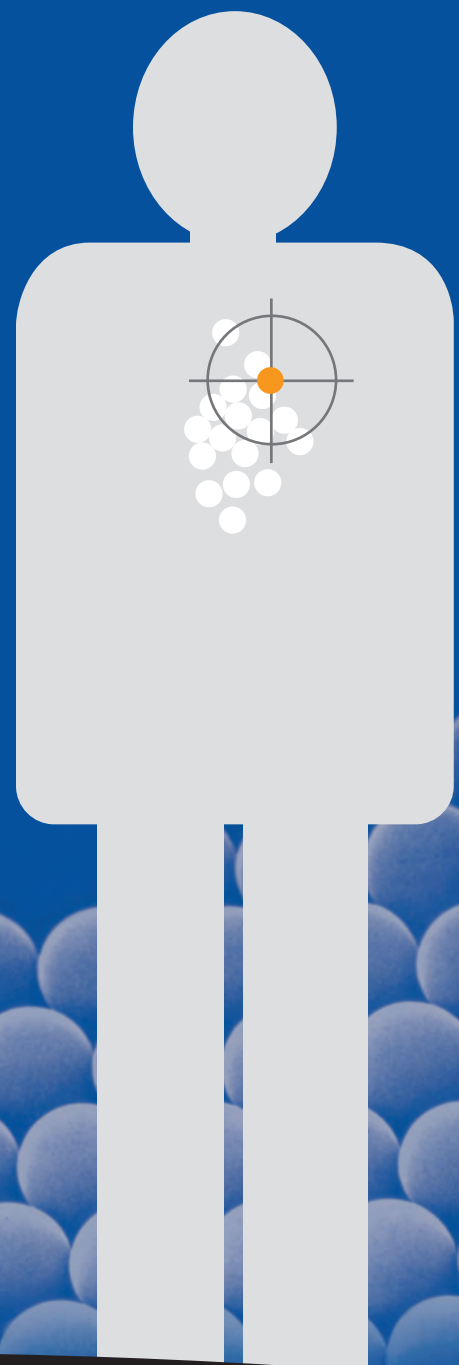

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Clean water for a thirsty world

By 2025, 3 billion people will be without easy access to drinking water. The cause is as clear as the water is dirty. Everyone is downstream from someone else's pollution.

Starting in the 1980s, NTNU researchers decided to tackle this challenge. The approach was simple: harness microbes to do the work. They discovered an elegant biological treatment process that uses a moving biofilm to cleanse community and industrial wastewater. Fish farmers can also use this invention, as can towns with highly polluted drinking water. In fact, more than 500 treatment facilities around the world have already put the discovery to work.

NTNU researchers are continuing to develop advanced membrane bioreactors, membrane filtration, and oxidation processes. Their goal is as clear as the water they produce: they want to bring clean water to a thirsty world.

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