

It's all about the method

All too frequently it is only after new technologies have been developed and deployed that research into their safety is conducted, and obviously this research can only take on a reactive role. In contrast, the emerging area of nanotechnology offers the opportunity to zero in on risks and hazards prior to the widespread application of “nano”. Empa is among the world’s leading institutions when it comes to establishing standardised – and thus meaningful – methods for evaluating nano-risks.

TEXT: Beatrice Huber / PHOTOS: Empa, iStock

New technologies can be a mixed blessing: they often harbour the potential for both good and harm. Nanotechnology is no exception. But while with other technologies the supposed and actual risks are often determined only after the technology has been put into widespread use, with nanotechnology the aim is to proceed the other way around. Countless projects worldwide are pursuing the goal of evaluating all the possible risks and hazards associated with nanomaterials. The nanotoxicologists at Empa are part of this effort, and in this they’re focusing primarily on establishing reliable test procedures.

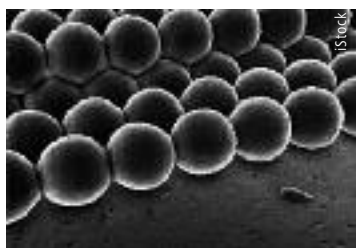
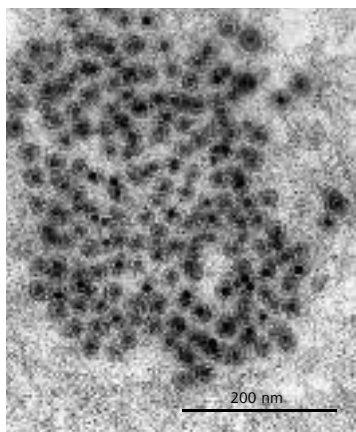
Only standardised tests allow meaningful conclusions

Previous studies on the toxicity of nanomaterials, in other words how poisonous they are, frequently led to contradictory results. Depending on the guinea pig (such as different types of cells or organs) and the procedures used to conduct the testing, nanomaterials have sometimes been found to be dangerous, sometimes harmless. This is not the type of result that could (and should) be expected from meaningful studies. Meanwhile more emphasis is being placed on the realisation that only standardised test methods and procedures can deliver reproducible results. “Only the validation of experiments leads to reliable conclusions,” says Harald Krug (see interview below).

In 2008, as part of the International Alliance for Nano Environmental and Health Safety Harmonization, Empa and other research institutes around the world gathered together in order to establish robust meth-



“We want to make reliable statements about risks and hazards.”



Nanomaterials in the spotlight: around the world, with the participation of nanotoxicologists from Empa, countless projects are being conducted with the goal of evaluating their every possible risk and hazard.

ods and standard operating procedures (SOPs). In the meantime, these institutes have already carried out various round robin tests; in other words, multiple institutes carried out identical experiments using the same procedures. They showed that only by using SOPs is it possible to arrive at truly reproducible results.

The VIGO project at the ETH Domain's Competence Centre for Materials Science and Technology (CCMX) similarly devotes itself to the standardisation of biological procedures. Researchers at Empa and the Swiss Federal Institute of Technology in Lausanne (EPFL) are participating by closely examining existing procedures so they can eliminate soft spots. MARINA, a similar project, is being set up at the European level. "With VIGO, Switzerland is already a step ahead of anywhere else in Europe," notes Krug. And VIGO isn't the only project dealing with the risk assessment of nanomaterials where Switzerland is playing a pioneering role.

Precautionary matrix – an aid for SMEs

In addition, the Precautionary Matrix for Synthetic Nanomaterials developed with the collaboration of Empa experts on behalf of the Federal Office of Public Health has met with great interest abroad. After a test phase running a full year, in March 2010 the precautionary matrix became available in a revised electronic version. It is intended to make it easier to recognise uncertainties during the production and handling of nanomaterials, for instance at the workplace, and then to introduce appropriate measures. In this way, especially small and

medium-sized enterprises (SMEs), which in contrast to large corporations frequently can't afford a department devoted to workplace safety, have a valuable tool at hand with which they can properly address any existing gaps in their knowledge. As a first result they can estimate whether or not a detailed risk assessment is called for.

DaNa ensures transparency and informs

Consumers as well have the right to be informed about the benefits and hazards associated with nanomaterials. This opinion is shared by the DaNa project partners including Empa along with five German institutes. DaNa stands for the acquisition, evaluation and widespread public presentation of Data and findings about Nanomaterials which are relevant to society. The project website is intended to bring clarity to existing knowledge and also to inform about gaps in our knowledge. Under www.nanopartikel.info consumers are provided with a serious, understandable source of information about nanomaterials and other aspects of nanotechnology. DaNa is a follow-up to the recently completed NanoCare project which was financed by the German Federal Ministry of Education and Research. //

For 20 years, Empa toxicologist Harald Krug has been working with nanotechnology to assess its possible benefits and risks. He talks about the safety research taking place at Empa with *EmpaNews*

Mr Krug, why is Switzerland so committed to safety research?

Well, safety research has long been a part of humankind's history with technology. Even the ancient Romans observed that certain working conditions, for instance in mining, could have negative effects on a person's health. Safety research always has mirrored and continues to mirror a country's culture and its willingness to be open to self-examination. For Switzerland, which can remain competitive only through top-notch innovations, safe products are absolutely essential. That's why it invests in safety research.

What are some recent developments in nano-safety research?

Until now, we were generally a step behind emerging technologies and thus were only able to react. Nanotechnology now offers us a chance to be proactive. So-called parallel safety research runs in tandem with the development of nanoproducts, in other words, before hundreds of tonnes of nanomaterials find their way into the environment.

What is Empa's role in all this?

We are among the world's leading institutions in the area of nanotoxicology. We conduct research not only to address specific questions, such as the effect of nanomaterials on immune cells, but also to develop new strategies, methods and procedures so as to achieve the highest possible level of standardisation. This goes hand in hand with the overall strategy at Empa. Our goal is to make reliable statements about existing and possible future risks and hazards. What's especially gratifying about our work is that it's having an impact; people around the world ask for our opinion. //