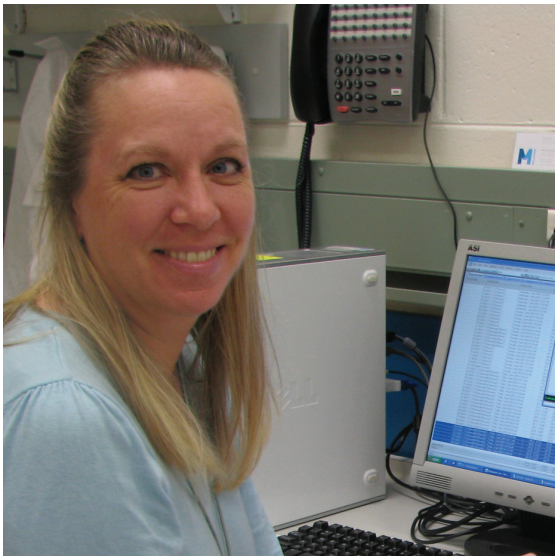
SCIENTISTS SPEAKING ON
nanotechnology



Doctor
Åsa Jämting

'Nanotechnology has a lot of potential benefits but it also has a lot of question marks. We're hoping to be able to strike out the question marks and make them exclamation marks'

SIZING UP THE NANOWORLD

Light from three lasers in a temperature and humidity-controlled laboratory at the National Measurement Institute (NMI) in Sydney sets the standard metre for Australia, as the path traveled by light in a vacuum during 1/229,792,458th of a second. This brings Australia into line with the SI, or international system, of units, which defines the metre. Laboratories around the country calibrate many fine measurements, such as lasers used in precision instruments, against the Institute's helium neon lasers.

NMI materials scientist Åsa Jämting is part of the team charged with the task of establishing a laboratory to set the standard of measurement for particles and structures on the nanometre, or billionths of a metre, scale.

The work coincides with the growth of the Australian nanotechnology industry driven by research hotspots around the country. It also comes as nanotechnology begins to pervade society, with the tiny particles finding their way into consumer products such as sunscreens, along with advanced materials, and technology used in ICT, catalysis, chemical and biological sensing and medical diagnosis.

The laboratory is building expertise in measuring the very small. It conducts research on measuring nanoparticles in solution and on the factors, including temperature, which can influence the accuracy of results. Within a decade, the international market for products embodying nanotechnology is expected to be worth trillions of dollars a year. Nanoparticles will be ubiquitous.

Nanoparticles have one or more dimensions measuring just 100 nanometres or less. Their properties differ greatly from those of larger particles of the same chemical composition, partly because a given mass of nanoparticles has a higher surface area than the same mass of larger particles. At the same time, quantum effects become more prominent with diminishing particle size. This can result in novel optical, electrical and magnetic properties of the material.

The properties of nanoparticles are often critically-dependent on size, so good nanoscale metrological infrastructure is central to a viable nanotechnology research sector and industry, and so many countries are strengthening their nanometrological know-how.

SIZING UP THE NANOWORLD

continued from overleaf

'Particles of different size perform differently,' says Dr Jämting, who has a background in materials property characterisation. 'If you know the size you can predict the response to greater accuracy.'

In one form of cancer therapy based on nanotechnology, particles of a particular size perform better than others, she says. 'You can tailor them to get a better result.'

Nanoscale metrological infrastructure is also central to regulation, especially if safety, health and environmental risks related to particle size or shape emerge.

'The NMI laboratory will provide important input into regulation,' she says. Nanotechnology is so broad, that many regulators, ranging from pharmaceuticals to environmental watchdogs, will oversee it.

The key to getting good measurements hinges on sample preparation, Dr Jämting says. That is partly because nanoparticles clump together, and this can skew the results. Another problem is distinguishing between the particles of interest and background particles. Nanoparticles occur in nature and are also found in car exhaust and industrial pollution.

The NMI is adding to its arsenal of sophisticated instruments for calibration and testing. A state-of-the-art instrument called an atomic force microscope (AFM), which will be directly traceable to the lasers used to realise the standard metre, is currently under construction and is due to be commissioned in 2010.

'Nanotechnology has a lot of potential benefits,' Dr Jämting says, 'but it also has a lot of question marks. We're hoping to be able to strike out the question marks and make them exclamation marks.'

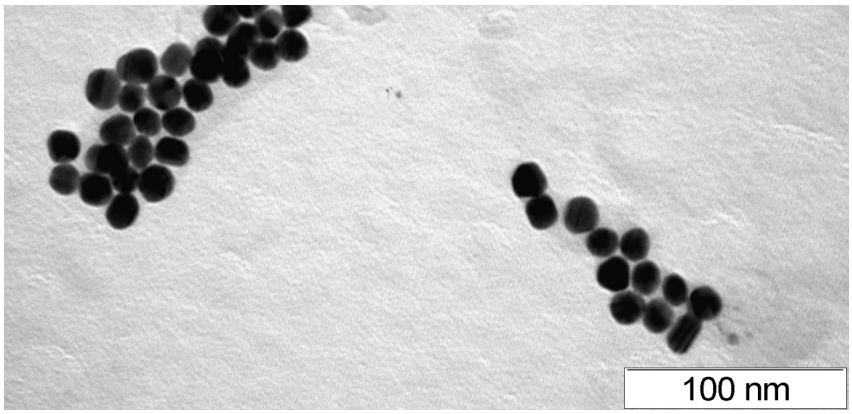


Figure 1: Transmission electron micrograph of nominally 18 nm gold nanoparticle at 300 000 magnification.

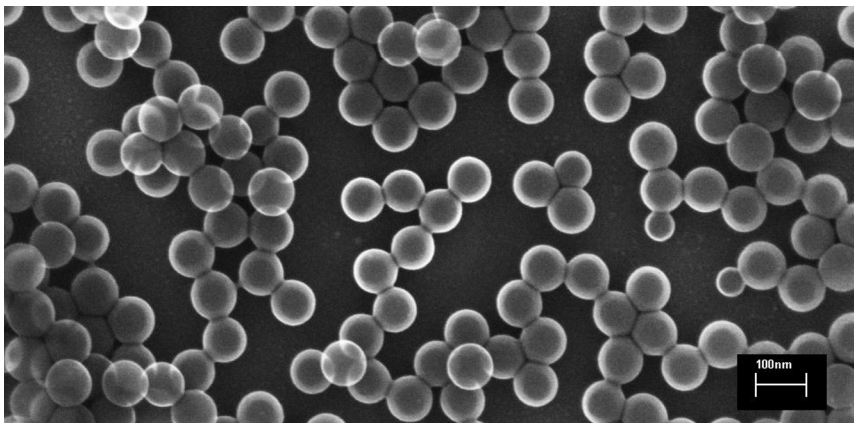


Figure 2: Scanning electron micrograph of nominally 100 nm latex spheres at 200 000 magnification.