Nanotechnology and synthetic biology

Report of the workshop at Planet Diversity Conference, Bonn May 14th 2008

Presentations

Maureen Butter, Platform Health and Environment Netherlands gives a brief introduction. Powerpoint New Technologies, why bother?. Nanotechnology and synthetic biology are both emerging technologies, nano being ultimate step in the existing tendency to miniaturisation and synthetic biology the next generation of GMOs. Lots of money go into these new developments, but there is too little attention to risks and adverse side-effects. A host of issues are associated with both (interconnected) developments.

Health and nanomaterials

- 'Inert' materials become reactive on nanoscale
- Toxicity depends on size, chemistry and form
- Mostly limited to insoluble substances
- Knowledge gap
- Legislation gap
- >300,000 essentially new materials

Nanotechnology designs materials and devices by engineering atoms and molecules. Nanomaterials refer to substances with a size up to 100 nanometer in at least one dimension. A nanometer is a billionth part of a meter, one million nanometer make up one millimetre. Human-made nanoparticles are either intentionally produced, by chemical or physical engineering or using biosynthesis or as accidental by-products, such as waste from intended production, or deriving from combustion processes. Most anthropogenic nanoparticles are known as ultrafine particulate matter, originating from traffic and industrial pollution.
Size and form may give rise to unexpected properties, including toxicity and ecotoxicity of substances generally considered non-toxic. Existing regulation doesn't take nanomaterials into account, so producers can (and do) apply them as they see fit.
A host of issues arise from these new technologies, apart from health and environment. They include social justice, corporate power, ethics and security. NGO's should bother, as products spread like wildfire and precaution is nowhere.
Maureen Butter, info@gezondheidenmilieu.nl.

Jim Thomas, ETC-Group Canada, gives a presentation on synthetic biology. He has no powerpoint, but the content is covered by a transcript of a presentation he gave earlier this year in Virginia (word document Synbiotalk.doc).

'Type "synthetic DNA" into Google and you will see adverts for companies with names like DNA 2.0 or GeneArt who will make synthetic DNA to order. On their websites you type in the order of letters you want for your synthetic DNA eg. GGTTAACTCGATC , hand over your credit card details and two weeks later you will receive a gene - or several genes - or someday soon a whole organism - in the post.'

Synthetic biology is a new and groundbreaking step in genetic engineering, which is now taken up by real engineers and information technologists. It has been enabled by major breakthroughs in other fields like chemistry, physics , biomolecular science and information technology. Although brand new, it develops with rocket speed, accelerated by the recent crises in food scarcity, climate change and oil prices.
The project of synthetic biology is to develop a whole range of patented standardized parts of life forms, from which the engineers can design whatever they want to produce just anything that is in demand. Synthetic organisms that can produce gasoline and jet fuel are promoted as

sustainable solutions to the energy crisis. The new rural landscape will be littered with bioreactors, producing fuel, plastic, rubber and whatnot from biomass.
Although the world largest companies invest huge amounts in synthetic biology, it is also rapidly becoming a 'garage technology', where designing and producing new life forms is no more difficult that designing a web page. You can make your own DNA, using a photocopier-sized DNA-synthesizer, available from eBay for no more than $ 400,-. It is even possible to order the DNA-sequence you desire from the internet. This raises huge security and safety issues, with no adequate answers available.
Agriculture is about to face large-scale revolutionary changes, with smallholders and nature as the losers and multinational giants like Dupont, Syngenta, Cargill, Chevron, Shell and Microsoft gathering even more concentrated power than they already have.
The sheer numbers and diversity of new species produced incurs the very real possibility of destroying the major global ecosystems like soil, forests and oceans.
Jim Thomas, jim@etcgroup.org.

Jurek Vengels, Bund/ FoE Germany gives a presentation on the use of nanotechnology in food and agriculture. Powerpoint Nanotechnology in food and agriculture. Nanotechnology has a very wide range of applications, of which consumer products like cosmetics, clothing and food form but a minor part. Friends of Earth Australia and Germany concentrate on consumer applications only, because they form good examples of the consequences for daily life They have recently published a report on nano in food and agriculture. The report (in German and in English) is available on the website www.bund.de.
In agriculture, nanotechnology is used to produce more potent fertilizers, plant growth treatments and pesticides. These can be made to respond to specific conditions or targets. Other applications supporting crop management are currently developed. And of course nanotechnology supports bio-engineering and synthetic biology.

> 'Scientists have suggested that particles a few hundred nanometers in size that are used as food additives may be a factor in the rising incidence of auto-immune diseases like irritable bowel syndrome and Crohn's disease.'

In food production, nanotechnology and nanomaterials are used in packaging and edible coatings to increase shelf life. Nanomaterials are added to food to enhance flavour and colouring, to increase bio-availability of nutraceuticals, to reduce caloric content or just to increase production efficiency.
Since labelling is not mandatory consumers have no way to know what products contain nanoparticles. Emerging toxicological evidence shows, that nanoparticles, even those which are widely used for years can harm human health. They pass from the gut into the bloodstream. They can pass the placenta, the blood-brain barrier and the cell membrane. Particles larger that the somewhat arbitrary boundary of 100 nm also may display emerging properties like increased toxicity, reason why Friends of Earth plead for a definition of nanomaterials including materials up to 300 nm in any dimension. Pending effective legislation and testing, Friends of Earth asks for a moratorium on nanomaterials in consumer applications.
Jurek Vengels, Jurek.Vengels@bund.net

Strategic discussion

Two additional slides from Maureen Butter show the problems encountered and the issues at stake.

Several NGOs attending this workshop are working on one or other of these issues and like to link up with others and share information and resources: ETC-group has a lot of materials and its website shows helpful links, as does Bund's.
It is advised to sign up the position paper at www.nanoaction.org.
There is great need to inform NGOs. The challenge is to give evocative examples but keeping the broader picture in mind. Possible opportunity: the Johannesburg agenda, item sustainable production. NGOs focusing on respectively health, agriculture, democracy or whatever issue must learn to cooperate on this cross-sectional issue of new technologies.
We need to invite politicians, at the same time working on grassroots education.
Don't present it as a new topic, but connect it to existing issues, like GMOs or agrofuels. Military applications and the field of human enhancement offer plenty of possibilities to raise interest.
Final suggestion: link up with other major groups, science, farmers, women, youth, labor etc.

Participants

This workshop was attended by 31 people. More would have wanted to, but the room was not large enough. The list of participants is included in this report.