Predicting and preventing heart attacks

Issue B1

Advanced atherosclerosis can lead to a heart attack or stroke without prior warning. If nanomedicine can predict if a patient is in that condition, treatments could be offered to reduce their risk, potentially saving many lives and much suffering.

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Improving life for patients and carers

Issue B2

The early diagnosis and efficient treatment of atherosclerosis could not only greatly improve the health and quality of life of heart and stroke patients, but also ease the burden on their carers.

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Economic benefits of reducing atherosclerosis

Issue B3

The reduction of heart attacks and strokes would also have large economic benefits at both family and national levels, reduce the burden on strained healthcare systems, and promote a more flourishing society.

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'Short Stay' nanoparticles for imaging

Issue B4

To detect atherosclerosis by imaging, the active nanoparticles must only be resident in the body for a short time. The body must then remove the particles efficiently to prevent harmful effects. It's a tricky balance to achieve.

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'Long Stay' nanoparticles for therapy

Issue B5

To treat atherosclerosis by drugs encapsulated in nanoparticles, the particles need to stay in the body until the drug has had a chance to work. They must not migrate to other parts of the body where they might cause harm.

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False positives and negatives

Issue B6

Human beings may vary enormously in their response to medical techniques and treatments. When using imaging to predict atherosclerosis it is vital to reduce as far as possible the risk of giving false indications, either way.

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How to select people most at risk

Issue B7

If we can image high-risk atherosclerotic conditions using nanoparticles, a reliable method is then needed to select patients most likely to be in this condition. Should everyone be scanned, or just some people, and if so whom?

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Need for Counselling

Issue B8

It will be important to provide suitable counselling for people who are invited to receive nanoparticle-based testing for high-risk atherosclerosis conditions. They need to understand procedure, its risks and benefits, and the possible implications of the results.

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Targeted drugs – Benefits

Issue B9

With normal drug delivery the medicine floods the whole body, as well as the site of disease. This can have harmful side effects. Nanoparticles which carry drugs specifically to diseased cells could reduce side effects and lower drug doses.

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Taking an example from cancer therapy

Issue B10

Nanoparticles have begun to be used in drug delivery to treat various cancers; this should encourage their use in addressing heart conditions and strokes.

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Precision for good or bad?

Issue B11

Encapsulating drugs in nanoparticles aims to target the drug accurately to diseased cells.
But the more precise, the more important it is to target the right place.
Do we understand the mechanisms of the body and disease enough yet?

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Post-blockbuster drugs and equity

Issue B12

Many pharmaceutical companies still rely on broad spectrum drugs with large markets. Targeted "block-buster" drug delivery and genetic profiling of patients should mean that future drugs will be more specific, for smaller markets, but more expensive? Can we afford them?

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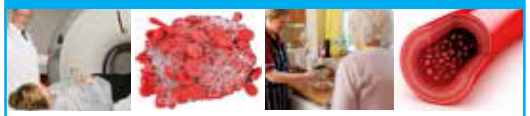
Being realistic about the benefits

Issue B13



New nanomedicines for atherosclerosis may be able to slow or arrest the condition, but curing it is a remote prospect.
The condition varies a lot among people, so a nanomedicine may work for some patients, but not others.

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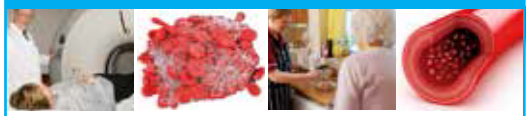
Possible toxic effects of nanoparticles

Issue B14



Some types of manufactured nano-particles may have harmful effects in the body because of their small size, unusual properties, and ability to pass through biological barriers, but others may be benign.

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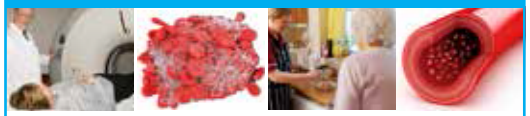
Are the health risks of nanoparticles overstated?

Issue B15



Nano-sized particles are not new. We may inhale them from volcanic ash clouds, burning candles, the exhaust from diesel engines, cigarette smoke, hairspray, and even toast. We drink them in milk and beer.

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Safety tests for nanoparticles

Issue B16

Nanoparticles used in medicine are tested for toxic effects, how different cells respond, and whether they go to the wrong parts of the body?
But uncertainties may still remain. How much assurance is it reasonable to ask for?

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How precautionary should we be?

Issue B17

How precautionary should we be about introducing new nanomedicines?
There are many uncertainties about the potential risks of nano-particles and devices, but millions of people long for treatments for atherosclerosis and cancers. Where do you think the balance lies?

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Side effects from nano particles?

Issue B18

Using nanoparticles to target drugs only to the affected site, should reduce some side-effects of medicines. But if nano-particles cross barriers to enter cells which were not intended, and they accumulate there, they may have new side-effects.

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Testing where nanoparticles go in the body

Issue B19

An important test for the safety of nanoparticles is to see in which organs in the body the particles are found after being injected, both the intended organs and elsewhere. This test has to be done in animals.

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How effective are animal tests?

Issue B20

Before new medicines can be tested for human use, they have to be tested on animals. But no result from a different species from ourselves can be wholly reliable. Is such information dubious or better than none?

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Reducing Animal Experiments: the '3R's'

Issue B21

All animal research in the EU is subject to the 3R's Principle which is to:

Replace by non-animal methods wherever possible,

Reduce the number of animals used, and

Refine methods to improve animal welfare.

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Research with animals must be in proportion

Issue B22

Some animal testing does cause suffering to the animal. This has to be in proportion to the benefit expected. It is forbidden to make any animal suffer longer than necessary for the test.

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Human cells as alternatives to animals?

Issue B23

Some medical researchers are using human cells grown in a laboratory to mimic how an organ like a kidney works. In future such 3D 'organoids' may be able to replace some uses of animals in research, but probably not all.

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Does nano risk testing have limits?

Issue B24

To find out if nanoparticles are toxic they must be tested in animals.
This means more use of animals in medical research. How do we balance this with the '3Rs' ethical/legal obligation to 'Reduce, Refine and Replace' animal testing?

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Medical treatments in extreme cases

Issue B25

In cases where a patient is terminally ill, and if he/she willingly consents, it is sometimes permitted to perform innovative procedures which have not undergone full testing. This might save the patient's life, but have an unknown chance of success.

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Need for Public Engagement

Issue B26

Nanomedicine has the potential to impact greatly on our future health care, in analysis, diagnostics, treatments and prevention. Scientists and clinicians need to engage with publics both to explain and to listen. This game is an example.

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Creating a nano-health divide?

Issue B27

Some nanomedical applications may be expensive. How do we avoid them being mainly for the rich? With a limited health budget, how do we balance the costs of new treatments with providing for all the other medical needs?

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Nanomedicine for the poor?

Issue B28

If nanotechnology is mainly market-driven for 'western' products, how can we use it to narrow the gap between the rich and the poor worlds? What should the priorities be for nanomedicine?

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Monitoring our own health data?

Issue B29

Wearable devices are becoming available to monitor the health status of our own bodies. Is it a good idea to do daily checks of ourselves? Can we rely on and interpret the information? Should this mostly be left to our doctors?

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Who should see my health data?

Issue B30

Nano-diagnostics could provide much information on our health status, but who should have access to this? My doctor, my family, my insurance company, my employers, a state database, or only myself? And under what conditions?

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Monitoring well people: what does 'well' mean?

Issue B31

If nanoparticles can monitor or image parts of our body for signs of disease, how far should we use this pro-actively to test apparently healthy people? Would this mean we are all 'ill'? What would being 'well' then mean?

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How much do we need to know, and when?

Issue B32

New diagnostic tests for atherosclerosis, before any symptoms, could be life-saving but what about testing for conditions without much effective treatment? And what if a test shows only a probability of a disease which I might never get?

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How to interpret our health data? Issue B33

Nano-diagnostics will enable us to know more about our present and future health. But how do we interpret this information? Some predict a big increase in the need for diagnostic or genetic counselling from nano-diagnostics. How should healthcare systems respond?

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Doctor-patient relationship Issue B34

Nano-diagnostics are predicted to shift the doctor-patient relationship to a more patient-led model. Is this a good or a bad thing, and why? What aspects should remain under professional control and supervision?

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Telemetry: remote health monitoring Issue B35

People living with chronic heart conditions can wear a transmitter so health care staff can monitor their condition remotely. If in future this was a nanodevice inside the heart, would this be much easier, or too risky, or too much surveillance?

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Nano-implants after an operation? Issue B36

Should nanoscale monitoring devices be implanted temporarily in patients during an operation? This would enable doctors to observe key functions remotely once the patient has gone home.

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