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Tackling global poverty

From the provision of clean drinking water to the early detection of disease, nanotechnology has the potential to make a real impact in the fight against global poverty.

It is easy to see nanotechnology as something that is being funded exclusively for the benefit of the developed world. The most widely publicized applications — be they serious, like next-generation electronic devices and targeted drug delivery, or frivolous, like stain-resistant trousers — will have little impact on the majority of the people in the world. However, if you look beneath the surface, there is enormous scope for nanotechnology to reduce poverty and improve living standards around the world. *Nature Nanotechnology* is publishing two articles on this topic[1,2] as part of a global effort by more than 200 journals to raise awareness and stimulate research into poverty and human development.

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In 2000 the United Nations adopted eight Millennium Development Goals[3] to "meet the needs of the world's poorest". These goals, all with target dates of 2015, include eradicating extreme poverty and hunger; reducing child mortality; improving maternal health; combating HIV/AIDS, malaria and other diseases; and ensuring environmental sustainability. As we approach the half-way point of this 15-year period, the UN describes progress towards the goals as "uneven": for instance, the target for extreme poverty is due to be met for the world as a whole, but not in sub-Saharan Africa, whereas the target on tuberculosis will be missed. According to Peter Singer of the University of Toronto and co-workers, nanotechnology can contribute to all five of the millennium goals listed above[4] (the other three are: to achieve universal primary education; promote gender equality and empower women; and develop a global partnership for development). This conclusion was based on a survey of experts that produced a ranking of the "top ten applications of nanotechnology for developing countries". The four leading applications were energy storage, production and conversion; agricultural productivity enhancement; water treatment and remediation; and disease diagnosis and screening. However, Singer and co-workers have been accused of being too optimistic[5].

It is generally agreed that shortages of water and contaminated water supplies are the biggest health problems in the world today, causing the death of some 4,500 children every day[6]. Thembela Hillie and Mbhuti Hlophe describe how nanofiltration membranes made from a variety of different nanomaterials are being used to provide clean drinking water[1]. Although this work is promising, Hillie and Hlophe stress the need for those involved in technology transfer to take account of the fact that developing countries differ in their needs, technical capabilities, infrastructure and market potential. "Moreover," they write, "if technology transfer is not complemented by an effort to develop local capacity, the entire process could prove to be futile".

Another area in which nanotechnology has the potential to make an enormous impact in the developing world is medicine. Whereas cancer dominates the nanomedicine agenda in the developed world, elsewhere the main targets are tuberculosis, HIV/AIDS and tropical diseases such as malaria and dengue fever, with an emphasis on early detection and prevention. Many conventional medical diagnostic techniques rely on expensive and time-consuming procedures, and can take days to produce results. Nano-enabled biosensors are able to detect pathogens directly, which removes the need for the various labelling and amplification stages associated with traditional diagnostics, making the results available in minutes. However, low-tech obstacles — such as a lack of refrigeration for medical supplies — remain.

It is estimated that some 95 of the 141 developing countries in the world depend on commodities for half of their exports[7]. Much of this income comes from agriculture, but metals such as copper and tantalum also play a role. However, the market for such materials is notoriously volatile, and as Richard Jones reports, there is evidence to suggest that developing economies that rely on such exports of minerals have slower rates of growth than comparable countries with fewer natural resources[2]. This is the infamous 'resources curse'. As Jones explains, developments in nanotechnology are going to add to this volatility.

Nanotechnology has its fair share of cynics. Contributing to the global effort to reduce poverty would go a long way to silencing them.

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