Chapter 60
Strategy and Policy Issues Related to Nanotechnology Innovations in Medical Education

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ABSTRACT

Nanotechnology, the science of building devices at the molecular and atomic levels, is finding applications in many fields. From computing to communication and to drug delivery, it continues to provide a new dimension on what science can deliver to the society. In this chapter, the author examines the strategy and policy issues affecting innovations in nanotechnology with specific focus on medical education. The field of nanotechnology is broad and encompasses a variety of disciplines, including the physical sciences, engineering, and biomedicine; consequently, an educational system that focuses on any single discipline will not provide adequate training. So, creating an environment in which students can obtain an interdisciplinary education is necessary. That will shape their perspectives as well as position them to creatively use the potentials of the technology to advance science and human society.

INTRODUCTION

"Nano" is a term creeping into our vocabulary and our culture like "cyber" in the 90s. The nanotechnology revolution has the potential to change the world on a scale equal to, if not greater than, the computer revolution. A nanotechnology revolution would have implications for education and infrastructure.

Nanotechnology is the science of building devices at the molecular and atomic level. Beyond being used in computers and communications devices, nanotechnology could be used extensively in drug delivery to fight diseases more effectively. There should be major advances in medical technology. Nanotechnology provides not only new

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approach to treatment and diagnostic options, but radically changes traditional paradigm of formal understanding of medical knowledge.

Many universities around the world have accepted the challenge of the time and offer more subjects at various levels with the prefix "nano" in the title. It is time that we educate ourselves about our possible future and 'the best way to predict the future is to create it' (Alan Kay).

The development of radically innovative nanotechnologies will challenge how we educate our future scientists at university levels. Characteristic trend for nanoscience and nanotechnology (N&N) is that its progress is accelerated, and interdisciplinarity plays a determinant role. Hence the interdisciplinary nature of nanoscale science and technology (Nano S&T) requires that we implement new paradigms for educating.

Since nanotechnology encompasses a variety of disciplines, including the physical sciences, engineering and biomedicine, an educational system focusing on single disciplines will not provide adequate training. US National Nanotechnology Initiative (NN1) is poised to provide a framework for the future of N&N.

NNI ROADMAPPING OF N&N EDUCATION WORLDWIDE

Two program documents are fundamental in roadmapping nanotechnology (NT) education pathway. In January 2000, President Clinton administration gathered its various nanotech projects under the umbrella of the National Nanotechnology Initiative (Toumey, 2005). National Nanotechnology Initiative supported by U.S. government holds Worldwide Leadership in Nanotechnology Research.

One of the main objectives of the NNI constitutes the support of education and training of the future workforce, including the creation of graduate student fellowships that are not tied to a single specific discipline (Merz, 2001). The aim is to develop educational resources, a skilled workforce, and the supporting infrastructures and tools to advance NT. In concert with the initiative's university-based research activities, this effort is designed to educate and train skilled workers, giving them the interdisciplinary perspective necessary for rapid progress in nanoscale science and technology. Researchers will also recognize and to think about the potential, the ethical, economic, legal and societal implications of nanoscale science and technology, which will underpin 'Responsible knowledge based' development of NT.

At the White House, at the 3rd of December, 2003, the President George W. Bush signed into law the "21st Century Nanotechnology Research and Development Act." This legislation puts into the law programs and activities supported by the National Nanotechnology Initiative (NNI), one of the President's highest multi-agency R&D priorities (U.S. Congress, 2003).

The US National Nanotechnology Initiative, German competence networks of nanotechnologies and European Union Framework programme are key drivers of nanotechnology development on a global scale. The main rationale and incentive for education in nanosciences and engineering also originate from governments, EU and UN organizations. The most essential teaching is made at university level. The European Union is stimulating the development of nanoscience education in universities. The Erasmus Mundus programme is funding nanoscience and nanotechnology education programmes involving universities in several European countries.

Dr. Mike Roco, founder, architect and ongoing intellectual leader of the US National Nanotechnology Initiative, foresaw a need for a multidisciplinary trained nanotechnology workforce in 2010-2015 about 2 million persons in total worldwide.

The European Action Plan for nanosciences and nanotechnologies included several measures to foster interdisciplinary human resources for nanoscience and nanotechnology. The European Commission highlighted the need to "promote the

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