

## The Bio/Nanotechnology Revolution

### BROAD IMPLICATIONS FOR HEALTH CARE'S FUTURE

Editorial Staff

Virtually everything important to health practitioners and patients will be changed by the revolution currently underway in biotechnology and nanotechnology. -- Focused Study on Biotechnology and Nanotechnology

Robert Olson, research director of the Institute for Alternative Futures, and principal author of Focused Study on Biotechnology & Nanotechnology.

A report commissioned by the U.S. Department of Defense's Health Affairs for Policy and Planning Coordination predicts that a "wide range of new biotechnologies based on modern genetics and the convergence of biology with electronics will profoundly reshape military medicine over the next 10-20 years."<sup>1</sup>

While this study was a project of the Military Health Services System (MHSS), and was used to complement a 5-7 year MHSS "strategic plan," the forecasts clearly have broad implications for health care in the near future.

The report also sees possible breakthroughs to nanotechnology in the same time period with "impacts of medicine that have barely begun to be imagined."<sup>1</sup> K. Erick Drexler, the leading expert in molecular nanotechnology defines nanotechnology as "atomically precise, functional machine systems on the scale of nanometers"<sup>2</sup> (billionths of a meter). Nanotechnology is not considered just another technology, but a new basis for all our technology.

The prognostications are the foundation of the study, and give one a glimpse of an amazing future for health care, and also some interesting possibilities for chiropractic: for example, hand held sensing devices to detect subluxations. Judge for yourself what some of the implications for chiropractic might be from these excerpts from the report's executive summary:

#### Disease Detection and Diagnosis

- "Within 2-5 years, inexpensive hand-held biosensors based on nanoscale ion channel switches will go into commercial production. They will allow simple detection of a wide range of diseases within minutes from a small sample of blood or saliva.
- "Within 5-10 years, hand-held biosensors, along with the development of minimally invasive biosensors, will have a significant impact on the design and operation of hospitals and other health care facilities, transporting samples within facilities, and sending samples out for analysis.
- "Gene chips for analyzing the distinctive pattern of genes active in different diseases will sweep aside traditional disease categories, replacing the old taxonomy with a far more powerful, complex one consisting of families of genetically defined subtypes of disease." (Note: The first commercial gene chip, formally called DNA arrays, was introduced in 1996.

Built heavily from the technology of the semiconductor industry, gene chips already decode genes 10-100 times faster than conventional methods. Chips to "detect and analyze prostate cancer will be among the first to see widespread use."<sup>1</sup>

- "Gene chips will make individual genetic profiling or genotyping possible at reasonable costs."

#### Treatment and Prevention

- "Between now and 2020, health care will evolve to a higher stage of customized care in which therapeutic selections will be precisely tailored to individual biochemistry.
- "The drug discovery and developmental process will be accelerated and fundamentally redesigned over the decade ahead in response to progress in genomics.
- "Biotechnology and genomics will produce new generations of antibiotics over the next decade that will help stem a potential global health crisis caused by the proliferation of bacteria resistant to conventional antibiotics.
- "Biotechnology will open up a new field of immunotherapy based on novel methods for fighting diseases that enlist the cells of the body's own immune system rather than drugs.
- "Gene therapy will emerge between now and 2020 as one of the truly revolutionary developments in the history of medicine, comparable in its impacts to past changes, such as the introduction of microscopy, anesthesia, vaccination, and antibiotics.
- "DNA vaccines will begin to be available over the next 5-10 years, and are likely to be universally adopted before 2020. They will be far superior to traditional vaccines, safer, and more effective at conferring both humoral and cellular immunity.
- Many new agricultural products will explicitly reflect a focus on enhancing health and treating disease. Plants will be genetically altered to improve nutrition.

#### Nanotechnology

- "If a breakthrough to a universal assembler occurs (a molecular-scale device with a robotic arm under computer control that assembles objects from the bottom up, atom by atom and molecule by molecule) within 10-15 years, an entirely new field of 'nanomedicine' will emerge by 2020. Initial applications will be focused outside the body in areas such as diagnostics and pharmaceutical manufacturing.

#### Other Areas

- "Within a decade, tissue engineering will grow from a research field to a major commercial sector.
- Over the next 20 years, genetic engineering, tissue engineering, and other areas of biotechnology will take health beyond the traditional treatment concepts of palliation (relieving symptoms), cure (stopping illness), and prevention (avoiding illness) and toward a new concept of enhancement (improving human performance).

*Editor's note:* If you're interested in a copy of the Focused Study on Biotechnology &

Nanotechnology, you can contact the Institute for Alternative Futures at 100 N. Pitt St., Suite 235, Alexandria, VA 22314-3108; tel: (703) 684-5880; fax: (703) 684-0640; e-mail: futurist-altfutures.com; website: [url=http://www.altfutures.com]http://www.altfutures.com[/url].

### *References*

1. MHSS 2020 Focused Study on Biotechnology & Nanotechnology, July 29, 1997. Primary author: Robert Olson, director of Institute for Alternative Futures; with contributions by Ed Ponatoski, SRA International, Inc., and Major Suzanne Pieklik, U.S. Army, p15.
2. Drexler, KE. "Introduction to nanotechnology," chapter 1 in Krummenacker M, Lewis J. Prospects in Nanotechnology: Toward Molecular Manufacturing. New York: John Wiley and Sons, 1995, p7.

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