

## Future Trends

*Spotlight on the Exponential Growth of Medical Utopias including Jewish Reflections on Stem Cell Research, Nanotechnology, Biogenetic Engineering and Radical Life Extension*

### Lesson 2: Biotechnology

#### Overview:

- Many of the most exciting advancements that are happening today in technology are in the space of biotechnology. Now married to information technologies, computers are increasingly stepping in to address the research needs of modern medicine. We are in the nascent stage of being able to reprogram our biology and plunge headlong into what has been called the 'golden age' of bioscience. The speed, price-performance and accuracy of diagnostic tools, imaging machines, modeling software and delivery devices is opening up a treasure house of discovery and virtuosity with respect to the wonders of the human body. From the perspective of the Torah, medical utopia is an intrinsic part of the Messianic age as well. Ridding the world of disease, ending aging and radical life extension, are all part and parcel of this process of upgrading the human body even to the point of the resurrection of the dead and the achievement of immortality.
- One of the stellar examples of the performance curve and exponential growth of a technology is in the form of genome sequencing. Mapping the first human genome was a multi-billion dollar project that lasted for some 10 plus years concluding in 2001. By early 2008 this was down to less than a week for \$100,000. [Update: after the filming of this class, the trend has continued. As of late 2008, a full human genome could be mapped for as little as \$5,000 in a matter of hours.] We are now perhaps only months away from sub \$1,000 sequences.
- 3D video now takes us inside of live cells in real time revealing the hidden worlds that lie therein. Modeling with computers can process myriads of compounds for drug developments. Stem cells can now be reverse engineered from human skin cells paving the way for the end of organ transplant as we learn to literally grow replacement parts for all of the organs and tissues of the body.
- Cellular division is an example of being 'fruitful and multiplying' on another scale. So too, the descriptions of the Torah may apply to every level of reality. Exile, like the archetype of all exiles—the state of restriction and limitation denoted by Egypt—can be transposed unto the problems of cell biology. The life of a cell is cut short by disease or aging as a result of the breakdown in communication within the body. Learning how to reestablish proper communication is the ultimate redemption from the limitation/exile with the cellular world. Mastery of this language offers the hope of correcting these limitations. Breakthroughs in this realm include the 'printing of new organs,' editing our DNA and RNA, cultivating stem cells and extending the cell telomeres (a significant factor in reversing cell aging and death).

#### In Summation:

- Our fantastic voyage through the inner workings of the body has begun. As we proceed, many of the discoveries along the way are going to uproot the basic sense of the human body, challenge us to dream bigger about the possibilities of our health and reshape many of the factors by which we define ourselves. Already, researchers have successfully piloted microscopic virtual doctors in the form of molecular sized devices through the blood stream around the body. Single cells may now target with 'smart bombs' to treat or terminate a cell that is diseased leaving surrounding healthy tissue unharmed. This is evidence of the Messianic age, a time when, as traditional sources inform us, more and more of the concealed parts of reality will become revealed to the eyes of all. Biotechnology today provides abundant testimony of this taking place.