Report

Redesigning Humans: Our Inevitable Genetic Future

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An acknowledged biotech authority and director of UCLA's Program of Medicine, Technology, and Society, Dr. Stock has collaborated in deliberations and developments blazing new biotech dimensions in this sweeping review. There's a treasure trove of possibilities afoot in the biotech revolution and this book addresses a broad range of them. It elaborates upon developments that move humanity along the newest range of bio-realms for repairing as well as enhancing health, preventing disease, boosting longevity, and enhancing quality of life.

Among the monumental biotech advances covered are human genome mapping, animal and plant transgenics, human fertility efforts and clinical medicine applications. The author covers a melange of miraculous efforts portending enormous promise, such as doubling lower animal lifespans by altering a single gene, DNA diagnostic chips, artificial chromosomes, *in vitro* fertilization, gene therapy and germline alteration that cut off dreaded genetic disorders. Human takeover and fast-forwarding of animal and plant evolution, he insists, are to be encouraged not discouraged. Human health and enhancement potentials involved in genetics are so enormous that countries failing to follow the lead of early adopters face prospects of falling behind.

Dr. Stock's previous book, *Metaman: The Merging of humans and Machines into a Global Superorganism*, covered man-machine augmentation with silicon-based artificial intelligence. This book carries these findings a few steps further, describing aesthetic surgery, prosthetic implants, electronic and mechanical restoration of senses that enhance carbon-based lifeforms. Restoring or improving hearing, sight, and motor skills hold out prospects for relieving serious afflictions that burden many. Somewhat more controversial are genetic means to boost intelligence, enhance memory, increase physical strength, elevate height that raise underperformance to average

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levels. More controversial is boosting human capabilities and physical attributes to superhuman levels - eyesight of an eagle, night vision of animals, sonar sensing of bats, scent of a bloodhound, and so on.

Stock sides with those who believe the most egregious error is not using our knowledge. We did not spend billions to discern biological blueprints merely to satisfy our curiosity. The very purpose of such a vast undertaking, the author argues, was to pursue improving upon what nature has provided. For most genetic advances the question, according to the author, is not so much whether, but when, where and by whom. Repressed in one location, further advances move to more permissive locations or go underground and gravitate into the hands of rogue scientists. Furthermore, when important medical procedures are denied in one jurisdiction, persons able to afford them simply travel to other places where they are available. Unable to obtain legal abortions for thalidomide-damaged fetuses, many Americans traveled to Sweden for that purpose. In like manner, Americans denied sex-change operations simply went to Denmark for the operation. Progress, is important to humanity, and is not to be denied. Better ways of doing things inevitably prevail, he maintains.

Girding individual "choice," Dr. Stock proposes adding a new chromosome pair to the human genome. Designed to carry specific therapeutics and traits, these "modules" could be switched on or off, at the carrier's option, simply by taking a pill or an injection. All the answers aren't in. Stock points out the complexity of activating genes in the right place, time and level.

He cuts through the age-old *nature* (genetics) versus *nurture* (environment and experience) debate showing clearly that there is no question that our genes tell us a great deal about who we are.

Setting "political correctness" aside, Stock examines some of the likely genetic differences we will find not only among individuals, but among the human populations as well, then discusses how we can deal with these differences within an egalitarian framework.

Along the way, readers are reminded of vexing questions posed by biotech: permitting diagnostic tests for untreatable diseases; denying experimental biotech treatment for hopelessly sick; forbidding women over 45 years of age from having a child without genetic screening; requiring parents (not society) to bear the costs of raising a genetically impaired child; prohibiting males over a certain age from fathering children.

Stock presents salient biotech advances in a scientific and non-sensational manner. He places great faith in risk-reward considerations rather

than theoretical, religious, philosophical, moral and ethical objections. Instead of merely posing abstract fears of nebulous possibilities that can't be disproven or proven, the author calls for reasoned judgment and solid facts to guide biotech advances.

Addressing have and have-not questions, he points out that affluent nations typically develop and prove costly hitech that eventually "trickles down" to less advantaged countries. Wealthier patrons "pave the way" for lower costs that open the way for others. Social justice does not necessitate that everybody have the identical status. Have-nots unable to pay for expensive genetic fixes, pose a problem common to all high cost goods and services.

It's been said 1000 deaths is a statistic, and one death is a tragedy. Regarding critics who complain that a single genetic-related death is one too many, the author cautions that stance would eliminate vaccinations and even reproduction itself!

If what nature has provided can be combined or recombined to enhance given properties it makes little sense not to proceed - cautiously, the author adds. Manipulating the organic chemistry of genes and proteins should be viewed no differently than a chemist's ability to manipulate, combine and extract inorganic chemicals to achieve designer materials. Life-saving fetal heart surgery should be viewed no differently than genetic intervention undertaken to save newborns from degenerative and early death otherwise inflicted by Tay-Sachs genetic disorder - or any other preventable genetic disorder.

Lest it be forgotten how fickle public attitudes toward advancing technologies can be, the author provides a reminder. Health care advances that spared countless lives from early demise, gave rise to fears that those who failed to die young would sully and lead to degradation of human evolution. Such worries proved foundless.

Consistent with life-giving potentials for extending life, the author questions the needless descent into decrepitude and decay. Not unmindful of related social implications, the author addresses impacts upon social security, workforce aging, and deepening gulfs in wealth and power entailed by longer lives. Rejecting arguments that people already live long enough, that the planet is overcrowded, that extended life expectancies are selfish, or that death should be allowed merely to run its course, the author unabashedly advocates extending life expectancies.

The author suggests that breeding dogs has led to an enormous diversity, and that human genetic intervention is likely to produce a simi-

lar range in us. But it won't be entirely unfamiliar. Seven-foot basketball players and three-foot dwarfs, 400-pound Sumo wrestlers and 80-pound fashion models show the degree of human diversity we already accept. Dogs (Canis familiaris), among the first domesticated animals, remain surprisingly similar genetically to their gray wolf ancestors but through a few millennia of selective breeding we have fashioned a remarkable diversity ranging from German Shepherds to Mexican Chihuahuas, giant St. Bernards to diminutive toy poodles, from bloodhounds with extraordinary sense of smell to springer spaniel game retrievers.

While cautioning against proceeding too far, too fast, the book debunks many of the common arguments against proceeding with new genetic procedures and technologies. Sound science tempered by objective risk-benefit analysis eventually carries the day - at least, so the author hopes.

Overcoming obstruction, at least to some biotech advances, will not be easy. Human cloning and genetic enhancing, in particular, are certain to entail protracted opposition. Abortion rights, still being vehemently and violently opposed decades later, is a harbinger. Contraception, abortion, in vitro fertilization, sex selection, cloning, and genetic intervention are among undertakings opposed by many religious institutions. Religious opposition to intervention in "nature" always has been and always will surround new technologies.

Dr. Stock covers a basic array of biotech developments hitting parenthood, including in vitro fertilization (IVF), egg and sperm banking and cryogenic preservation, embryo selection, preimplantation genetic diagnosis, human genetic modification/engineering, germline engineering and enhancement, reproductive cloning. Attitudes toward such new technologies simply take time to change. Medically-assisted birth in hospitals, was considered "unnatural" in 1900 when only 5% of births occurred in such settings. Today, most parents rely on hospital expertise as the "normal" birthing option to assure that the full range of assistance is available should anything go awry. Cute cloned pets may begin to warm people up to the idea of genetic intervention but birth of an adorable cloned human baby, the author notes, would not melt away public opposition.

Germinal choice technology (GCT), the author believes, will become a procreative freedom and protected right. He rejects government controls on procreation, and suggests that parents will make much better decisions. While judges or lawmakers may set edicts, they do not have to

incur the suffering of a child left to live a painful and short life, or bear the heavy expenses and guilt of caring for a seriously disabled child. Collective wisdom and consensus transcend commissions of experts who might otherwise make decisions for parents. He acknowledges that some parents will shun such interventions, just as many now ignore opportunities to learn the sex of their fetus. But giving birth to seriously genetically impaired babies will be considered increasingly avoidable and irresponsible, he feels.

Reiterating his basic faith in the advance of biotech, he contends that if biotech can assure healthy babies and safely enhance their capabilities, parents will take advantage of those potentials. Tragic as cutting any potential life short, an estimated 90% of couples abort fetuses testing positive for cystic fibrosis. Dr. Stock highlights practical matters that will strongly influence the adoption of these new technologies. In vitro fertilization, he points out, is not avoided because it may be immoral but because it is costly, not covered by insurance, unreliable, unpleasant and intrusive.

He foresees the time when IVF becomes the norm and traditional reproduction reckless, when pre-implantation screening for defects becomes routine, and couples want to control the timing of conception and birth. Babies will be made to order (designer babies) rather than begotten. Sex will become more recreational than procreational. It all takes time. Trends toward fewer children per family have important portent for these genetic technologies too, since parents who have one child will be more likely to embrace the full measure of what genetics has to offer to assure "genetic fitness".

He believes that the biggest threat is governmental controls over reproduction choices rather than free parental choice. The tragedies of Nazi "ethnic cleansing" or sterilization laws were brought about not by genetics but by government tyranny, he points out. China's restrictive controls on reproduction go further than any other major nation and although enforcement is lax, China's 1995 Maternal and Infant Health Care Law contains many eugenic elements: compulsory premarital checkups, sterilization for "genetic diseases of a serious nature" and "mental diseases," and one-child-per-family inducements.

If you are looking for a quick fix on the sweeping panorama of change wrought by genetics this is the book to read. The pages present debates that will shape the 21st century. Enthralled or occasionally appalled by life altering prospects, the pro and con treatment of both optimistic pos-

sibilities and pessimistic concerns will provide perspective and understanding. Genetics and life sciences has reached a threshold where its life-giving benefits may be deterred but not denied. Staying informed and abreast of the times, knowing where to invest, knowing which jobs and livelihoods to prepare for and go after, and grasping the nature of the miracles that loom, is to be found in this important and influential book.