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The Socioeconomic Impacts of Emergent Biotechnology on the Next Human Age

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ABSTRACT

Modern biotechnology has progressed to unforeseeable heights, from genetic engineering to radical life extension. The rapid advent of this technology has enforced upon us a duty to contemplate the ethics surrounding it to inform our decisions. One pressing aspect of contemporary bioethics lies in medical developments that have become widely consumed resources. In modern society, big pharmaceutical companies dominate the healthcare industry, which makes them uniquely positioned to introduce new-age biotechnology as consumer resources. A "big pharma" future exemplified by the emergence of revolutionary new-age biotechnology presents severe ethical concerns. This paper examines potential scenarios where emergent biotechnology becomes a consumer resource as a result of aggressive marketing, indirect coercion, and monopoly of the "big pharma" companies. Chasing higher profitability and benefiting from their monopoly position, big pharmaceutical companies can price new biotechnologies at excessive levels, resulting in new biotechnology proliferating along socioeconomic lines. Such a development threatens to create an elite genetic class and destroy social mobility. In order to mitigate such consequences, this paper proposes a price cap mechanism to improve equal access to emerging biotechnology and promote innovations in breakthrough treatments.

Big Pharma and the Next Human Age

Ever since the beginning of the human species, technological developments have been part and parcel of our advancement as intelligent creatures. These developments have come in various forms but have always been tools for human progression. One could even argue that these tools not only serve as benchmarks for societies but also make us distinct from our animal counterparts. Influential discoveries such as the forging of alloys launched civilizations into the Bronze Age, filled with revolutionary technological and societal advancements that prepared humanity to enter the next stage (History.com Editors, 2021). Even more recently, with the use of GMOs in agriculture, societies worldwide ventured into the Green Revolution, expanding their capacities to improve quality of life in unprecedented ways (Encyclopedia Britannica, n.d.). The discovery of new technology allowed humanity to push towards never-before-seen heights.

As we have progressed at a breakneck pace, a new tool has fallen into our hands: modern biotechnology. The discovery of the double-helix structure of DNA by Watson and Crick was the first step in turning our efforts inward to our innate genetic blueprint (National Library of Medicine, n.d.). These discoveries provided an impetus for creating new, revolutionary biotechnology that stretches our perceptions of health. New biotechnology applications, from genetic enhancement to radical life extension, have opened possibilities for the medical field of untold capacity.

However, these technological advancements cannot be taken solely as the next natural step for humanity with blinding fervor. The biotech revolution will be the next stage for us to face, and it will set the course for all humans, not just healthcare professionals and their immediate patients. Thus, we must use our other defining and unique factor as humans to scrutinize these developments: our morality. Examining the possible

outcomes of biotechnology through an ethical lens is one of our generation's most challenging but imperative tasks.

As the biotechnology question possesses many faces, we must view every aspect with great care. One possibility that deserves consideration is that biotechnology may become a consumer resource that behaves accordingly in a free-market environment common in many western societies. It is without question that large pharmaceutical corporations have a tremendous presence, both politically and economically, in modern health industries and would thus play a significant role in shaping the existence of new-age biotechnology. As we enter the biotech age, we must consider the moral and socioeconomic consequences of the technology proliferating along socioeconomic lines. This paper describes potential scenarios wherein emergent biotechnology becomes a consumer resource that propagates along socioeconomic divisions as a result of aggressive marketing, indirect coercion, and the monopoly of "big pharma" companies. It then examines the impacts of such developments on social dynamics and human dignity and explores ways to mitigate their potential detrimental effects.

The Establishment of Big Pharma in New-Age Biotechnology

New-age biotechnology behaves differently than other existing drugs. The main differences lie in the incredible therapeutic and enhancing capabilities of new technology like genetic manipulation and mood-enhancing drugs. While many individuals may feel apprehensive about such technology, some will find it hard to explain their unease. As Leon Kass pointed out in "The Age of Genetic Technology Arrives," many people may find it hard to limit such biotechnology because its results are so alluring and promising (2004). This initial disposition towards these types of technology will be capitalized upon by parties that seek to profit from their widespread use: large pharmaceutical companies. They may aim to proliferate these technologies throughout consumer markets while maintaining complete control over their distribution.

Marketing

New biotechnology could enter the consumer market as a resource through intensive and exaggerative marketing by the pharmaceutical industry. Francis Fukuyama highlighted one such example in his book Our Posthuman Future, where he discussed the drug Prozac and its relatives. At the time, many advocates of Prozac touted it as a miracle drug, capable of altering personalities to adopt healthier lifestyles. However, consumers were uninformed about their possible side effects, and many patients did not experience the same miraculous outcomes advertised (Fukuyama, 2003). Fukuyama noted that several critics claimed that the manufacturers attempted to cover up the side effects when promoting Prozac (Breggin and Breggin, 1994 as cited in Fukuyama, 2003) (Glenmullen, 2000 cited in Fukuyama, 2003). The example demonstrates how effective big pharma's marketing techniques can be. By portraying their products as ultimate panaceas, big pharma has successfully driven up the consumption of inherently defective drugs.

Besides their ability to promote consumption, big pharma companies are capable of concealing risks to assuage consumer concerns. For instance, at its introduction in 1996, the opioid drug OxyContin produced by Purdue Pharma, was aggressively and successively marketed to consumers despite public knowledge that opioids and other painkiller drugs produced by the same company had addictive properties. A large portion of the marketing campaign was devoted to the "systematic effort to minimize the risk of addiction in the use of opioids," with Purdue Pharma announcing to consumers that "the risk of addiction from OxyContin was extremely small" (Van, 2009). Through these marketing efforts, Purdue pharma suppressed consumer concerns about opioid usage as OxyContin began to flood the consumer market with widespread uses, which led to "OxyContin [rising] to blockbuster drug status" (Van, 2009). The case of OxyContin and Purdue Pharma illustrates the ability of big pharma companies to overcome initial fears and risks associated with their products

through marketing. Big pharma could use such marketing techniques to introduce future biotechnology to mislead consumers about potential health risks and overcome their initial apprehensions.

The examples above shed crucial insight into the misleading marketing of certain drugs preceding their successful introduction to the consumer market. However, what is especially worrisome about the new-age biotechnology is its potential to be perfected. As biotechnology becomes "perfect," side effects and efficacy questions will no longer be relevant. The "too good to be true" skepticism associated with traditional medicines may be thrown out the window as the demand for "miraculous" health benefits overshadows initial apprehensions. With the allure of seemingly unmatched benefits from the new-age biotechnology and their assured efficacy and safety, big pharma companies may feel free to play them up, drastically improving their ability to introduce the technology as consumer resources. With such influential marketing campaigns, it is very plausible that large pharmaceutical corporations can and will successfully make new biotechnology a widely consumable resource.

Indirect Coercion

The pharmaceutical industry may increase the adoption of new biotechnology through indirect pressures upon consumers. These indirect pressures, as opposed to advertising, do not directly pitch the use of the technology to consumers but instead affect the circumstances in which they live. It can occur by decreasing the availability of conventional treatments for the same issues that new biotechnology resolves. For example, introducing new biotechnology to treat chronic illnesses could place indirect pressure upon the prices and availability of conventional treatments. A study released by the CDC in 2009 found that chronic diseases were responsible for more than 75 percent of the $2.5 trillion spent annually on health care (Erdem, Prada, and Haffer, 2013). With the introduction of preventative measures enabled by the new biotechnology, the industries marketing the conventional treatments will shift gears to sell the new technology due to its greater marketability and versatility. While much of the original population that struggles with chronic illnesses can find this alternative option appealing, some individuals may remain wary of the new biotechnology and choose to stay with conventional treatments. Large pharmaceutical companies can push these consumers toward new treatments by reducing production and raising the prices of traditional medications. Rising living costs and socioeconomic conditions corner many individuals with chronic diseases against a wall. While a majority of consumers may feel they have had a choice, economic pressures placed upon them by the pharmaceutical industry can push them to start using the new biotech treatments against their initial wishes.

Furthermore, big pharma could coerce individuals to use their new biotech treatments by manipulating insurance rates indirectly. Kass also noted this possibility regarding genetic modification of babies in the womb, stating that if insurance companies denied coverage of certain genetic diseases, it might compel individuals to seek genetic abortions or intervention (2004). However, this issue affects many more than just the unborn. As radical life extension becomes feasible and the use of biotech for such means skyrockets, diseases that come with age become less and less common. With a growing population adopting new biotechnology, fewer people will purchase insurance plans such as institutional long-term care or long-term hospitalization. With less demand for such insurance plans, companies will raise their prices to maintain a profit or cease to offer them in the first place. Instead, the insurance companies may pivot to providing coverage for new biotech treatments to meet increasing consumer demand. Such a change in insurance coverage may compel individuals who were initially wary about the new technology to seek these treatments. Pharmaceutical companies can benefit tremendously from such a shift in the insurance industry and may even endorse the change as insurance companies start offering plans covering the new biotech treatments. The mere entrance of emergent biotechnology pressures insurance providers to switch gears, creating a positive feedback loop with patients coerced into using these new biotech treatments.

Monopolies

Driven by a desire for higher profitability, large pharmaceutical companies may seek to secure control over the production and distribution of the new biotechnology through monopolies. Though some may be skeptical of a handful of companies holding jurisdiction over such important technology, the history of big pharma speaks for itself. In the United States, there are currently only three insulin manufacturers: Eli Lilly, Novo Nordisk, and Sanofi (Cefalu et al., 2018). While insulin is crucial to the survival of Type-1 diabetes patients, there seems to be an utter lack of competition in the market that would keep the prices of insulin low. A study conducted in 2016 demonstrated that the cost of insulin rose 197% from $4.34 per milliliter in 2002 to $12.92 per milliliter in 2013 (Hua et al., 2016). The price of insulin has not dropped since then despite patients' endless suffering and persistent campaign for price regulations.

How can the price stay so high despite public resistance to such exorbitant and rising rates? Would the US government not interfere to break up such a monopoly and bring prices back down? The lax regulation of the pharmaceutical industry may be linked to the political control the industry exerts through its lobbyists. According to Oliver Wouters, the pharmaceutical industry spent $4.7 billion on lobbying and $1.3 billion on supporting federal and state campaigns of sympathetic legislators from 1999 to 2018. Despite the amount dedicated to exerting political control over drug policies, the study also found that the $4.7 billion on lobbying and $1.3 billion on campaign contributions accounted for only approximately 0.1% of the estimated $5.5 trillion spent on prescription medications in the United States (Wouters, 2020). While the pharmaceutical industry has exerted significant political control to maintain its monopoly status, it clearly has plenty of untapped resources to exercise more extensive influence.

In addition, big pharmaceutical corporations can secure their control over biotech production and distribution through acquisitions of small and medium biotech companies. Small and medium biotech companies have dominated new drug pipelines. In 2018, "emerging biopharma companies patented almost two-thirds of new drugs and registered 47% of them" (IQVIA Institute for Human Data Science, 2019). Acquisitions of promising biotechnology characterized by specific know-how and patented technology have allowed big pharma to maintain their domination of emergent biotechnology. From 2010 to 2019, big pharma has struck 596 major acquisition deals with a collective of $1.6 trillion changing hands in these transactions (Biomedtracker, 2020), demonstrating big pharma's determination to exercise control of emergent biotechnology. A recent analysis by Jefferies analyst Michael Yee indicated that the top 20 pharmaceutical companies combined had enough capital to buy all small and medium biotech companies (Nathan-Kazis, 2022). This acquisition strategy allows big pharma to maintain a firm grip over the consumer market while acquiring the know-how to produce emergent biotechnology treatments. The resources at big pharma's disposal and their ability to control such treatments through acquisitions and market exclusivity ensure their right to market new-age biotechnology.

The significance of these monopolies lies in their innate control over their market. Such power would be instrumental in introducing new-age biotechnology as a consumer resource by allowing big pharma to dictate consumer behaviors. With their complete domination over the market, pharmaceutical monopolies will be able to market emergent treatments at any price point they please while utilizing the marketing and coercion practices mentioned above to drive the consumption of new technology. If a small or medium company is poised to introduce competitive biotechnology with more benefits, pharmaceutical monopolies may acquire it outright. This extensive capacity to control every aspect of a consumer market can make big pharma the sole distributor of emergent biotechnology.

The Consequences of a Big Pharma Future

While the new-age biotechnology may very well fall into the hands of large pharmaceutical corporations, one lingering question is what precisely a big pharma future entails. To answer this question, we must first evaluate what a big pharma future means. Firstly, because the pharmaceutical industry wishes to seek the highest profit, big pharma will do everything possible to transition biotech treatments from therapeutic use to enhancement. Secondly, there will be no universal access to the technology as long as big pharma companies continue to maximize profits, as evident in the case of insulin providers (Cefalu et al., 2018) and Gilead Sciences (Rizvi, 2020). Finally, we must acknowledge that a socioeconomic divide exists within societies, leading to some individuals being unable to afford new biotech treatments.

Genetic Elitism

With the advent of genetic technology, the transition from therapeutic uses of gene editing can take a quick and irreversible turn towards genetic enhancement. Kass states that "we are powerless to establish ... clear limits to [genetic technology's] use" (Kass, 2002, p. 124), and this statement could not be more accurate. It is unwise to assume that when genetic engineering becomes widely used, practitioners will refrain from indulging their clients' demands for enhancement. Legal regulation can serve as an effective barrier for good actors. However, as shown by the case of He Jiankui (Normile, 2018), no amount of legal regulation can stop the progression and usage of this technology once it enters this world. Moreover, once members of society have gained genetic enhancements and have an inherent advantage over their peers, the flood gates of genetic enhancements will open wide. It is improbable that any amount of regulation could hold the line against a population that argues for a right to self-enhancement.

New questions can arise about the status and dignity of humans if self-enhancement through gene therapy materializes. The "GenRich" scenario, presented by Lee Silver, illustrates the disastrous possibilities of the unfettered proliferation of genetic enhancement, which creates an elite aristocracy based on genetic superiority through enhancements that the "GenPoor" lacks (Silver, 1998 as cited in Fukuyama, 2003). This dehumanization of individuals based on genetic composition is reminiscent of the evolutionary Darwinism of the early 20th century. However, unlike the "elite" who justified their superiority on baseless science in the past, this future scenario is terrifying because they can argue for some form of genetic supremacy over others. With only a minuscule percentage of the population acquiring such improvements and becoming "superior humans," the likelihood of an emerging class of genetic elites grows. This attitude might evolve into aggressive paternalism, in which the new genetic elites adopt an authoritarian mindset, dominating the populace directly or indirectly. This future is made possible through big pharma's control over genetic enhancement, as the price gap could become insurmountable for people of lower socioeconomic status, especially at its initial conception. Those who gain access to it initially would be the first to claim superiority. As the rich continue to enhance themselves, they may view themselves as entirely separate from humanity, condoning the "GenPoor" to a nearly animal-like status.

Social Mobility

Another potential social consequence of introducing new-age biotechnology (and therefore genetic enhancements) into the world as a consumer resource could be the destruction of social mobility. If genetic enhancements become available only to the privileged few, the development of a genetic divide may coincide with a widening socioeconomic gap within societies.

It is an incontestable fact that some jobs are more desirable than others by metrics of their pay and labor intensity. Certain professions are unavailable to portions of the population due to their requirements in skill and education. Within current societies, it is possible for individuals born into a poor socioeconomic standing to "bootstrap" their way into better positions through outstanding talent and hard work. If new biotechnology

enhancements enter societies at a price only wealthier individuals can afford, socioeconomically disadvantaged individuals could lose the opportunity to be enhanced. With natural aptitudes and traits like high IQ previously being distributed throughout societies in a "genetic lottery," the restriction of genetic enhancements to upper-class individuals via price will result in a genetic divide along the economic lines. Wealthy families will continuously produce genetically superior students and workers that out-compete their unenhanced and poorer counterparts for educational opportunities and high-paying jobs. The net effect is that the "GenPoor" are kept socioeconomically poor with no means of social mobility while the "GenRich" continues to widen the genetic and economic divide. Ultimately, this will result in poor individuals having no choice but to take labor-intensive and lower-paying jobs or face unemployment.

This scenario raises a serious question of whether a genetically enhanced society will be a moral one, as Kass remarked that "what [genetic technology] enthusiasts do not see is that their utopian project will not eliminate suffering but merely shift it around" (Kass, 2002, p. 133). An economically and socially set world can occur if the new-age biotechnology is allowed to propagate along the socioeconomic divide as a big pharma future would entail. A socioeconomically set society's potential social and ethical consequences should warrant enough to avoid it at all costs.

Possible Solutions

To prevent the scenarios discussed above from occurring, we must integrate effective and long-term solutions to combat current trends within the pharmaceutical industry. By achieving complete market exclusivity, large pharmaceutical companies are free to inflate drug prices and thus inadvertently introduce healthcare disparities along socioeconomic lines. With the primary ethical concern of a big pharma future stemming from disproportionate access to new medical resources, the most pressing task is to eliminate price barriers by driving down the overall cost of healthcare.

Price Limitations

One potential solution to improve access to modern biotechnology is price caps or limitations on drug price increases. Price caps are a form of price control that establishes limits on what providers can charge for their goods or services. By limiting the price of modern biotechnology resources, price caps can eliminate cost barriers to access to new treatments, thus helping combat healthcare disparities. Current price cap legislation from countries worldwide can serve as a basis for establishing limits on the price of new biotech treatments. For example, Japanese price cap laws have instituted a price mechanism for drugs, where "the revised price for each drug is lowered so that, in aggregate, it is 2 percent higher than its volume-weighted average market price" (Ikegami and Anderson, 2012). The mechanism allows pharmaceutical companies to earn a profit while preventing unjustifiable increases.

Even so, some may argue against the use of price caps, stating that an overall drop in revenue of pharmaceutical companies can lead to corresponding cutbacks in research and development, therefore stalling new drug innovations (Badger, 2021). With such limitations on profit, it would seem that pharmaceutical companies may now be discouraged from investing in medical innovations as their efforts would be unrewarded. However, price caps on pharmaceutical earnings would not drastically affect drug innovation because

1. pharmaceutical companies currently operate at extremely high-profit margins;
2. large pharmaceutical companies are not solely responsible for new drug innovations; and
3. differential price caps can encourage new drug innovations rather than prolonged production of profit-driven generics.

Big pharmaceutical companies enjoy high-profit margins due to their ability to market drugs at excessive prices. In addition to the case of insulin, numerous accounts of price gouging have become commonplace within the pharmaceutical industry. However, these exorbitant prices do not reflect claims from pharmaceutical companies that prices need be high to fuel new drug discovery research. Based on data from the top fifteen drug producers, "in 2015, the premium earned by US net prices exceeding other countries' list prices generated $116 billion" (Yu et Al., 2017). The profit was on top of what the pharmaceutical companies earn when selling their drugs at the list prices. However, that year "the companies spent just 66 percent" of the extra profit on their global R&D (Yu et Al., 2017). This drastic disparity between the profit and the research funding demonstrates that even if regulatory bodies introduce price caps, pharmaceutical companies have more than enough resources to continue funding innovations at a profit.

Furthermore, the importance placed upon large pharmaceutical companies in drug innovation is misguided. For instance, many of the "new" drugs created by large pharmaceutical companies are minor variations of existing products to extend patent protections and thus preserve their monopoly status (Feldman and Wong, 2017). As mentioned earlier in this paper, new and small biopharmaceutical companies are the primary source of drug innovations in the US. Thus, while price caps may cut into profits of large pharmaceutical companies, drug innovations will continue to be carried out by smaller, innovative companies.

Finally, price caps on emerging biotechnology may encourage future innovations through differential pricing models for innovative drugs. For example, in the German pharmaceutical reimbursement legislation, increases in drug prices are prohibited by law unless there is substantial proof of extra benefit. Drugs with proven additional innovative traits are allowed to increase in price to a certain degree. When an "added therapeutic benefit of the new medicine over the appropriate comparator" is observed within three months of its introduction, new prices can be set through negotiations between the pharmaceutical companies and the regulatory bodies (OECD, 2018). Such a framework allows a government to incentivize pharmaceutical companies to create innovative therapies that provide legitimate benefits rather than a slew of similar drugs to maintain profits.

Price caps upon novel therapies can effectively aid in minimizing healthcare disparities. Note that this paper does not advocate price caps as the sole solution to combat pharmaceutical monopolies and improve access to novel therapies. Instead, it suggests they work in combination with other measures such as anti-trust legislation and unique patent laws regarding new biotechnology.

Conclusion

The current pricing practices, lobbying efforts, and market domination of big pharma companies demonstrate their immense control over the healthcare market and their capability to introduce new-age biotechnology as consumer resources. The potential consequences of new biotechnology becoming consumer resources and propagating along the socioeconomic lines can further amplify the healthcare disparity and exacerbate the existing socioeconomic divide in societies. The arguments in this paper do not object to developing biotechnology to achieve its full potential but to engage in such advancements; we must prepare for the coming age by implementing preventative measures now. A legal framework consisting of anti-monopoly policies, such as price limitations and anti-trust regulations, can improve access to novel therapies and reduce health disparities. By baring the exploitation of such critical biotechnology, the tremendous benefits of the new biotechnology can be enjoyed equally and distributed justly.

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