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# Expectation and futurity: The remarkable success of genetic determinism

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ABSTRACT

Genetic determinism is nowadays largely questioned and widely criticized. However, if we look at the history of biology in the last one hundred years, we realize that genetic determinism has always been controversial. Why, then, did it acquire such relevance in the past despite facing longstanding criticism? Through the analysis of some of the ambitious expectations of future scientific applications, this article explores the possibility that part of the historical success of genetic determinism lies in the powerful rhetorical strategies that have connected the germinal matter with alluring bio-technological visions. Indeed, in drawing on the recent perspectives of "expectation studies" in science and technology, it will be shown that there has been an interesting historical relationship between reductionist notions of the gene as a hereditary unit, coded information or functional DNA segment, and startling prophecies of what controlling such an entity might achieve. It will also be suggested that the well-known promissory nature of genomics is far older than the emergence of biotechnology in the 1970s. At least from the time of the bio-utopias predicted by J.B.S. Haldane and J. S. Huxley, the gene has often been surrounded by what I call the "rhetoric of futurity": a promissory rhetoric that, despite momentous changes in the life sciences throughout the 20th century, has remained relatively consistent over time.



## 1. Introduction

Critiques of genetic determinism are now widespread; the idea that genes alone have the power to shape both bodies and behaviors is far from being as broadly accepted as it was a few decades ago.Gene-centric views have been severely questioned by new findings and knowledge in molecular biology and genomics (Keller, 2002). And, to many, the so-called "postgenomic revolution" seems to have put the final nail in the coffin of the "determinist" gene (Meloni, 2016; Richardson & Stevens, 2015). However, even though the complexities of gene expression were little known or recognized few decades ago, criticism of genetic determinism has been rife ever since the heyday of gene-centric enthusiasm.[1] From the first decades of the 20th century, many biologists, embryologists, and physicians of different nationalities have been hostile to diverse versions of genetic determinism. Why, then, were gene-centric positions so successful in the past? Why were so few of these earlier critiques taken seriously, if they were noticed at all?

This article provides tentative answers to these questions. It will explore the possibility that genetic determinism is a pragmatic positon that can be rarely confuted with evidence and good arguments. Philip Kitcher observed that fighting against genetic determinism is like battling against the undead (Kitcher, 2001). It will be argued that the philosopher's frustration of fighting against the "undead" might lie in the fact that the gene is a pragmatic tool, and for a pragmatic tool the principal question is not "What is it?" but rather: "What we can do with it?" But if a conceptual or material tool like the gene can be defined by its concrete or conceived uses, there are at least two senses in which the prospective use works for shaping the concept. First, the tool is conceived as purely instrumental in achieving a particular task. In that sense a gene might be seen as a conceptual device for making sense of different observations or experimental results. For example, Wilhelm Johannsen or Thomas Morgan's conceptions of the gene were purely instrumental for their experimental purposes (Allen, 1978; Falk, 1984). While for Johannsen the gene was a word designating the observable fact that "… many properties of the organism are conditional on individual, separable and thus independent 'states', 'basis', 'dispositions' found in the gametes"(Roll-Hansen, 2014, 2433), Morgan believed that the ontology of genetics was not a pressing issue for the development of the discipline. As he argued:

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[1] See for instance Esposito, 2016 for a recent general overview. See also Goldschmidt, 1938; Sapp, 1989; Lewontin, 1991; and Keller, 2002, among others.

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"… at the level at which the genetic experiments lie, it does not make the slightest difference whether the gene is a hypothetical unit, or whether the gene is a material particle (Morgan, 1934, p. 215). In both cases, the gene was conceived as a useful conceptual tool for experimental purposes. However, there is a broader way through which the prospective uses of a tool might define it: when the tool promises solutions for answering pressing social and political issues through, for instance, its supposed successful applications to human or animal heredity, agriculture, or medicine. Accordingly, beyond its purely instrumental task, the "gene" can also be seen as a conceptual device that has often been framed through the rhetorical deployment of its extraordinary powers for future uses in many different social contexts. This is the sense that will be explored in this article.

One of the main problems that the previous argument faces, however, is: how did imagined futures shape or influence past conceptions of heredity? In other words, in what way do promises and expectations interact with the scientific feats of the presents? Although the answer is far from simple, the past few decades have produced an extensive literature on the "sociology of expectation" in science and technology that has seriously tackled the issue (see Brown, 2003). Through the analysis of many techno-scientific cases, from High Definition Television to cloning technologies, from communication technologies to Eugenics, expectation studies have shown how promissory utterances can be performative and drive ideas, technologies and results (Brown, Rappert, & Webster, 2000; Koch, 2006). Expectations can be productive insofar as "they guide activities, provide structure and legitimation, attract interest and foster investment. They give definition to roles, clarify duties, offer some shared shape of what to expect and how to prepare for opportunities and risks. Visions drive technical and scientific activity, warranting the production of measurements, calculations, material tests, pilot projects and models" (Borup, Brown, Konrad, & Van Lente, 2006, pp. 285–6). Simplifying the issue, we could say that my intention to travel quickly to Paris from Madrid shapes my decision to take an airplane instead of a train. Future intentions constrain present actions for many different reasons and shape decisions in different ways. Accordingly, research programs in science and technology – together with the concepts, methodologies and practices – may be deeply influenced by explicit or implicit future expectations, insofar as they produce a particular space of interests, necessities, constraints, aims and decisions.

It is well known that, in the context of the life sciences, biotechnology and genomics have been deeply affected by promissory statements of their extraordinary applications. For instance, Nik Brown and Nicolas Rose have introduced the concept of "economies of expectations or hope" linked to recent biomedicine: expectations, therefore promises and anticipations, connect patients, scientists, health care professionals and biotech companies in the generation of investments and profits (see Brown, 2003;; Rose, 2008). Sunder Rajan's analysis on promissory statements in the context of the biotech industry also showed how forward-looking statements have become an essential part of the new genomic enterprise. To him, the promises of extraordinary applications of biotechnological knowledge "provide the conditions of enablement for a certain type of present" (Sunder Rajan, 2006, p. 125). Genomic science, moving within a space of neoliberal markets, makes the rhetoric of hype and hope indispensable precisely because credible promises generate cycles of investment and value. The determinist gene (or the determinist genome) is part of this social machinery of expectations and profits.

As this article shows, however, the promissory nature of biotechnology, particularly genomics, is not obviously related either to the contemporary biotech industry or to neoliberalism. Indeed, both genetics and genomics have very often been surrounded by what I call the "rhetoric of futurity": a discourse which includes expectations, hopes, promises and visions of the coming future. Despite dramatic changes in definitions, technologies, political creeds, institutional frames, and scientific traditions throughout the history of genetics and genomics, this rhetoric surrounding the gene did not vanish, but has been quite consistent over time. It continued well after the World War II, through the industrialization of research and the "marketization" of science (see Nelkin, 1995; Wright, 1994).

To better define the historical space in which these promissory visions linked to genetic determinism proliferated, I draw on Rose's distinction between the old and new politics of life. The old biopolitics was based on the management of life through the state, public institutions or philanthropic enterprises, while the new biopolitics has "been worked out in the practical ethical work of entrepreneurs deciding where to invest their capital and which lines of biomedical research and development they should pursue" (Rose, 2003, p. 41). Paralleling these important changes in the politics of science throughout the 20th century, the "rhetoric of futurity" also changed its reference. As we will see, while the old rhetoric addressed the state and was often intertwined with technocratic solutions, the new rhetoric mainly addresses consumer's wishes and investor's interests in a neo-liberal, democratic environment (See Meloni, 2016). For instance, whereas in the 1930s Hermann Muller tried to convince Stalin of the importance of genetic knowledge for the progress of Soviet Union (Muller in Glad, 2003), today Randy Scott, the founder of Genomic Health Inc, needs to convince investors of the importance and economic potential of Genomics, especially the prospect of the new "consumer genomics" (See Sunder Rajan, 2006, p. 197).[2] Of course, Muller and Scott addressed different subjects and had different aims. However, they both share the idea that the future lies in the effective control of genes. So, although promissory statements may address diverse subjects and interests in different times, we can observe a deeper continuity throughout the 20th and 21st centuries, i.e. the remarkable permanence of a determinist view of heredity connected with extraordinary promises of biotechnological intervention.

Indeed, it will be noticed that there is a thread linking the first geneticists, the later neo-Darwinians, the molecular biologists, and the enthusiasts of the Human Genome Project (HGP onwards). For many past geneticists and contemporary scientists, a place without illnesses, without criminals or crimes, yet enjoying an unlimited quantity of food and energy is not an unrealizable promise if science is properly applied to politics and society. These visions are not simply the product of science-fiction writers, journalist's overstatements, or the exaggeration of few crank scientists. If we look seriously at the history of genetics, we realize that this rhetoric of futurity is an integral part of the discipline whereby prediction and control are the main epistemic values. For instance, Hermann Muller saw the gene as an autocatalytic and heterocatalytic unit (Carlson, 1981); Edward Tatum regarded the gene as a molecule containing information for synthetizing proteins; Francis Collins sees the gene as a piece of code inscribed into a functional piece of DNA. Despite all these differences, one central conceptual element remains unchallenged throughout: the idea that there are small factors, molecules, mechanisms, or informational bits that cause

[2] Another suggestive, and more general, way to distinguish between these two moments in science policy is the difference between a social-collective future and a stakeholder future proposed by Brown, Rappert and Webster: "The future seems no longer to be produced collectively through some subscription to a wider collective set of norms, but consumed through disaggregated stakeholder populations" (Brown et al., 2000, p. 12).