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BOOK REVIEW

The Connection Between the Body and the Environment: a Changing View

Meloni, Maurizio (2019) *Impressionable Biologies: From the Archaeology of Plasticity to the Sociology of Epigenetics*. Routledge, New York and London. ISBN: 978-1-138-04941-3, 216 Pages, Price: $ 27.50 (paperback)

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1 Introduction

The author of the book takes a broad scope of different perspectives to cover our constantly increasing knowledge in biology. This is an ambitious book, written by a sociologist with great knowledge in biology although with some exceptions concerning facts about epigenetic inheritance (see my comments on chapter five). The book is divided into five chapters, all focussing on the connection between the body and the environment, and how the view of this connection has changed over time. The title of the book, *Impressionable biologies*, points to another perspective of biology than the natural science one—expressed in the words of the author as—"defining biological matter as deeply imbued with social meanings, not just 'malleable' but durably 'impressionable'" (p. 28). The text is sometimes too verbose, especially in chapters one and three, and sometimes not stringent, implicating difficulties to follow the line of argument. The level is rather advanced. Thus the book is best suited for university teachers and researchers in biology education.

2 Chapter One

Chapter one starts with a description of how novel insights in molecular biology have given new perspectives on the connection between the body and the environment: "a new entanglement of bodies and the environment … increasingly relevant in postgenomic models" (p. 1). Examples of fields encompassing these ideas are environmental epigenetics, developmental origins of health and disease and microbiomics. The postgenomic bodies are described as "fully absorbed in their surroundings … boundaries between the body and the outside world … [becoming] uncertain", and that "This is not quite the same as saying that genes and environment 'interact', as we have known for the whole of the twentieth century" (p. 1). This reasoning leads to the word plasticity, "probably the word that best captures the spirit of postgenomic times" (p. 1), and how it has been used in recent history and is used today. It is noticed that plasticity is "very far from sociological

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radars" (p. 8), but that "It is enough to quickly scan a number of popular science books to realize that the social circulation of claims about the plasticity of … the body becomes more visible by the day" (p. 8). In the literature, plasticity is described in positive terms, "choice, control and reversibility" (p. 9) relating to an individual manner, and also as a "different, darker and more viscous plasticity" (p. 9) linked to vulnerable human groups. In the section "A genealogy of plastic power", the author focuses a genealogy approach of plasticity, with gendered, racialized and classed examples. The text leads to epigenetics, which the author wants to reframe "within a broader history of body world configurations" (p. 18). As epigenetics has had huge impacts during the last decades, the author ascribes the last two chapters to this field.

The chapter gives an overview of different views of the body and its connections to the environment during the last centuries with the term plasticity in focus. It is rather easy to follow the line of argument. However, sometimes sentences are too long (up to eleven lines), making it difficult for the reader to focus the content.

3 Chapter Two

Chapter two starts with the question What were bodies before the Enlightenment? The author answers this question by "humoralism is an excellent point of entrance" (p. 35). He characterizes it as "a medical practice, but … also [as] an 'ethnography' and 'sociology' of the ancient world" (p. 43). Humoralism is described as the doctrine that the body is composed of elementary fluids (humors—blood, choler, black bile and phlegm), whose balance is altered by changes in the surrounding environment. Environmental influences include water, food, air, geographical position, etc. As there is a constant flow between the body and its surrounding, the goal is to maintain "humoral balance through nutrition, exercise, evacuations and secretion" (p. 36). In addition, psychological conditions depend on the balance. The humoralist view expressed that "the female body was a point of particular anxiety … it was widely assumed that women were of a softer, more permeable and less stable nature … women have been depicted as more liquid and transparent than men, subjects to passion, volatile and 'leaky vessel[s]'" (p. 51). A pregnant woman had a certain responsibility. The humoralist theory postulated that "a gestating mother's thoughts, her emotions, and even contents of her sights – for instance, a wild animal or a scary event – could leave a permanent imprint on her unborn child" (p. 53). Thus, "women were supposed to conduct themselves in order to ensure the wellbeing of their offspring" (p. 56). Bodies were presumed to be affected by place, in the sense that different places had its own unique nature. "Some places created virtues and nobility, and nurtured good customs and natural capacity to govern. Others were hostile, and condemned entire nations to inferiority and servitude" (p. 60), resulting in the view of superiority of certain human groups. The chapter follows the humoralist thoughts from Mesopotamian, Egyptian and Greek epochs.

The chapter gives a good insight into a humoralist view of the body and its close connection to the surrounding world. The author points to resemblances and differences from the modernistic perception of corporeal plasticity. The chapter gives a good platform for the next chapters, is well written and easy to follow.

4 Chapter Three

Chapter three describes how the humoralist body has turned to be a "modernistic body of biomedicine" (p. 67), in which "internal regulation, stability, control and individuality" (p. 72)

are much more in view than during the humoralist framework. According to the author, five different factors have been important in this transition: "Bernard's *physiology*, *bacteriology* and *immunology* … Darwin's notion of natural selection and Weismann's germ-plasm theory" (p. 71). This change is also discussed in a political context; for example represents Weismann's germ-plasm theory a theoretical framework for "the liberal citizen … whose destiny starts from scratch every time: 'every new generation comes into the world pure and uncontaminated'" (p. 72). Concerning Darwin, the author points to his "radically different way to conceive the power of the environment … it was now a selector acting indirectly via the reproductive system. This shift had fundamental consequences for the way the relationship between the organisms and the environment was conceived" (p. 81–82). The author describes Lamarck's contribution as "difficult to overestimate" (p. 78). He points to the wider society, where the framework of inheritance of traits "became a flag for social groups often leaning toward political radicalism" (p. 78). The chapter ends with a looking ahead to epigenetics and postgenomics.

The chapter is extensive but abounding in words, sometimes having long sentences, resulting in difficulties to follow the line of arguments. The order of the different sections is not obvious. A clarifying introduction about how the chapter is organized had assisted the reader.

5 Chapter Four

Chapter four lifts important insights by Weismann (1891) and Johannsen (1911), insights now being obvious but at that time appearing "deeply chocking" (p. 100). Weismann advocated the important principle of which cells are transferred to the next generation. He saw the difference between mortal somatic cells, constituting the body, and immortal germ cells, constituting the only link running through generations. Johannsen (1909) pointed to the distinction between the genotype, "the 'inner constitution' of a group of organisms" (p. 101), and the phenotype "its manifest morphological expression, which is accessible 'by direct inspection'" (p. 101). Another important step is the introduction of the concept of epigenetics, coined by Waddington in the 1940s to describe the "conceptual space to bridge heredity and development and avoid the 'black boxing' of the organism" (p. 108). The concept is aimed to frame the developmental processes from genotype to phenotype. In 1958, Nanney added a molecular biology view "which occurs on the top of genes … that regulates gene expression beyond what happens in the 'genetic library'" (p. 110–111).

An exponential growth of publications about epigenetics has occurred since 2000. Many of these focus epigenetics as the bridge between environmental factors and genes. Examples are cancer epigenetics, epigenetics in syndromes in mental health and neurodegenerative disorders like Alzheimer's and Parkinson's, epigenetics' role in environmental contaminants and toxicants, and social and behavioural epigenetics. The last includes changes in epigenetic marks induced by, e.g. psychosocial stress, trauma, differences and changes in socioeconomic status, poverty and social adversity. This shows that epigenetic studies cover an increasingly wide range of areas, and "is adding something significant to our understanding of the biology-society relationship, not only covering new fields compared with genetics, but also proposing a different way of thinking" (p. 116).

In my opinion, this is a most central and important part of this book, to show how recent ground-breaking discoveries in molecular biology could be applied on the biology-society debate.

6 Chapter Five

Chapter five points to that the centrality of genes has turned out to be much more problematized in the twenty-first century than before. We are now focussing regulation of genes, and not what could be regarded as "good" or "bad" genes. The chapter contains a stimulating discussion about how our new knowledge of epigenetics has added interesting cultural aspects to different fields. As an example, the author quotes the Australian anthropologist Emma Kowal (2016), who nicely expressed Indigenous people's view of genetics and epigenetics, respectively.

> For the last two decades, Indigenous peoples have consistently resisted genetics on local, national and international scales … Adding the prefix "epi", however, makes a big difference. In the last few years, epigenetics has struck a chord within Indigenous scholarship and Indigenous media. Compared with the fear of genetics, the embrace of epigenetics is remarkable. (p. 149)

The following gives an example of why epigenetics is embraced by Indigenous people. The author quotes Warbrick et al. (2016):

> ... it is not difficult to see the theoretical link between epigenetic determinants of health and a Māori view … which locates the health of individuals within the context of whakapapa; a term concerned with the links between environment, genealogy and posterity. (p. 149-150)

My main objection about the content of this chapter concerns heritability of epigenetic marks across generations. Many facts are delivered, however not properly structured, and some conclusions are wrong. The biology behind this area is rather complex, and it is clear that the author does not master it entirely. This is a pity, as possible inheritance of epigenetic marks is the one with greatest principal importance, for example in discussions about *epigenetic responsibility* for future generations, meaning that epigenetic marks acquired in one generation could be inherited to the following. The author writes: "… there is no reset button at each generation …" (p. 160). This is not true, as sperm cells loose almost all epigenetic marks compared with the cells, from which they are generated. Intense research is ongoing to understand if epigenetic mechanisms are involved in inheritance of acquired traits through the meiosis stage in humans. For a richer explanation, see, e.g. Morgan et al., 2019, *Driving the next generation: paternal lifetime experiences transmitted* via *extracellular vesicles and their small RNA cargo*. Thus, the author's text about inheritance is unclear and not correct, and should be considered as speculations, not facts.

Compliance with ethical standards

Conflict of interest The author declares that he has no conflict of interest.