Face à l'antibiorésistance: Une écologie politique des microbes [*Facing antibiotic resistance: A political ecology of microbes*]

by Charlotte Brives (2022) Paris, Éditions Amsterdam, 340 pp.

Cécile Fasel
University of Lausanne

How can we understand the relationship between capitalism, the WHO's urgent warnings about the alarming rise in antibiotic resistance, the structure of clinical trials and the practices of Evidence-Based Medicine? What if bacteriophage viruses – viral particles that infect bacteria (more commonly known as "phages") – provided a privileged access point to grasp how politics, epistemic infrastructures, medical practices, and ecologies are co-produced?

Charlotte Brives publishes *Face à l'antibiorésistance* as the fruit of an ethnographic inquiry conducted over several years in laboratories, hospitals and associative milieus in France, Switzerland and Belgium. Moreover, the book builds upon years of reflections on the relationships between humans and microbes. As both a trained biologist and an anthropologist, she has co-directed *With Microbes* (Brives et al. 2021), a pivotal work for the anthropology of microbes, and is currently leading two research projects on the anthropology of phages. In her book *Face à l'antibiorésistance*, Brives follows phages through the multiplicity of assemblages in which they are caught and in which they act. She accompanies and makes visible the deployment of phage therapy as a possible alternative to antibiotic therapy at a time when antibiotic resistance has become the object of scientific and very largely public concern. This anthropology of phages involves meeting many actors, human (patients, scientists, physicians, policy-makers...) and non-human (viruses, bacteria, geopolitical borders, chemicals, languages, guidelines...). It also implies exploring relationships that are always particular and always open to renegotiation; histories and knowledge to be made and remade; and a whole antibiotics infrastructure – which is both politico-economic and epistemic – that, for the time being, tightly conditions the circulation of phages as a possible therapy. Giving special importance to a series of rich interviews, and deeply documented from a historical and biological point of view, the book unfolds in nine chapters, each being an encounter with various modes of phage existence *via* the relationships that bring them into being. By *embedding* her practice on various scales of time and space, Charlotte Brives leads us to question in depth what capitalism is doing to the living, as well as how we have to re-knit our practices and relationships in this context.

STS scholars have been keenly discussing the mutual reconfiguration and tight interweaving of medical practices, politics and the living itself. While the governing of microorganisms

TECNOSCIENZA. Italian Journal of Science & Technology Studies
15(2) pp. 161-164 ISSN 2038-3460
DOI: 10.6092/issn.2038-3460/21233

through technologies and human practices (including medicine) has been analyzed as "microbiopolitical" regimes (Brives and Sariola 2021; Paxson 2008; Paxson and Helmreich 2014), the contemporary "political" that allies ethical subjectivities, health policies, molecularized medical practices and biomedical technologies, has been qualified as a "politics of life itself" (Rose 2007). It is in this context that Brives powerfully demonstrates what is political about microbial ecology. On the one hand, it is the production of knowledge. From the choice of its objects and methods to the sedimentation of certain propositions and what they enable to be put in place, the production of knowledge is entirely traversed by, and acting within, the political. This is nothing new. But Charlotte Brives' work gives substance and bodies, to what today seems to be an obvious statement. Such is the case with André's body, whose encounter opens the book with a bang (Chapter 1, pp. 49-ff.). André's body is caught in a complicated and painful web of chronic infections, legislation, geographical and ontological boundaries, DIY bladder polls, and anger. The crux of the matter appears to be the double border, both geopolitical and ontological, between a chemical substance and a registered drug – a double border that makes the use of phages in Western Europe extremely complicated. To provide a basis for understanding this intricated web, Brives constructs her book around a powerful history of the production and utilization of antibiotics (Chapter 7, pp. 209-ff.), which reveals the infrastructure that these chemical molecules produced and require. By infrastructure, Brives, following Susan Leigh Star, means "a complex system of relations between living beings (human and non-human), things and discourses" (p. 211). The industrialization of antibiotic molecules involves extracting the microorganisms that produce them and putting them to work in standardized ecosystems. It is also the precondition for capitalism's objectification of living organisms on a global scale. Antibiotic molecules have been used on a massive scale as "wonder drugs" in human clinics, facilitating the reproduction of the workforce; however, they have also been used on an even larger scale on farming and livestock farms, first as therapeutics and prophylactics, then as growth promoters. Industrially-produced antibiotic molecules played their part in making possible what Haraway and Tsing have called the "Plantationocene" (Haraway 2015): a global simplification of ecosystems, rendering both gigantic and fragile a system of industrial exploitation and commercial circulation of human and non-human living things. This history also shows how the antibiotic infrastructure constitutes the onto-epistemic milieu in which the whole of biomedicine now inevitably unfolds. Industrial production of antibiotic molecules has grounded the paradigm of evidence-based medicine and the obligatory passage through randomized clinical trials (Chapter 6, pp. 181-ff.), implying *de facto* full powers for the private pharmaceutical industry and its logic of profitability. Antibiotic infrastructure also grounds the binary order of infection and eradication as clinical axiology (Chapter 5, pp. 153-ff.). And if the production of knowledge is a political thing, the writing of history is not to be overlooked. Fully partaking this ethos, Brives not only writes her history of the antibiotic infrastructure, but also puts forward what she calls "alternative histories" (Chapter 2, pp. 71-ff.). That is, those stories that do not build their narrative arc upon the somewhat classical positivist and virile sequence of impotence → discovery (great man) → victory (hegemony of antibiotics). Rather, these "alternative histories" are those that make visible what phages have done since their silent disappearance from European pharmacopoeia in the late 1970s. Through them, we are thus taken back to the USSR during the Cold War, to drug stores and

medical facilities in cities such as Tbilisi, Kiev or Karkov; and also to present-day Georgia, and to those French associative milieus where doctors and patients are fighting to promote the development of phage therapy. These stories show that giving bacteriophage viruses the status of a drug today requires making them completely different, "incommensurable" even, from what they were in the 1970s. The networks of knowledge and techniques, regulations, and geopolitical borders have changed, as have biologies themselves. Therefore, to participate in this new world, phages need to be reinvented. And it is this reinvention, multiple and situated, that Charlotte Brives invites us to witness, better understand and care for.

On the other hand, it is also political, in microbial ecology, how human communities are engaged in complex relationships with communities of microbes. Since the AIDS epidemic, but perhaps on an even larger scale since the COVID-19 epidemic, it is pretty hard to argue that the relationships between human communities and microorganisms are anything but political. While on the one hand human practices and (geo)political power are forces that (dis)organize the circulation of (microbial) life, on the other hand, microorganisms can irrupt in, and disrupt, the (geo)political forces and human practices (Brives and Sariola 2021). In this sense, microbiopolitics is a historical force that shapes our present and future in both a (geo)ecological and political way (Landecker 2016). However, these relationships have been elaborated, thought out, regulated and made political for as long as cheese, beer, and other fermentation processes have existed. They have blossomed in modes of existence far more complex, therefore, than that of the therapeutic or vaccine arms race and Emmanuel Macron's bellicose statement that "we're at war" against the SARS-CoV-2 coronavirus (Brives 2020). Charlotte Brives, not interested in fancy poetic neologisms, but convinced that language has real performativity, proposes the concept of "pluribiosis" to designate this complexity of the living, revealing, through a well-documented detour into the ecology of phages (Chapter 4, pp. 125-ff.), the fact that entities, environments, and relationships are inter-defining and becoming; that they are never fixed, never impermeable. Pluribiosis thus encompasses a processual and relational conception of living things, as well as of the knowledge produced from and within them. Thus, if the various systems for categorizing and fixing the living are useful, even necessary, heuristic elements for any practice, *a fortiori* scientific, they must be conceived as being themselves modulated by the relationships in which they are woven; but the modalities of categorical fixing of the living must also be conceived in their own performativity, in that they too have a real impact on the entities they define. What the living, be it human or non-human, does to itself, in the multiplicity of relationships it weaves, forms so many "microgeohistories" that scientists, when they isolate and purify bacteriophage viruses to then determine their efficacy on a particular bacterium of a particular patient, attempt to suspend, to immobilize in order to objectify them (Chapter 3, pp. 97-ff.). Biological matter is both historical and potential, evolving, resisting, adapting and innovating. The development of antibiotic resistance is a painful demonstration of the "recalcitrance" of living organisms (Chapter 8, pp. 241-ff.) and of the fact that they will always exceed our expectations. It is therefore with humble precaution that we must consider the relationships between human communities and other living beings, and more specifically the current developments in phagotherapy. Within the framework that history has provided for our present, and to a certain extent our future, how can phage therapy be made to exist in a way that is both accessible to

all, and yet always profoundly situated and "individualized"? How can we take into account, therapeutically, particular microgeohistories, without making phage therapy a luxury option, out of pix for it to be profitable? Alternatives do exist, and Brives shows us some of them. There are public laboratories and pharmacies on the bangs of the drug market, where profitability is the only compass. In the final analysis, this is what the political ecology of microbes is all about: the moral and political proposals made by actors on how bacteriophage viruses should be used. And it is to such proposals that Charlotte Brives contributes.

As Bruno Latour notes in his preface to the book, Charlotte Brives had the intelligence to be in the right place at the right time. Everything is yet to be done: "The *politics* [of phages] are wide open for the time being" (p. 1, *italics in original*). Such an actual openness is what makes Brives' work so fascinating, and the questions it raises all the more urgent. We regret, however, that there is as yet no English translation of this work. This is a book that will prove important to many scholars. First, to those interested in the anthropology of microbes, and in reading a smart complexification of the so-called "microbial turn" (Paxson and Helmreich 2014) and to those keen on witnessing "science in action" and the assembly process of "socio-technical networks". Second, it is a book that is relevant to all of those interested in the question of how (and why) we should do STS in the crisis of the capitalist system. What does it mean to be a committed and militant researcher when Gaia bursts in, violently, and in return, the exploitation of the living seems ever more barbaric? As Isabelle Stengers, cited by Brives to open the book, writes: "Fighting against Gaia makes no sense; it's all about dealing with her. Dealing with capitalism makes no sense; it's about fighting against its grip" (Stengers 2013, pp. 64-65).

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