

INTRODUCTION

Starting Points



How do bacteria, viruses, microscopic matter and people interact, and what do such interactions mean for trends in obesity, antimicrobial resistance or the unequal spread of infectious disease? More abstractly, how do invisible microbes and inorganic particles relate to the constitution of society, and vice versa? In this book we bring recent developments in social theory, and in particular theories of practice, to bear on these questions. This is a fast-moving field in which concepts from science and technology studies, feminism (Kirksey 2014; Lorimer 2016), geography (Gandy 2006) and anthropology (Helmreich 2009) are gaining traction, and in which there is a resurgence of interest in the biological and social basis of health and well-being (Kirksey and Helmreich 2010; Maller and Strengers 2019; Brives et al. 2021). In building on these ideas, and in taking them in a different direction, our central proposition is that practices, as defined by Andreas Reckwitz (2002), Theodore Schatzki (2002) and Elizabeth Shove et al. (2012), constitute the ‘site’ of what Tim Ingold describes as the biosocial. In explaining what he takes this term to mean, Ingold writes as follows:

That life unfolds as a tapestry of mutually conditioning relations may be summed up in a single word, social. All life, in this sense, is social. Yet all life, too, is biological, in the sense that it entails processes of organic growth and decomposition, metabolism and respiration, brought about through fluxes and exchanges of materials across the membranous surfaces of its emergent forms. (Ingold 2013: 8)

This is the root of the notion of the biosocial: not interaction or complementarity between the biological and the social, but a form of emergent intermingling, the characteristics and qualities of which are grounded in

past and present practices and in their material effects. The concept of the biosocial, defined in this way, complicates and unsettles established methods of thinking about infection, immunity, the body and its metabolism. It also opens the way for practice theory and for an account of the mutual conditioning on which biosocial becoming depends. Ingold is an anthropologist but there are affinities between his approach, which focuses on processes of living and becoming, and practice theory, which also bypasses talk of people and their environments.

This might come as a surprise to some, but in social theory, practice is not a synonym for what people do, or for behaviour loosely defined. Many authors write about practices, including ‘cultural practices’, ‘social and political practices’, ‘material practices’, ‘public health practices’, ‘practices of care and support’, ‘scientific and technical practices’ and ‘institutional practices’ (Brown and Kelly 2014: 293), using the term to stand for all things social, or to represent specific forms of human activity. Talk of practices is consequently folded into explanations that revolve around other concerns, including accounts of colonialism (Anderson 2006), capitalism, the intensification and standardisation of agriculture (Landecker 2016a), trends in obesity (Paxson 2023), and the histories of materials, products and devices (Liboiron 2016; Engelmann and Lynteris 2020).

Accounts like these foreground familiar concepts of power, showing how knowledge and action are skewed by dominant geopolitical interests and the reproduction of disadvantage. For example, there is widespread acknowledgement that social situations in which diseases like Ebola take hold are marked by past and present inequalities (Dry and Leach 2010), and by the value that is or is not placed on expert versus lay forms of knowledge. Others write about how situated knowledges become mobile and how relations are reconstituted as forms of standardised expertise circulate (Anderson and Adams 2007), and about global networks, assemblages and ecologies (Hinchliffe 2022).

In discussions of this kind, the language of practice has a subsidiary role: slipping into and out of an exceptionally wide range of disciplines and usually doing so without comment or question. When attention does fall on the concept of practice (Hinchliffe 2022), questions tend to focus on what, if anything, this term might add to already established fields, and to already established ways of thinking about disadvantage, disease, global epidemics and postcolonial or feminist perspectives on technoscience.

This is not the approach we take. Rather than patching loose concepts of practice on to other traditions, we work with a repertoire of ideas rooted in the narrower and also more technical field of ‘practice theory’. When framed like this, the task is *not* to augment an existing agenda, but to recognise that practice theory redefines the ways in which questions are

formulated and in which topics of materiality, space, time and inequality are conceptualised and addressed.

There is no single or definitive version of practice theory, but for readers who are new to this field, theories of practice have a number of features that set them apart from other traditions in the social sciences (Hui et al. 2017b). One is that practices – not people, not microbes, not environments – are taken to be the central topic of conceptualisation and analysis. There are different ways in which practices are defined, but there is general agreement that ‘practices consist in organised sets of actions, that practices link to form wider complexes and constellations – a nexus – and that this nexus forms the “basic domain of study of the social sciences”’ (Giddens, 1984: 2; Hui et al. 2017b: 1). In this analysis, people figure as the ‘carriers’ (Reckwitz 2002) and crossing points of multiple practices, the details of which are marked by the material and ideological traces of the past.

Practice theorists contend that these arrangements are recurrently reproduced and entangled in the ongoing and always changing plenum of practice. This is consistent with the claim that complexes and bundles of sayings and doings combine to form what Schatzki describes as large social phenomena (Schatzki 2016a). In keeping with practice theory’s commitment to a flat ontology, Schatzki argues that social life is laid out on a ‘single plane’, meaning that there are no ‘macro’-level drivers that bear down on ‘micro’-level action. Instead, what are described as large phenomena, including forms of governance, trade and so on, are understood as effects of practices, that are also locally enacted (Shove 2023).

In going along with the conclusion that the widespread and the localised are similarly ‘composed of practice-arrangement bundles’ (Schatzki 2016b: 52), we also go along with the view that the social world is a ‘mass of linked practices and arrangements that is spread out across the globe and constantly changing through time’ (ibid.: 52). From this perspective, it is misleading to interpret something like antimicrobial resistance as an outcome of industrialisation as if this were an abstract force with a life of its own. Instead, patterns of antimicrobial resistance, along with many other features of the microscopic world, are taken to be effects of changing complexes of practices, multiply re-enacted and connected, but not explained by a dominant logic whether that is of capital accumulation, colonialism or globalisation.

The suggestion that ‘significant features of both individuals and their activities and structures and institutions are products, elements, or aspects of practices’ (Schatzki 2016b: 53) consequently reframes familiar agendas in the social sciences. For example, what some authors think of as human behaviour (including perceptions of germs and responses to them (Greenhough et al. 2018)) is instead taken to be a consequence of the

emergence and enactment of practices – washing, bathing and so forth – carried by people and reproduced via shared understandings and material arrangements. Similarly, first-hand accounts of individual suffering are never just that: they are always and inevitably anchored in spatial and temporal histories that extend beyond moments of experience. In other words, behaviour, or what individuals do, is entangled with and caught up in microbial lives and in the distribution of microscopic materials, and is not a discrete factor that affects them, or that is affected by them.

Next, practice theorists including Reckwitz (2002) and Schatzki (2019) insist that aspects of the material world, including particles, infrastructures, bodies and microbes, are woven into the conduct and transformation of bundles and complexes of practice (Shove et al. 2024). In taking these ideas further we introduce the concept of a milieu, a term we use to describe the layering and remaking of webs of connectivity, the always changing features of which mirror the material and ideological traces of practices, some local and some more widespread. Although Ingold acknowledges that emergent interminglings entail ‘processes of organic growth and decomposition, metabolism and respiration, brought about through fluxes and exchanges of materials’ (Ingold 2013: 9), he does not elaborate on what these processes are, or how they might be studied. In our view, practice theories provide a means of understanding what intermingles with what.

If practices, as we interpret them, and as described above, are indeed the ‘site of the social’ (Schatzki 2002) and if the social is at the same time the biological (Ingold 2013), it seems obvious that biosocial relations and trajectories are outcomes of and integral to biosocial practices. This simple reasoning provides the starting point for this book.

In taking the logic of biosocial becoming to heart, we reject narratives of human and non-human interaction as *explanations* of change on the grounds that accounts of this kind depend on relations between what are taken to be fixed entities rather than the dynamic practices of which people and microbes are constituted. However, we go along with the suggestion (a) that social practices are crucial for which microbes and organisms meet, and for where and how this occurs, and (b) that these meetings enable some kinds of intermingling and prevent others. As we explain, this combination of traditions helps make sense of the characteristics and qualities of the biosocial and of the formation and reproduction of different milieux.

Working through the implications of these ideas, the following chapters take the reader along a path on which familiar narratives of unequal exposure give way to tales of intermingling and on which previously clear-cut distinctions (the body, microbes, health, disease, normal, pathological) recede. As we demonstrate, treating practices as the site of the biosocial does not undermine the importance of thinking and writing about

biosocial differences and health inequalities, but it matters for the terms in which this is done.

Before embarking on this adventure, we take a moment to describe the intellectual landscape in which this book is set.

The Social and the Biological: Conceptualising Public Health

In many respects the history of public health, as a branch of medicine, is defined by the analytic separation of the biological and the social, and by judgements about public and private responsibility and the scope for intervention. This way of framing public health did not arise by chance. In the Western world from the nineteenth century onwards, the predominance of germ theory, the pre-eminence of the microbiology of infection and the development of techniques to see inside the human body eclipsed previous forms of holistic thinking. At the same time the disciplines concerned with the social began to diverge from natural science. As the Cartesian dualism of mind and body crystallised, the division between the social and biological became entrenched. These divisions are reproduced in the field of what is now called public health, and in the disciplines that came together to confront various threats to human health.

The aim of reducing or mitigating sources of harm or people's exposures to them underpins different sorts of responses. Some interventions focus on individual actions, hence advice on food, alcohol, lifestyle and exercise. Others address 'environmental' factors like housing conditions, air pollution or the sale of potentially harmful products. Although they are not always made explicit, the very idea of 'public' health justifies efforts to reduce social gradients and inequalities of risk and exposure. This is not only because infections spread through society. While this is often the case, the distribution of non-communicable disease is also important for people's lives and for the chances of getting ill. As we know, those who live near major roads are exposed to particles associated with increased risk of lung and heart conditions including asthma, chronic bronchitis and chronic heart disease. Similarly, people who live in damp or mouldy conditions, or who have poor sanitation or limited access to drinking water, are likely to encounter a much wider range of potentially harmful bacteria than others. Interventions designed to improve public health consequently include regulations and investments in infrastructures including drainage, sewage systems and the like. In this context, levelling social difference and reducing the incidence of disease in the name of the public good depends on managing the social as a means of modifying the biological.

As one might expect, there is a further tendency to focus on the pathological. For example, although many bacteria are ‘good’ for human health, interventions are typically organised around the reduction or elimination of harm. It is also usual for measures to address one disease at a time, whether that be cholera, tuberculosis, measles or Covid-19, and to overlook or fail to engage with coexisting and multiple forms of biological and social intersection.

In moving beyond the study of associations (for instance between poverty and exposure to air pollution), new and not so new studies suggest that a more syndemic approach is needed to understand how viral infections, non-communicable disease and social and economic conditions combine and interact across centuries and generations (Singer 2009). Some of this research is concerned with identifying the role of stressors in the social and material environment and the physiological and psychological responses in humans and animals. This is a rapidly expanding field and there is a huge literature that seeks to identify the mechanisms through which social and environmental factors affect the details of human biology, including Hannah Landecker’s work on the kinds of ‘signalling’ involved (Landecker 2016b).

In theory, developments like these have the potential to redefine the focus of public health, but in reality they are tempered by the need to identify and implement measures that fit within a rather narrow remit. This pragmatic aspect helps explain the tendency to concentrate on the present, not the long history of social difference or the design of infrastructural arrangements and not the co-evolution of bacteria, viruses and more complex organisms. It also explains the tendency to focus on isolated risks, and to overlook the ways in which they combine.

As these few comments suggest, the conceptual separation of the biological and the social goes hand in hand with an interest in human health and in pathogens (not in the ‘health’ of the microbial and biochemical world as a whole), linked to a logic of causation in which environmental conditions are associated with the prevalence of specific diseases, analysed and tackled one at a time.

Beyond the world of public health, there are broader and livelier debates about the constitution and transformation of microbial ecologies, the relation between ‘good’ and ‘bad’ bacteria, and the body as home and host to a myriad of micro-organisms, metabolic processes and chemical interactions. From this more encompassing point of view, the global milieu is one in which plants, insects, animals and humans coexist with microbes, bacteria, viruses and fungi. This takes us into the realm of ‘more-than-human’ studies, including research that foregrounds the ethical and political implications of creating ‘healthy’ ecologies of people and other creatures (Maller 2018).

The Social and the Biological: Conceptualising Micro-Organisms

Over the last few decades, social studies of microbes and of matter have made use of concepts from actor network theory and feminism and of relational accounts of things, people and metabolic processes (Sariola and Gilbert 2020; Seeberg et al. 2020; Brives et al. 2021). As a result, there are now ‘multiple terms that seek to describe the fact that humans are always comprised of and connected to multiple bodies and agents, the majority of which are invisible to the naked (human) eye’ (Meloni and Maller 2024: 9). Researchers who are interested in interactions between microscopic entities and in processes that extend beyond the margins of the body, including metabolic processes and processes of infection and contagion, conceptualise ‘the social’ in various ways.

The first and arguably most common strategy is to treat the social and economic realm as a background condition that generates and sustains specific patterns of exposure. This takes many forms, but in describing the field of what they refer to as ‘environmental epigenetics’, and the effects of the Anthropocene, Maurizio Meloni and colleagues argue that ‘The spread of antimicrobial compounds throughout ecosystems has altered microbial evolution, distribution and biogeography, with significant implications for human-microbial relations’ (Meloni et al. 2022: 476). Landecker attributes this spread to the global intensification of agriculture, aquaculture and surgery. As she goes on to explain, ‘the local biological microscapes of cellular life’ are as indicative of ‘the uneven effects of extractive colonialism and twentieth-century industrialization, as are the lakes, rivers, and skies’ (Landecker 2024: 22). In these accounts, and others like them, social and economic processes are thought to have tangible if unintended consequences for pollution, climate change, endocrine disruption, body mass and so on, and for the spatial and social distribution of contagious and non-contagious disease (Helmreich 2009).

Other commentators zoom in on the detail in order to show how capitalist or colonialist relations generate encounters between people and potentially harmful substances, including food. Amy Moran-Thomas’s ethnographic research is a good example. In *Traveling with Sugar: Chronicles of a Global Epidemic* Moran-Thomas (2019) writes about the experience of people living with diabetes in Belize and about how processed foods and sugary drinks have been folded into the ‘normal’ diet. As with Stephen Hinchliffe’s study of shrimp farmers in Bangladesh (Hinchliffe 2022), or with Anna Tsing’s description of the biological and commercial ecology of matsuke mushrooms (Tsing 2017), ways of life (and the microbial/biological/material processes associated with them) are implicitly defined by political and economic relations that extend far and wide, and that also

change over time. In all of these accounts, ‘local’ configurations of agriculture, pollution and exposure are thought to be symptomatic of transnational pressures.

There are connections between these traditions and methods of conceptualising and representing entities, processes and microscopic materials that are too small to be seen. In this context, studies that focus on the production of scientific knowledge and on how ideas about microbes and diseases are taken up often foreground controversies or battles between different social groups. In writing about how this plays out in the agricultural sector, Kristina Lyons concludes that understandings of the soil are ‘deeply enmeshed in struggles between farmers, state officials, aid workers, popular agrarian movements, and scientists. These struggles are over the meanings, imaginaries, and material actualizations of “productivity,” “rural development,” “sustainability,” “peace,” and what constitutes a “good and just life”’ (Lyons 2020: 5). Lyons’s work on agriculture is not an isolated example.

In an extended treatment of the turn from humoral to germ-based theories of disease, Bruno Latour (1993) writes about Pasteur’s ideas not in the abstract, but as they figured in the contested meaning of expertise, the character of medical training, and the reconfiguration of institutional relations. Alongside changes in the medical profession, the normalisation of Pasteur’s ideas also required new ways of bathing, cleaning and disinfecting. Germ theories are now well established but as Beth Greenhough et al. (2018) explain, everyday and scientific ideas about pro- and antibiotic responses inhabit a grey area in which invisible threats (and benefits) are perceived and managed in different ways. This is important in that, however they arise, theories about the microscopic world, and the terms in which bacteria and viruses are described, are ‘performative’, meaning that they matter for how microbes and people develop and change together.

In a justly famous contribution in which he laments the lack of attention given to the hardware of social life, Latour argues that ‘Students of technology are never faced with people on the one hand and things on the other, they are faced with programs of action, sections of which are endowed to parts of humans, while other sections are entrusted to parts of nonhumans’ (Latour 1992: 254). Latour’s proposition is that artefacts including door closers, hotel keys and seat belts represent non-human ‘actants’ and that these masses and forms of matter could and should have a central role in social theory. Over the last few decades there has been sustained interest in the social organisation of the material world.

Although it is true that the field of material culture studies continues ‘to operate with a conception of the material world, and of the nonhuman, that focuses on the artifactual domain at the expense of living organisms’ (Ingold

2012: 428), this is not the whole story. Latour's principle of symmetry, in which human actors are analytically on a par with non-humans, informs a more recent flood of multispecies ethnographies and studies that refuse to take people to be at the centre of (material-cultural) attention. Instead, concepts like those of the extended body take up, and take on, the challenge of thinking about much more distributed forms of agency, scattered between people, objects and things of nature. Related notions of delegation (from human to object) and hybridity (as when the margins of a person and a car blur (Dant 2004)) teeter on the edge of the conceptual fault line that separates actor network theory from more fluid accounts of living as a form of intermingling, knotting and threading (Ingold 2008).

Actor network theories and strands of feminist research represent points of reference for sociologists and geographers interested in how species interact (Haraway 2008), and in how these exchanges, or intra-actions, are constituted (Barad 2003). The project of understanding how human and non-human entities shape each other, and how relations between them are configured, is so basic and now so normal that it is barely noticed, but it is not without its critics. One of the most important objections is that for all the talk of relational multispecies intra-action, there is a tendency to hang on to, and in fact depend on, a view of the world populated by linked, but nonetheless discrete entities, whether human or not. In countering this approach and in explaining the difference between actor network theory and his own account of flow and emergence, Ingold imagines a debate between an ant (which represents actor network theory – ANT) and a spider.

Ingold's hypothetical ant is wedded to a view of the world defined by nodes and by connections between them. According to the ant, human and non-human actants (including ships, documents, trained bodies) represent 'immutable' mobiles that move between and consequently link disparate locations (Law 1986). By contrast, the spider, which refuses to distinguish between itself and its environment, 'writes' as follows: 'It is as though my body were formed through knotting together threads of life that run out through my many legs into the web and thence to the wider environment. The world, for me, is not an assemblage of heterogeneous bits and pieces but a tangle of threads and pathways' (Ingold 2008: 212).

In this exchange there is a clear divide between actor network theory, which deals with relations between (provisionally) fixed entities, and a spidery world in which there are no fixed entities and thus no possibilities for hybridising or interacting, one entity with another. It is true that these positions represent fundamentally different ways of conceptualising the material and the social world, but it is possible for them to coexist. It is, for instance, plausible and reasonable to think of network-based representations

as snapshots of arrangements frozen in time and to view accounts of intermingling and flow as accounts of how such arrangements change. In the last part of this opening chapter, we expand on this suggestion and on its implications for the design of the book as a whole.

Practices as the Site of the Biosocial

The field we are about to enter is already crowded with ideas, including ideas about public health and the place of the ‘material’ (including microscopic materials, viruses and bacteria) in science and technology studies, and in anthropology, sociology, history and geography. Despite differences of emphasis, many of the authors cited above are committed to the project of revealing connections between what are taken to be social, natural or biological processes. Some write about the political, cultural and economic aspects of knowledge production: whose agendas are addressed? Which assumptions are buried in scientific method? How are understandings of humors and germs reproduced in daily life? Others show how infrastructures and institutions (of family life, work, consumption and production) generate distinctive habitats and encounters between people and microscopic materials, how climate change affects the circulation or proliferation of bacteria, viruses and particles of one kind or another, and how processes like these affect human and non-human biology. Similar ideas are embedded in studies that decentre the human and that attribute multispecies relations to contemporary forms of capitalist or colonial power.

In moving between these positions, and in going beyond them, the chapters in this book are built around a distinctive logic in which we discuss relations between people, microbes and particles as outcomes of practice, and in which we also view practices as sites of more fluid forms of biosocial becoming. In setting out the steps of this argument we turn from relatively straightforward analyses of encounter (Part 1) to more subtle interpretations of emergence and entanglement (Part 2), and to an account of how past practices and biosocial relations combine to form uneven and unequal foundations for the future (Part 3). Along the way, we show what practice theories bring to the conceptualisation of classic themes of exposure, infection, adaptation, reproduction and inequality.

Although the book is designed to be read as a whole, each of the chapters works with different examples, including water, plague, antimicrobial resistance, obesity and air pollution. This is partly pragmatic – we want to engage with important issues in public health – but also strategic: it is through this selection of cases, and the order in which they are introduced, that we construct a many-layered account of what practice theory brings

to the analysis and conceptualisation of ongoing processes of biosocial becoming.

By way of introduction, the first part of the book shows how social practices orchestrate *interactions* between people, particles and microbes, and the spread of contagious disease. In detail, Chapter 1, ‘Separation and Concentration: Water Infrastructures in Practice’, considers the development of urban systems designed to keep harmful bacteria and humans apart. Chapter 2, ‘Contagion and Circulation: How Infectious Diseases Spread’, suggests that what looks like the spread of infection can be understood as the more localised emergence of ecological packages in which contagious diseases thrive. We illustrate this idea with reference to the waves of plague that swept through Europe in the Middle Ages, and we discuss the implications for epidemiology, this being a field that focuses on what are often unequal encounters between people and pathogens.

In Part II we turn from a discussion of interaction and encounter to an analysis of emergence and *intermingling*. In taking up this theme we begin with a discussion of geographical extent and spread before turning to questions about how configurations of materials and practices evolve and how past arrangements shape those of the future. Chapter 3, ‘Recursive Relations and Spatial Distributions: Antibiotics and Antimicrobial Resistance in Practice’, uses examples of antimicrobial resistance to describe the interlocking geographies of social practice and the microbiome. Chapter 4, ‘Passing Through and Passing On: Beyond Embodiment’, turns from matters of spatial distribution to processes of persistence and transformation. In this chapter we consider the human body as a crossing point of many practices, and as a ‘carrier’ or means by which some practices (and effects) move, epigenetically, from one generation to the next. Empirically, we refer to examples that have to do with food and obesity. In this chapter, and in our subsequent discussion of air pollution and accumulation, we move away from a discussion of microbes (bacteria, viruses, fungi) and concentrate on matter including bodies, fat and inorganic particles. This is not a mistake on our part. Instead, it represents a deliberate attempt to expand the scope of our analysis, and to illustrate the relevance of a practice-theory-informed analysis for issues that are high on public and political agendas. To reiterate, the chapters included in Part II are designed to show how materials and organisms intermingle through and as an effect of social practices as these are distributed geographically, and as they unfold from one generation to the next.

The third part brings these strands together to provide an account not only of the process of human and microbial entanglement, but of what is intermingled with what, and how past arrangements underpin present and future differences and inequalities. Chapter 5, ‘Qualities and Inequalities:

The Air We Breathe', discusses indoor and outdoor air as a means of showing how histories of practices (and related exposures, accumulations, ecologies) constitute and spawn differences and gradients that are embedded in ever changing milieus, the details of which are crucial for how processes of biosocial becoming take the forms they do and for related textures of advantage (Shove 2023). This is just one example of how the traces of past practices converge, and in converging shape the direction in which future arrangements unfold. As represented here, the concept of milieu, which captures aspects of these mutual transformations, helps represent overlapping processes through which organisms (including people), microbes and inorganic matter shape each other, and helps show what these processes mean for the contours of an always emerging landscape of difference and inequality.

In the final chapter, 'Converging Conclusions', we take stock of what practice theories bring to the project of representing and investigating processes of biosocial becoming. As we explain, there are synergies with existing debates about performativity and paradigms, and about space, time, materiality, difference and inequality. There are also features that set practice theories apart, and that underpin what we take to be a distinctive method of conceptualising contemporary forms of intermingling (between particles, people and microbes), and the trajectories these take. In bringing the book to a close, we anticipate some of the criticisms we are likely to face: that there is a realm of nature that is separate from the social world; that practice theory is ultimately human-centric; that practice theory has nothing to say about power, inequality and difference; and that practice theory is of little or no value in promoting change. This exercise has the double function of allowing us to specify the limits of our approach and the contribution we make.

As outlined above, the book is built around a handful of core ideas, starting with a discussion of human and microbial interactions and with distinctions (Chapter 1) and overlaps (Chapter 2); the next step is to consider the spatial (Chapter 3) and temporal (Chapter 4) aspects of intermingling before bringing the first two parts together to provide a distinctive account of differences and inequalities in health and well-being (Chapters 5 and the Conclusion).

Before going further, we have some words of caution, first about the cases and examples we discuss. For the most part, we work with instances in which bacteria, viruses, body masses and inorganic particles represent sources of trouble. This is not because we want to give the impression that all microbial and material arrangements are problematic. Far from it. Instead, we have picked examples that seem to us to do a good job of illustrating the processes and relations that are at the heart of each chapter.

These are not exclusively associated with positive or negative outcomes but are common to both. In any case, and as is also obvious, normative interpretations of ‘good’ and ‘bad’ are of their time, and are themselves indicative of forms of knowing, understanding and valuing that are inseparable from conjunctions of practice that are always on the move. To reiterate, our account of exposure, intermingling and the constitution of unequal milieux is as central to the study of mutually beneficial relations between microbes and organisms – and to research that deals with processes of fermentation (Hendy et al. 2021), food production (Paxson 2013) and digestion (Lorimer 2016) – as it is to the project of conceptualising the spread of disease.

Our second caution has to do with the relation between microbes and organisms, which are living, and inorganic matter, which is inert. In other contexts, and for other debates, this might be an important point of difference, but it is not especially significant for the story we tell. To some extent this is because it is often difficult, and sometimes pointless, to tease the biological and the inorganic apart. As anyone who has had food poisoning knows, it is important to maintain levels of minerals and salts in the face of bacterial mayhem. However, the more important reason is that *all* of the matter that we discuss is ‘living’ in the sense that it is folded into more extensive milieux and into relational complexes of practice. This is why body fat, *E. coli* and particles of combustion engine exhaust figure alongside each other in the chapters to come. It is also why this study of the world of the very small is not tied to the realm of microbiology, and it is why the book also deals with matters and milieux and with processes that play out across different scales.

This brings us to a related concern about the scope of our analysis. As is obvious, microbial life and non-human interminglings predate the emergence of social practice. In addition, there may be parts of our world (deep underground, or at the bottom of oceans), and of the universe, that are untouched by past and present doings and sayings, and that are immune to anthropogenic climate change and to the global, perhaps extraterrestrial, circulation of pollutants. We have more to say about this in the final chapter, but in what follows, we write about the spatial and temporal zone of biosocial becoming, not about the ‘laws’ of nature as if these had an independent existence of their own.

A further word of warning, and one that is especially relevant given the enthusiasm for multispecies ethnographies, is that the first few chapters take a largely human-centric view of human and non-human interaction. In effect we go along with the conclusion that it is good to keep people and potentially harmful pathogens apart, and that infrastructures and institutions have this effect. These certainties fade as we move through the book, as we view bodies as sites of intermingling and metabolic flow, as the air is

cast as a fluid milieu, and as we turn from a discourse of inequality (which is indeed about how relations between practices affect different groups of people) to an account of how some but not other forms of biosocial change come about. Rather than being a slip-up on our part, this is consistent with an approach that is designed to show *how* microbes and organisms constitute biosocial configurations, the details of which mirror and matter for normative discourses and categories, for interpretations of inequality and difference, and for what happens next.

Finally, it is important to remember that we do not take the term ‘practice’ to stand for human activity alone. Instead, and in working within the frame of *practice theory*, we write about doings and sayings that exist across space and time; that are reproduced, carried and transformed by configurations of material and other elements (human and non-human); and that form part of more extensive bundles and complexes.

For readers who are primarily interested in practice theory, our approach expands the scope of what it means to think about where, when and how practices arise and change, how they link together, and how they constitute overlapping milieux that are plainly more-than-human. Among much else it shows how microscopic particles of organic and inorganic matter figure in the lives of practices and in how future configurations are shaped by past arrangements. For those who write about microbes and society, or who work in public health, medical anthropology, geography or sociology, this book also breaks new ground. In this case it does so not by dismissing existing approaches, but by starting in another place, and by offering new ways of thinking about classic themes in science and technology studies and in representations of the more-than-human. For this readership, the aim is to demonstrate the relevance of social theory, and especially of practice theory, to how problems are defined and understood, and to the responses that follow.