**Humans and their fellow travellers.**

In my first lecture I argued that organisms were a kind of process. But this argument largely took it for granted that we know what we are talking about; we know an organism when we see it. Today I begin with a rather different approach to the question, What is an organism?

Here is a standard view. There are two kinds of organisms, single-celled and multicellular. A single-celled organism, unsurprisingly, is a single cell. Its boundary is the outside of the membrane that surrounds the cell or if, as is the case with bacteria, algae, fungi and some protists, there is a partially rigid cell wall outside the cell membrane, then that is the boundary. Multicellular organisms originate with a founding zygote which then continues to divide and differentiate. The sum of all the interconnected cells derived from the zygote constitutes the organism. The outside layer of cells, or those bits exposed to the outside world, form the surface of the organism. This will consist of either cell membranes or cell walls. Or so the story goes.

However, a number of biologists and philosophers have recently insisted on a problem with this story. Starting with single-celled organisms, although there are many cells for which this story works well enough, the great majority of bacteria and archaea are found in complex communities, either of their own kind or, very often, containing many different varieties of microbes. Especially interesting among these are the so-called *biofilms* that form on almost any damp surface, from the slimy surfaces of rocks in a stream, to the plaque that forms on our teeth. [SLIDE] They have been called the most successful life form on Earth.[[1]](#footnote-1) These communities have a characteristic life cycle, recruiting various kinds of member in a particular order, and eventually dispersing. The bacteria in a biofilm excrete compounds that form the so-called extracellular matrix. This keeps the residents in a more or less fixed location and protects them from a range of threats. It also allows the recycling of waste products from dead cells and even stores genetic material for potential lateral transfer. And biofilms exhibit a division of labour analogous to that between the various tissues and organs of a multicellular organism. Some cells adhere to the surface on which the biofilm forms, others provide sequential chemical stages in the metabolism of the system’s food. Still others specialise in generating the constituents of the extracellular matrix.

 Given all this, there is an excellent case for considering biofilms to be a kind of organism. They are functional wholes, able to provide the means for their persistence over time, and exhibiting a characteristic life cycle. Many would still insist that they are better seen as ecological communities in which various individual organisms (bacterial cells), come together and interact for their mutual benefit. But the question then arises, if the constituent cells of the biofilms cannot function fully in isolation, should *they* be seen as organisms? It is true that these cells can survive in isolation for a time, as they do when dispersed from the biofilm. But if they cannot grow or reproduce until they find a fresh community or biofilm in which to insert themselves, they should perhaps be seen as more like free floating gametes than complete organisms. This is not a simple issue to resolve, but it does indeed seem that many of the cells involved in biocells are unable to grow and divide outside the peculiar context of a biofilm.

 Biological orthodoxy generally rejects the suggestion that a biofilm is an organism, generally because biofilms do not form identifiable lineages. When the component cells in the biofilm disperse they may end up rejoining a significantly different set of cells to form a different biofilm. The lineages in which evolutionary change can occur remain the lineages formed by the constituent cell rather than a lineage of biofilms. One might, nonetheless, ask why the role in evolutionary theory should be more important than the ability to survive and reproduce in determining the proper reference of the term “organism”. A biofilm is, at least, a coherently organised biological individual. Moreover, as already noted, it is not clear that many of the single-celled constituents of biofilms are able to function independently.

 This problem is strikingly reflected in the current state of bacterial taxonomy. Traditional rules of biological nomenclature require that a material instance of a named organism be held in some suitable collection or museum. For bacteria, the required material is a cell culture. But the vast majority of bacteria cannot be cultured in a laboratory, and in many cases it is likely that this is a consequence of the fact that they are obligately social members of multispecies communities. While there are estimated to be millions of bacterial species, only about 20,000 have been named.[[2]](#footnote-2) Something seems to have gone wrong.

 If the correct diagnosis is that the biofilm is actually a better candidate for being an organism than the individual cell, this has profound implications also for how we should think about the multicellular organism. As I mentioned in my first lecture, multicellular organisms, in the standard sense that includes only the cells derived directly from the founding zygote, are not, at least in the vast majority of cases, viable in isolation and also require symbiotic relations with a great many other types of cell. Considering just the human body, somewhere between 50 and 80 percent of the cells in it are non-human. Fellow travellers are mainly bacteria, but also include archaea, protists and fungi. There are also, as I shall discuss shortly, countless viruses.

 Not all these cells non-human cells are beneficial. Some may be seriously pathological, and some may be neutral, doing little harm or good. Interestingly, whether a kind of cell is beneficial or pathological may depend very much on circumstances, especially on its location. Cells that are beneficial in the gut may be lethally toxic in other parts of the body. What is important and now widely agreed is that many of these bacteria are essential for the health of the human. Digestion, development and immune function are only the most clearly established functions in which symbionts play essential roles. It is clear, in short, that the healthy human is a multi-species symbiosis.

 It has become common to refer to the human with all its symbiotic partners as a holobiont.[SLIDE] And it is increasingly common among philosophers and some biologists to argue that it is the holobiont that best qualifies as the human individual. I am generally sympathetic to this proposal, but there is a problem, exactly parallel to that described for the microbial biofilm. Holobionts don’t form lineages of the kind that I discussed in the last lecture. Some symbionts are passed on by parents, and can be treated as a parallel mode of inheritance fully aligned with genetic transmission. Here we might mention the mitochondria, internal constituents of the eukaryote cell, often referred to as the powerplants of the cell. It is widely accepted that two billion years ago the ancestors of the mitochondria were free-living bacteria, subsequently enveloped by another early cell. After two billion years of evolution it has come to specialise in a few vital metabolic functions, and has lost many of the functions it would require to live independently. At this point there is no theoretical reason to think of it as a distinct entity.

But many symbionts are recruited from the environment. And indeed, it is highly desirable that this should be the case, because the recruitment of local bacteria is likely to be an important way of tracking and responding to changes in the environment. But in that case, as already explained, holobionts are not lineage forming; and if they are not lineage forming, it appears that they are not the individuals that evolved. This problem is, it seems to me, unanswerable in a world of things. If a human is a thing that evolved, but the thing that evolved cannot function in the way a human does, we have an impasse.

 But recognising that we live in a world of process offers a straightforward way out. Let us agree that what has evolved is what is described by the orthodox concept of an organism: either a single cell, or a cell lineage. I have sometimes referred to the latter as an MDCL, a monogenomic differentiated cell lineage, and I shall do so now. [SLIDE; the point of the picture is that the second row should be seen as a simple continuation of the first.] (Actually, those of you who attended my last lecture will know that this is something of a misnomer. The set of cells derived from the founding zygote is really analogous to a clade, not a lineage. The lineage leading to my liver cells is not the same as that leading to my brain cells, though both converge at the zygote, the universal common ancestor. But I will not worry about this here.) Since the sperm and egg that formed the initiating zygote both came from members of the humans species, an evolving lineage, we can trace this backwards down the human lineage. So humans qua MDCLs are part of an evolving process traceable back through countless ancestral species to LUCA, the last universal common ancestor. This is the perspective that makes a biologist focused on evolution think of the human organism as the MDCL.

Now consider a bacterium that is an obligate symbiont of the human. This is also part of an evolving process. This process and the human MDCL lineage are perfectly intertwined. Every component of the bacterial lineage is embedded in the human lineage. Yet the two differ completely in the ways the processes persist; the one by cell division, the other by sexual reproduction and a long, complex developmental process. Nonetheless, the two lineages help to stabilise each other. The bacteria are entirely dependent on the humans to provide their living environment, and the bacteria, ex hypothesi, provide some necessary service to the humans. Now contrast an environmentally acquired but essential symbiont. Very likely this microbe does not require the specifically human environment; it was just hanging around waiting for somewhere to go. Perhaps it can live in other species or even in freestanding biofilms. The lineage of this organism bumps into the human lineage here and there, but is not constantly intertwined.

Finally consider a holobiont. Central to it is an element of the human lineage. This inevitably comes with a certain number of microbial symbionts with which the human lineage is fully intertwined. Many other microbes will pass through it, some essential contributors to the system drawn from the environment, others more or less neutral or harmful in their contributions. A considerable part of this microbial flow through the system contributes to the stabilisation of the whole, though some parts, pathogens, may threaten its destabilisation. Is there any answer to exactly how much of all this is truly part of the functional whole? Surely not. But this is just what processes are often like. As I explained in my first lecture, processes do not have clearly defined boundaries. This is because, as in the present case, they are stabilised by a host of interactions at their boundaries. Think once more of an eddy or a wave. There is no place where the eddy ends and the surrounding stream begins. The flow of energy from the stream to the maintenance of the pattern that is the eddy is a continuous process with no defined border.

Quite generally, processes can interact and intertwine while stabilising (or destabilising) one another. Think, for instance, of social or economic processes, such as unemployment, inflation, or the welfare system. [SLIDE] Individuals engage with these larger processes. For example, becoming unemployed may reduce their expenditure, thus contributing to a downward pressure on inflation, and increasing the flow of resources from the welfare system. Individual economic acts cannot be uniquely partitioned between such processes and all of them aggregate to form flows such as national income. What is included in these larger aggregates, finally, is a matter of decision, though sometimes one with considerable normative if not metaphysical importance. I think, for example, of the debate over whether unpaid domestic work should count as part of GDP, a decision which has decisive effects on the well-being of many people, mainly women.

Much the same is true of the holobiont. Living material flows through this complex system and, depending on its importance and its length of stay, may have a greater or lesser claim to be included as a constituent of the persistent whole. Thinking of a human as a holobiont, we may worry whether the surface of the living system is the human skin or the complex communities of microbes that cover it. The answer, I suggest, is that either may be correct, and the decisive question is why one is asking the question. In the context of central evolutionary questions, it may be appropriate to think of the human as the MDCL. For many physiological questions it will be necessary to think of a more expansive holobiont.

And this looseness of boundary, the possibility of distinguishing different, overlapping systems within the flow of biological material, is not an objection but a virtue for a process ontology; not a bug but a feature. This becomes clear when we explore the relation of the individual human to larger systems of which it is part. But before discussing this topic, I want to look at one further, rather surprising component of the holobiont, the virome.[SLIDE]

I have mentioned that there may be several times as many bacteria in the human body as human cells—though recent estimates have suggested the numbers may be more nearly equal. As this discrepancy suggests, this is not an easy thing to measure. But for present purposes the fact that there is a very large number, certainly in the tens of trillions—which is a lot—will suffice. There are also a great many viruses, in fact about ten times as many as there are bacteria. Just as it was for a long time thought that bacteria were at best harmless and frequently dangerous, but recently it has been realised that many are highly beneficial or even essential for the lives of the multicellular organisms that they inhabit, so it is with viruses. While even many scientists continue to see them as generally pathological, it is gradually becoming clear that many, perhaps most, are harmless or beneficial.

The great majority of the viruses living in or on a human are phages, viruses that reproduce in bacterial cells rather than human cells. Natural hypotheses are that these viruses might be functional for the holobiont by protecting against pathogenic bacteria or, more interestingly, regulating the numbers of symbiotic bacteria. Evidence for the first function is provided by the high concentration of phages on the mucus tissues of the mouth and other orifices, obvious places for the potentially dangerous encounter with harmful bacteria.

The second function is supported by a rather more theoretical argument. Presumably the maintenance of these large numbers of viruses implies that their hosts are the symbiotic bacteria that live in the human body, suggesting that that they are predators on these generally friendly bacteria. But mathematical ecologists have long studied the cyclical oscillations characteristic of populations of predator and prey organisms. The battle between a virus and its bacterial host would be expected to follow a similar pattern, as large reductions in the bacterial population due to viral predation eventually bring it to a level where viruses cannot find prey, and their population collapses in turn. The lack of any such dynamics is suggestive of the absence of such straightforwardly predatory interaction. It seems, in fact, that the population of viruses in a human is fairly stable. Waves of a virus may infest a host as a pathological infection, but the background virome, as the whole viral population is known, remains much the same. This suggests that the virome is part of a stabilising system that, perhaps in conjunction with the human immune system, helps to maintain stable and optimal populations of bacteria.

There are also more subtle ways in which viruses help to combat microbial disease. Several harmless viruses have been shown to protect against pathological viruses. For example, human pegivirus (HPgV-1), appears to have a beneficial effect on a number of harmful viral infections, including HIV.[[3]](#footnote-3) Examples of benefits supplied by viruses to their multicellular hosts are growing all the time.[[4]](#footnote-4) We should, perhaps, find this quite unsurprising. The image of the living world provided by the holobiont, in which multiple different organisms or, better, lineage segments of organisms, since the time scales of the kinds involved in these complex systems are very different, come together to provide stabilities in the living flux, makes it natural to ask of the 38 trillion viruses that live in our bodies, not How do we survive their hostile intentions?, but What are they contributing to the wholes of which we are part?

How is the enormously complex system maintained, or stabilised? One very important way is through the immune system. Contrary to the still widely disseminated self/other theory, according to which the immune system simply distinguishes human from non-human cells, and attacks the latter, insights into symbiosis have been one factor that has led to more sophisticated views. Clearly the immune system must somehow distinguish desirable from pathogenic microbes, both cellular and viral. And it is also very active in disposal of dead or diseased human cells. Given the fact that the difference between beneficial and pathogenic microbes can be place dependent, this is a difficult task. One suggestion is that the immune system does not respond in the first instance to the intrinsic nature of the entity with which it interacts, but rather to sudden changes in the chemical environment. If that is correct it is rather literally a stabilising system.

Second, interbacterial interactions can maintain the stability of the bacterial communities that are part of a holobiont, and thus the holobiont itself. Much of this is achieved through the cooperative construction of biofilms, in which the extracellular matrix protects the community from many threats, including antimicrobials. (Hence the ability of humans to take antimicrobial drugs without suffering catastrophic systemic damage.) More complex systems involving host/bacteria/phage interactions may also be fundamental to system stabilisation.

In sum, there are very strong reasons not to think of the human individual as merely composed of what have traditionally been thought of as human cells, but as also including a multitude of bacteria, viruses, and perhaps protists, fungi, archaea and more. But there still may seem to be a problem for how these complex individuals, holobionts, evolve. If they are, indeed, the functional individuals that forage, eat, mate, and so on, they are presumably the individuals that are exposed to natural selection; they are, as it is said, the units of selection. But if the units of selection are not capable of reproducing, then selection will not have any effect on the distribution of traits in the next generation. I have already said that for (some) evolutionary purposes we should still consider the MDCL as an individual. But I want now to look more critically at the argument that the holobiont cannot function perfectly well as such a unit and even qualify as lineage forming.

First, we should again note the difference between symbionts that are passed on by the parent and those that are recruited from the environment. In the former case we have simply an alternative path of inheritance from the parent to the offspring, and so no problem. A well-studied case is the many insects that carry bacteria inside their cells, bacteria that have long ago lost the ability to function independently. In some cases it is not clear that the embedded bacteria, such as Wolbachia, [SLIDE] are wholly beneficial to the insect, but this doesn’t matter. The status of the bacterium in evolution is no different from that of the nucleus, also transferring a packet of genes between generations. With luck, over time, natural selection will better align the interests of the insect with the effects of its captive bacterium.

Environmentally recruited bacteria may seem more problematic. If only a small proportion of the bacteria live in human holobionts, then a human whose success is augmented by a beneficial change to the bacterium will have little effect on the likelihood that future generations of humans will recruit the improved bacterium. However, there are several caveats. First, if the bacteria are generally symbionts of mammals, say, a benefit to one mammal will often be a benefit to another. Second, recruitment is unlikely to be random. Holobionts constantly shed symbiotic microbes, and offspring are therefore generally more likely to recruit symbionts that originated from their parents, simply because these are in the vicinity. Moreover, there are various ways by which symbionts are passed on to offspring that are surely evolved. Mothers infect offspring with bacteria from the birth canal, and the niche may well be constructed in ways that exclude inappropriate potential partners.

But finally, not every aspect of the holobiont needs to be equally evolvable. This is true even of MDCLs as units of selection. Different parts of the genome are subject to variable mutation rates, for instance. And even if none of the factors just mentioned applies, a successful mutation in a symbiont will minimally increase the probability of finding this mutation in the next generation. The upshot of this, I suggest, is that there is no reason to deny that holobionts are fully lineage forming entities. Where the population of lineages is bounded by relations of reproductive connection, i.e., the large host organism forms a well-defined species, there is no reason not to describe this as a lineage of holobionts. This clearly applies to humans. There is an interesting question whether this argument can be made for symbiotic systems that lack the boundary-providing large multicellular organism, for example for biofilms. I am not convinced that there are not lineages of biofilms, but this is an argument for another time.

As is a theme of these lectures, for any living process we can ask what it is that sustains it in a condition that is always far from thermal equilibrium, always under threat from the force of entropy. Life, as I am trying to present it, is quite generally an intertwining of parts of lineage processes to produce stable individuals. These individuals, in turn, generate new parts—organisms—to sustain the lineages that they include. There are several aspects to the stabilisation of these individuals. There are the internal reactions generally considered as physiological, and I think that important symbiotic processes naturally belong within the science of physiology. There is a wide range of ecological relations with other lineages, as predators and prey or just modulators of the environment, such as the earthworms that increase the fertility of the soil and the availability of plant food. At the extreme, are highly evolved mutualisms. A famous example is the relationship between ants and acacia trees, [SLIDE]in which the ants protect the trees from a wide range of predators, while the tree provides the ants with shelter and food. The relations between humans and their various livestock species might also be considered mutualistic. The large majority of birds on the planet are chickens and ducks raised by humans. Whether this technical evolutionary success provides any adequate justification for the often appalling conditions in which these animals live is another question. [SLIDE]Ants also take care of livestock, such as aphids and scale insects, which they protect from predators and milk for their honeydew. There will be a few more points in these lectures at which I will remark the interesting parallels between humans and social insects.

Of even greater importance for humans is the way their lives are sustained by their relations to other humans. But before turning to that topic more generally, I want to say a little about another aspect of human individuation that I think can be much illuminated by a process ontology, pregnancy.

Pregnancy

A common understanding of pregnancy is that a new life begins when an egg is fertilised. From the moment of fertilisation, a woman is both an organism and a container for another organism. This is the “bun in the oven” view of pregnancy. The mother is cooking, or anyhow incubating, the new individual. One might suppose that considerations of symbiosis show that we are already known to be hosts to countless other organisms. But physiologists tend to think of the human as a hollow tube, with the alimentary canal strictly on the outside. [SLIDE]On the holobiont view, several pounds of bacteria within the tube are counted as part of the human organism. But whether one thinks that the symbionts are separate organisms external to the body or parts of the body, they are not distinct organisms within the body. So the container view of pregnancy proposes an unusual, perhaps unique, ontological situation.

In parallel to the proposal we have been considering for microbial symbionts, might we rather take the foetus to be a part of the mother? [SLIDE]It is interesting to compare the many representations of the pregnant female that emphasise the distinctiveness of mother and foetus, with photographic images in which the distinction is often much less sharp. The proposal that the foetus is better seen as a part of the mother has been strongly advocated by Elselijn Kingma, whose work has also done much to bring the question to the attention of philosophers, and the proposal has much to be said for it. The relations between a foetus and a pregnant female are intimate beyond any other between distinct organisms. All the flows of nutrients, oxygen, and other chemicals essential for its well-being pass through the mother to the foetus. It certainly does not qualify as an autonomous thing or substance. It is true that it isn’t exactly autonomous even when the umbilical cord has been cut, but it does at least have its own reasonably clear boundaries.

What makes this debate so important is, of course, its relevance to the question when a human life begins, and hence to the ethics of abortion. The answer that it begins at fertilisation is philosophically coherent—a process that may eventually lead to a human life begins there—but the enormous difference between a single cell and a developed human being makes the answer very unhelpful. Those who believe that the right to life begins at fertilisation generally base their claim not on the nature and status of this particular human cell but, if not on a religious corollary to this, for example that it is the moment of ensoulment, at least on a philosophical claim, that a new essence has appeared. I do not believe either of these claims; but neither is anyhow well-suited to the defence of a right to life. Religious beliefs are far too diverse to ground public policy. No one whose religion forbids it should be required to have an abortion; but nor should the beliefs of the religious be imposed on those with different or no religion. Essentialism is a fairly technical philosophical doctrine, and is probably not deployed much in this debate. But, or so I have argued extensively over the years and in these lectures, it is anyhow simply false: biological systems don’t have essences.

The philosophical problem that emerges if we recognise the inadequacy of conception for this purpose, is that of finding any well-motivated answer to the question when the developing foetus should be counted as a person with rights. In the debate over the ethics of abortion many sensible people agree that foetuses past a certain developmental stage deserve at least respect, whereas similar claims for fertilised eggs are much harder to sustain. Most people are not greatly concerned by the numbers of such cells stored in liquid nitrogen, some of which may be transplanted into women and most of which will eventually be disposed of. So where should we draw the line?

One line has been drawn by a number of ethicists, though for a different purpose, defining the cut-off point before which it is permissible to experiment on human embryos. This is the appearance of the primitive streak, an important developmental structure that appears about fourteen days after fertilisation. The rather bizarre justification for this criterion is that, or so it is claimed, after that point it is no longer possible for the embryo to divide and develop as twins. Here is the argument. Suppose you are the same individual as your week-old embryo. But that embryo might have twinned, and been identical to another person. Then, your twin would also have been identical to the same embryo and, since identity is transitive (if a is identical to b and b is identical to c, a is identical to c) you would have been identical to your twin. [SLIDE]But that is clearly impossible, and the demonstration that it is possible provides a reductio ad absurdum of the original premise. So, it is concluded, the person you are cannot have come into existence until twinnng is no longer possible.

If this argument strikes you as fishy, so it should. The possibility of the embryo turning into two people rather than one should be an argument against experimenting with it not the opposite. And returning to the question of abortion, most advocates of women’s right to choose would put the stage at which a pregnancy can be terminated a great deal later than two weeks.

Kingma’s proposal that the embryo and then the foetus are parts of the woman’s body fits well with the common formulation of abortion rights in terms of a woman’s control over her own body. Abortion, from this point of view, amounts to elective amputation of a non-essential part of the body. But the view does face a serious dilemma.[[5]](#footnote-5) On one horn of the dilemma, the new individual does not come into being until birth. Prior to that there is one individual, afterwards two. This does put a very heavy philosophical burden on the act of birth. This is, of course, a far from arbitrary event in the life history of mother and baby, but whether it is sufficiently so to constitute a coming into being of an individual *de novo* is another matter.

On the other horn of the dilemma, we allow that the new individual preceded its birth, but also that it did so as part of another individual, its mother. As Kingma discusses, this view explicitly acknowledges that one organism can be part of another organism, which she notes to be a problematic concession within the substance ontology to which she still adheres. She is, therefore, reluctant to embrace either horn of the dilemma.

Personally, I am happy to embrace the second horn of the dilemma. But I do so because in a process ontology such a part/whole relation just isn’t a problem. Kingma, however, explicitly endorses a substance ontology, and perhaps for this reason seems unwilling to endorse either horn of the dilemma. For, as I noted in my first lecture, one of the most characteristic features of a substance or thing ontology is the autonomy of a thing. And it is hard to be less autonomous than being part of something else.

How should we describe pregnancy within a process ontology? Easily, I think. If life is a flow of activity, then pregnancy is a bifurcation within that flow. Bifurcation is itself a process that takes a considerable time. Indeed, though birth is a highly significant event, it is hardly a point at which bifurcation is fully achieved and the two processes are fully separated. It is true that it does become possible, if often traumatic, to separate the processes at the point of birth. But this point only shows that it is not possible at any earlier stage in the most trivial way. Birth just *is* the separation of mother and foetus, subsequently reclassified as infant. Compare here the gradual bifurcation of a species as a subpopulation becomes gradually isolated from the parent population, though reproductive links continue as they diminish in frequency. There is no precise moment at which separation has been achieved even though there comes a time in the future when there is no doubt that separation has been achieved.

I have not answered the question when a developing human process becomes a person with ethical rights; indeed, I have refused to do so. There are, I think, only two points within the biological reality that provide any clear basis for such a decision, fertilisation and birth. But for reasons I have indicated there is no widely acceptable basis for marking a line at fertilisation; and few people will wish to defend the acceptability of fortieth week abortions on the ground of an absolute ontological divide between the foetus and the neonate.

As I shall discuss in much more detail in my next lecture, the beginning and end of a process, and specifically a human process, are to a substantial degree conventional decisions, properly based on pragmatic considerations. Compare the convention that in some cultures the eighteenth birthday marks the divide between adolescent and adult: some such boundary is necessary, and that seems (to us, now) about the right time. Moreover, separating a process from its surroundings, or from a process with which it is intertwined, is not something it does for us, but something we do conceptually. It is unquestionably natural to differentiate the foetus conceptually from the mother. It has a relatively sharp boundary, it has a distinctive genetic structure, and it has a unique expected fate. But, on the other hand, it is intimately connected to the mother by material and energetic flows, and by mutual influences on the physiology of both parties. It is, in short, a distinct and differentiating process that is part of a larger process. It will not be easy to decide what stages in the development of this process mandate or preclude particular kinds of treatment given the gradually divergent interests of the two separating parts of the process. But at least we can do so on the basis of discussion of relevant features such as sensibility or consciousness, and with proper respect to both parts of the process that we wish to separate. To ground such a discussion in hypotheticals about possible twins serves only to show the deficiencies of a substance ontology.

Human cooperation

Any organism is a process sustained by internal and external processes. It is also a part of a hierarchy of processes—molecule, cell, organism, lineage—which, to varying degrees sustain one another. Most lineages generate organisms without doing much subsequently to stabilise them. But as I discussed in the last lecture, the evolution of new characteristics of the lineage itself has eventually led to the emergence of social interactions that do play a major part in the sustenance of the species’ members. Humans, as I then noted, are unique in the way they have developed social interactions and possibilities, though perhaps the eusociality of Hymenoptera (ants, wasps and bees) and termites is a comparably successful alternative route.

The understanding of life as involving the mutual stabilisation of processes already shows, in opposition to the extreme emphasis on competition characteristic of much evolutionary thought, that life isa highly cooperative process. Nonetheless, the uniqueness of human cooperation is hard to overstate. It is the ability to deploy a huge range of skills and resources in a concerted and organised ways that has made possible the domination of life on our planet that humans, for better or worse, have achieved.[SLIDE] This development does not, of course, depend solely on the unique properties of individual humans. The orchestration of effort needed to build a stadium or run a rail network also requires a complex social structure. The evolution of governments, money, educational systems, food distribution networks and so on are all fascinating stories, but far beyond what I can discuss today. Such institutions shape the processes that result in these massively complex joint ventures. But the developmental flexibility of the human individual is an equally essential background condition. The combination of skills needed to accomplish these massive transformations of our world—niche constructions—is only possible because individual humans have the developmental plasticity to direct their capacities towards a vast range of specialised abilities. Developmental plasticity is characteristic of almost all organisms, but perhaps none to the extent that is found in humans.

Given all this, it is a remarkable fact that political ideology and psychological and economic theory has been dominated for the last 150 years or more by the ideology of individualism. Individuals, in this view of the world, do not generally cooperate, but they compete for a limited quantity of goods. In economics, the most important background condition is scarcity, necessitating this competition. As is well-known, the competitive assumptions behind natural selection and economics have been passed backwards and forwards between biological and political thought for over 200 years. Famously, Darwin identified the work of Thomas Malthus, claiming to demonstrate the necessity of poverty or death as the geometric growth of production outpaced the linear growth of resources, as a decisive inspiration for his idea of natural selection. [SLIDE]

Not only is the well-being of the individual human generally conceived by central schools of social scientists solely in terms of the satisfaction of specific personal desires, but even the amazing feats of cooperation alluded to a moment ago are seen ultimately as consequences of the choices of self-interested individuals. No doubt the enslaved people who built the White House and the US Capitol in Washington, D.C did so because the option of working on these edifices was preferable to the brutal punishment that was the only alternative. But today, when no one is technically enslaved to build, say, the Burj Khalifa in Dubai, currently the world’s tallest building at 828 meters, the cooperation between the army of engineers, construction workers, building supply merchants, electricians, surveyors, painters, plumbers and so on is generally understood as a concurrence of individually optimal decisions. Even the architects, town planners, and so on who created the conditions that made this cooperation possible are merely pursuing their own personal goals.

There is no doubt a grain of truth to all of this. People in many contemporary countries experience their choices of activity as free, subject, admittedly, to constraints of ability, opportunity and resource. I can buy whatever I can afford, and work in whatever field I have managed to obtain qualifications for (typically subject to resources) and for which there are openings. But this misses a much larger point. Even if I have the resources of Jeff Bezos or Elon Musk, my very existence is dependent on the fact that, for whatever reason, many people are growing food, building houses, etc. As far as I know neither Bezos nor Musk grows food or builds houses, two of the many things that must be provided for me to be free to choose my calling as a philosophy professor or a multi-billionaire. Whatever the significance of the degree of choice we, or some of us, exercise in pursuing our life plans, this autonomy is fairly trivial in comparison to the vast amount of labour of countless others that is necessary merely to maintain our life processes. And of course this is why it seems so risible for some libertarians to imagine that Bezos or Musk has somehow earned his billions. Even if some good decisions they made have provided great benefits to the human species, the total dependence of the ability to make those decisions on the work of many suggests that a quite modest exceptional reward for their contribution would be sufficient. Even more risible, if possible, is the proposition that only the prospect of wealth many thousands of times that of their less fortunate conspecifics could be sufficient to motivate them to make significant contributions to the general good.

I have pointed to some familiar absurdities in current political discourse, but absurdities that are quite widely believed. Why are such things widely believed? I would like to propose that something that at least makes it much easier to believe is the continued dominance of thing ontology. For a thing ontologist, it is natural to think of individuals as autonomous entities that interact to make a new entity, society; and it is these autonomous constituent individuals that determine what this new entity does. Autonomy is, after all, one of the fundamental characteristics of a thing. Or perhaps, as Margaret Thatcher, a notorious champion of individualist ideology, famously remarked, society does not exist at all.[SLIDE] The profound falsity of this remark perhaps helps to explain the incalculable damage that the ideology it expresses has done to the lives of billions. At any rate, some such picture is thoroughly articulated in two varyingly influential scientific programmes based entirely on the interactions of purely self-interested competitive individuals, namely evolutionary psychology and neoclassical economics. I have discussed the intrinsic defects of these projects in detail elsewhere, and won’t try to do so again here. For present purposes it will be sufficient to stress how much they share the grounding in isolated autonomous individuals that I have been and shall be criticising throughout these lectures. Seeing the human individual as a complex process sustained in its far from equilibrium condition by countless interactions with other organisms, human and otherwise, and by a vast infrastructure also created by vast numbers of humans dead and alive, the assumption of isolated self-interested individuals seems nonsensical. Indeed, it is no surprise to find it to be an assumption that serves mainly to foster socially dysfunctional behaviour.

Let me just add that it is not my intent to deny any status to the human individual or reduce human life to the condition of interchangeable ants, devoted only to the service of the community. I shall take up this topic in the next, and especially in the final lecture, which addresses individual freedom. In the fifth lecture I shall take up the theme I have just been discussing, of human sociality, and explore some perhaps surprising implications for the understanding of various classifications within the human species.

But for now, it remains only to thank you for your attention and welcome your questions.

1. https://www.nature.com/articles/nrmicro2415 [↑](#footnote-ref-1)
2. <https://www.nature.com/articles/s41396-021-00941-x> (2021) [↑](#footnote-ref-2)
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8837232/ [↑](#footnote-ref-3)
4. https://www.nature.com/articles/nrmicro2491 [↑](#footnote-ref-4)
5. https://www.cambridge.org/core/journals/royal-institute-of-philosophy-supplements/article/lady-parts-the-metaphysics-of-pregnancy/BC5DF25B12B9FB6384695218A6EDD2D3#fn01 [↑](#footnote-ref-5)