

# Activity, Process, Continuant, Substance, Organism

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## Abstract

This paper is a response to the suggestion that *processes* provide a better framework for interpreting science, biological science especially, than do *substances*. The philosopher of substance is ill-prepared, it has been suggested, for the question ‘how a combination of processes can maintain the appearance of stability and persistence in an entity that is fundamentally only a temporary eddy in a flux of change’. In response, I defend a plural ontology of process, activity, event and continuant, and show how a sortalist philosophy of substance that makes Hilary Putnam’s distinction of ‘realism’ from ‘metaphysical realism’ can treat disputed questions concerning the identity and individuation of colonial siphonophores, slime moulds and plant-colonies.

## 1.

In a manifesto entitled ‘A Process Ontology for Biology’ and issuing from the Centre for the Study of Life Sciences, University of Exeter, John Dupré has proposed the question whether *things* or *processes* provide a better framework for interpreting science. He says that this question should be ‘a central concern for everyone interested in the metaphysics of science’.<sup>1</sup> He is ready to think that it is a real option to abandon the substance-theorist’s preoccupation with ‘the changes that occur to an entity and the conditions under which an entity can remain the same thing through change’<sup>2</sup> and to embrace instead a process-theorist’s concern with ‘how a combination of processes can maintain the appearance of stability and persistence in an entity that is fundamentally only a temporary eddy in a flux of change’.

Dupré is not alone in his readiness to embrace an ontology of processes.<sup>3</sup> But my own response to the question he has raised is not to

<sup>1</sup> See <http://thebjps.typepad.com/my-blog/2014/08/a-process-ontology-for-biology-john-dupre.html>

<sup>2</sup> Speaking for substance-theorists, let me insist that the words ‘remain the same thing’ be replaced by the word ‘persist’, unless our preoccupation is to be misdescribed.

<sup>3</sup> See for instance *Individuals Across the Sciences*, ed. A. Guay and T. Pradeu (New York: Oxford University Press, 2016). But these authors

disagree over the importance of processes. It is rather to contend that, if the idea of persistence is to have even a toe-hold within a scientific world-view that extends to the realm of organisms – if that world-view is ever to afford the option to make the barest cross-reference between some  $x$  or other at this time and some  $y$  at another time –, then there is need for an ontology not simply of *event*, *process* and *activity* but also and equally of *material things*, things that persist however temporarily from one time to the next. For present purposes it will suffice to call these latter, with W. E. Johnson, continuants.<sup>4</sup> Continuants exist in time, have material parts and pass through phases. But such phases are not the material parts of the continuant. The phases are parts of the continuant's span of existence. Contrast processes. The phases of a particular historically dateable process *are* its parts.

There are further differences between processes and things. A process can be rapid or regular or staccato, or steady. It can even be cyclical and lifelong. Consider the Krebs cycle. Talk of organisms certainly demands talk of the processes by which they are maintained. But how is talk of organisms to be replaced altogether by talk of processes which submit to attributions such as rapid, regular, staccato, steady or cyclical? Organisms themselves cannot submit to these attributions. Meanwhile an organism can be the proud possessor of eight fingers and two thumbs. Can a process? In pressing these points, I shall appear to hark back to the archaic style of disputation proprietary to 'linguistic philosophy'. Yet, archaic or not, difficulties of this sort are suggestive of real distinctions – distinctions that are crucial perhaps for the philosophy of individuation. Does it not help towards the understanding of what an item is to ask what one can truly say about it?

## 2.

Such arguments move much too swiftly, I fear, to carry full conviction among those who need convincing. Dupré himself is more

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state their aims differently: '[We] suggest a shift from an ontology of *substances*, *invariance* and laws to an ontology centred on *processes* and change'.

<sup>4</sup> Johnson defines a continuant to be 'that which continues to exist throughout some limited or unlimited period of time, during which its inner states or outer connections with other continuants may be altering or may be continuing unaltered.' *Logic*, Part III (Cambridge: Cambridge University Press, 1924), xx–xxi. It should go without saying that on these terms *continuant* is a determinable notion – the most that can be available in advance of empirical experience or inquiry.

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interested in the radical redescription of biological reality, or so I surmise, than in the emendation of existing accounts of it. So let me begin afresh upon the effort of persuasion and invite the reader to try to imagine a world of pure process – of process without anything else. Let us try, for instance, to imagine a world consisting only of weather – a world where hurricane struggles with tornado for supremacy and powerful winds constantly oppose or cut across one another or combine to overwhelm all the other forces of the heavens. Such a world might seem to approximate to a world of pure process. But in a vacuum there is no weather. If there is to be weather, there must be not only process but also air or earth or water or ... some material principle which is other than process. (Could matter itself amount to no more than a process?) And, once there is any material principle at all, the collision of one process with another cannot help under some circumstance but make some quantities of matter collide and occasionally concreate with other matter. Not all the results of such concreation need be momentary. To judge by the report of Diogenes Laertes IX.7 [Diels-Kranz A1], the thought is at least as old as Heraclitus: ‘the totality of things is harmoniously joined together through *enantiodromia* [the running of this against that]’. In a world properly of process *and* matter, moreover – in a world such as can be the object of biological science – there wants at least one other thing, namely the possibility to refer twice to one and the same material concretion.

Here, in the world where we are, that condition is satisfied. Indeed our world-view has long since committed us to the existence not only of atoms and the rest, but also of re-identifiable organisms and micro-organisms. At the subatomic and subsubatomic level all sorts of problems arise about the identification and reidentification of individual entities. Such problems have been thought to threaten the whole ontology that we try to apply there. But only a rather special kind of fanatic would claim that problems of this kind must undermine the possibility of genuine identity and difference of continuants at the macroscopic level. The subatomic level is not the level at which we have to account for the identification and reidentification of most of that which we know about from biology or enquire how living things relate to the processes that combine to enable or constitute their continuing existence.

### 3.

In the effort to master these questions, some theorists of process without substance are apt to invoke the idea of *genidentity*. In their

article 'To be continued: the genidentity of physical and biological processes', Thomas Pradeu and Alexandre Guay<sup>5</sup> write

What does the concept of genidentity say? In a nutshell, [genidentity] says that the identity through time of an entity X is nothing more than the continuous connection of the states through which X goes. For example a 'chair' should be understood in a purely historical way, as a connection of spatio-temporal states from its making to its destruction. The genidentity view is thus utterly *anti*-substantialist in so far as it suggests that the identity of X through time does not in any way presuppose the existence of a permanent 'core' or 'substrate' of X. It also leads one to replace the question 'what *is* X, fundamentally?' by the question 'How should I *follow* X through time?' ... In this context, the notion of individual becomes derivative ... It will not be unreasonable to [contend] that processes are ontologically prior and individuals should be conceived as the specific temporary coalescences of processes ...

In response to this I protest first that, according at least to my own avowedly 'substantialist' account of what it takes to find a thing X and then find X again later, it is only required that in tracking X one should attend to the activity of X – attend that is to X's way of being and behaving.<sup>6</sup> Such a principle (I insist) need not invoke any 'permanent core' or 'substrate'. The operation of a principle of activity for X's kind of thing will involve matter, but it is not excluded that that matter be exchanged constantly. Everything depends here on what kind of thing X is. Let me add that, among the proper parts or constituents of continuants of a given kind, nothing excludes the possibility that there be further continuants. Indeed, in the case of a continuant with the principle of activity of something alive, it may be discovered that it is essential to the life and survival of that continuant that it have within it certain other continuants, microbes, symbionts etc. This I learn from Dupré and Pradeu themselves. But in this connection everything depends on the empirically discoverable demands of the particular principle of the activity that sustains the stability and persistence of the sort of organism in question.

The second point I put to Guay and Pradeu relates to what they mean by 'temporary coalescences of processes'. Do they mean the coalescence of *matter* with *matter*, a coalescence brought about by

<sup>5</sup> See their contribution to the edited collection referenced at note 1.

<sup>6</sup> See sections 8–10 of my 'Identity, Individuation and Substance', *European Journal of Philosophy* 20(1), March 2012.

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distinguishable processes? Or do they mean the process that results from the confluence or concurrence of the various processes which sustain the something or other that is some organism? On a literal reading of what they say, it seems they can only mean the second. They can only mean that the organism is *itself* a process. Only this literal reading distinguishes their position from the ‘substantialist’ position from which they seek to distance themselves.<sup>7</sup> But are they content for this to be what they mean? The discomforts of taking such a position (see again section 1 above, *ad finem*), would be out of all proportion with any real difficulties in the philosophy of continuants.

### 4.

Where the idea of genidentity is concerned, I am drawn to a rival account:

[An] examination of the concepts and principles of relativity ... shows that they rest squarely on the ontology of things and events. A *world-line* is a sum of events all of which involve a single *material* body; any two events on the same world line are *genidentical*. That which cannot be accelerated up to or beyond

<sup>7</sup> In a further effort to reconcile Guay and Pradeu to ‘substantialism’ in the form in which I have tried to present it, let me quote (yet again – see *Sameness and Substance* (1980), page vii) from a text I have long revered:

The essence of a living thing is that it consists of atoms of the ordinary chemical elements we have listed, caught up into the living system and made part of it for a while. The living activity takes them up and organizes them in its characteristic way. The life of a man consists essentially in the activity he imposes upon that stuff ... It is only by virtue of this activity that the shape and organization of the whole is maintained. J. Z. Young, *Introduction to the Sciences of Man*. (Oxford: OUP, 1971).

Another text by which I might seek to distance Guay and Pradeu from their reading of substantialism comes from Aristotle himself (*Metaphysics* 1050b2):

Substance or form is *energeia*

Perhaps this is to say, not without some grammatical obscurity, that substance or form is active being. What I should *like* Aristotle to be saying here is that for *x* to be a substance is for *x* to have a principle of activity (in the sense I give these words in the article referenced in note 6). But it will be for the scholars of the *Metaphysics* to unwind the syntactical and interpretive intricacies of Aristotle’s sentence.

the speed of light is something with a non-zero mass. But only a continuant can have mass. In like fashion, the measuring rods and clocks of special relativity, which travel from place to place, are as assuredly continuants as the emission and absorption of light signals are events. Nor does relativity entail that large continuants have temporal as well as spatial parts ... We suggest that that rejection of the old (substantialist) ontology be postponed until such time as the promised alternative is in a much more liveable state. Peter Simons, *Parts: a Study in Ontology*, Oxford, OUP, 1987, page 127.

Genidentity thus explained depends on the idea of a world-line and that idea depends on the idea of a material body. It is a relation between the events that involve a material body. On these terms – genidentity being glossed as Simons glosses it – it is simply impossible to reconstrue genidentity as a link between physical states whose concatenations can stand in for material bodies. We needed material bodies from the outset in order to say what a world-line was.

## 5.

Guay and Pradeu may try to show that there is another way to say what a world-line is. But this is the moment for me to turn to their admirable suggestion that the philosophy of biology needs to focus upon the question ‘How should I follow X through time?’. No proposal could be more welcome. I have long promoted the very same question – not because I have wanted to show the notion of individual continuant to be derivative in the way that Guay and Pradeu propose, but because I have wanted not to strain and strain in scholastic fashion after the idea of the singular essence of a thing. There had to be another way. The thought was that, in order to understand identity and individuation, one needs to study the way in which we learn to track continuants of any particular sort – at the same time, in the course of doing this, exploiting and extending our knowledge of how and why these things, of this or that sort, behave as they do.

Applying the question ‘How should I follow X through time?’ to the context of biological science, Guay and Pradeu make a whole wealth of suggestions about how the competent inquirer must proceed: by consulting considerations of ‘causally significant process’; by reference to considerations relevant to ‘internal organization as measured in terms of intensity of interactions’; and by consulting considerations relating to ‘well-specified metabolic interactions’ that contribute to the

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'cohesiveness' and unity of a whole organism, as well as to 'higher level interactions', some of them on the part of the immune system, which themselves 'exert control over metabolic interactions at a lower level'.

### 6.

I have three kinds of doubt whether these proposals – interesting and enlightening though they are, and illuminating as they are of the ways in which scientists have tried to understand the secret life-cycles of strange creatures – can in the end help to vindicate any theoretical preference for a simplified ontology of process over the larger ontology that I advocate.

The first doubt concerns how well the thoughts, ideas and scientific practices of the investigators who have created the branches of biology that Guay and Pradeu appeal to can cohere and consist with the claim that the concept of individual organism is 'derivative'. Could some revised research practice of these investigators amount to their dispensing with all implicit reliance on the determinables *continuant* and *organism*? Could these investigators really think of the organisms they study as simply concatenations of states? If they were asked what concatenates the states in question, they would surely refer to their however provisional account of the life-cycle of a given organism. There is more to this preference than meets the eye. A concatenation, being defined by its membership, has its members necessarily. To imagine the smallest difference in a concatenation is to imagine a different (non-identical) entity. Is this not a special disadvantage? We need a 'connection' between states – a connection that is more specific moreover than undifferentiated succession or causation. We need the provisional account of the life-cycle of an organism.

My second doubt concerns cohesiveness, unity, wholeness ... I submit that, au fond, such ideas depend for their application on a context that is framed by the kinds or kinds of kind in question. They need to be glossed in context as 'one f', 'a whole f', 'something cohesive in the manner of an f', 'unitary f' ... and in the presence of some adumbration at least of the concept f. Is it all right for the concatenation-of-states construal of continuants to wait for its implementation upon the prior operation of criteria informed by thoughts about the nature of the bearers of those states, namely (as I should say) the organisms themselves?<sup>8</sup>

<sup>8</sup> Suppose the putative parts of a putative thing are all present but in the wrong array. Is the entity 'cohesive' or 'unitary'? If not, why not? Well,

The third doubt relates to something we all three agree about, namely the role of principles in the reidentification/tracking/following of a particular continuant (as I should say) or concatenation-of-states (as they would say). It relates also to something we do not agree about. I say that these principles depend not on the idea of a concatenation of states but on the idea of some continuant or other.

I begin upon this by remarking that simple logic requires that such tracking principles should respect both the reflexivity of identity and the indiscernibility of identicals. These imply the symmetry or reversibility and the transitivity of the relation which must hold between X and the this-or-that to which we trace it. Suppose that some putative principle **P** carries us from X to Y and carries us from Y to Z. Then **P** gives us a path back and forth between X and Z. Suppose however that **P** also gives a path between X via Y to Z' but **P** offers no path between Z and Z'. Then we shall have a contradiction. Z and Z' are distinct – there is no identificatory direct route between them – and yet also identical. For, via Y, **P** carries us back from Z to X and carries us back from Z' to X. So  $Z = Z'$ . But on the basis of **P** we had *also* supposed that  $Z \neq Z'$ .

Any tracking principle **P** that gives such a result in any of its applications will need to be reconsidered. I am uncertain what Guay and Pradeu will say that that involves. But anyone who takes the idea of a continuant in the way I do as primitive – and not as reducible to the account of a mere concatenation of states – will say that any workable tracking principle must arise from some however provisional conception of the particular kind of thing that is to be followed or tracked. In the face of contradiction it is this conception, the conception that animates principle **P**, which needs to be reshaped. Suppose, for instance, that in the sort of case we began with the conception was the conception of *human being*; and suppose that, as it stood, this conception allowed us to think of a human being as starting its existence as a zygote. The trouble would be that, as is well known, the human zygote may divide at any moment before the twelfth day after conception and give rise to two separate embryos (twins). It follows that the principle corresponding to the conception of human beings that we began with cannot stand. It is a mistake to think of a human being's existence as starting before the formation of the embryo (see Chapter One, section 10). The conception we began with

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constituted so, the entity cannot participate in the mode of activity that is proprietary to it and definitive of its kind. Is it not in the light of *this* that 'cohesiveness' has to be interpreted and determined?



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needs correction. The earliest moment a human being can begin is with the embryo. I am not sure how that point will come out on the concatenation of states conception.

### 7.

Here, arising from the last point but moving on to something else, someone may offer an interesting objection. ‘*Genetically* speaking surely *Z* and *Z'* really are the same. And, in that case, is it completely clear that **P** must offer no direct path between *Z* and *Z'*?’ Such an objection is highly instructive. Anyone who is a sortalist about identity in the same way as I am will insist that, if **P** is meant to track *human beings*, then **P** cannot stand. On the other hand, if **P** is a principle deriving from the non-singular idea of some [*particular*] *human genotype* or *lineage*, then there ought indeed to have been a path back and forth between *Z* and *Z'*.

The point I want to make now is that, where identity is concerned, everything depends on what *category* of thing and what *kind* of thing one is to single out from the rest of reality. Is the item in question concrete or abstract, is it a thing or a nature, a particular animal or an animal species, something singular or something plural, a member or a class, a plant or a plant-colony, a clone (specimen) or a clone (group), a token or a type, a continuant or an aggregate ...? And is it a substance or a process?<sup>9</sup>

### 8.

Having now, in this way, more or less reinvented the sortalist conception of identity, let me try to apply it to some part of the area where philosophers of biology such as I have already named experience the doubts that prompt them to try to dispense (or dispense initially) with continuants proper or cause them to long for a purer ontology of processes. Let me apply the sortalist approach to some of the

<sup>9</sup> A word more about the logical adequacy requirement upon principles such as **P**. It demands more than respect for symmetry, reflexivity, and transitivity. It demands that grounds for the identity of *x* and *y* be grounds for the indiscernibility of *x* and *y*. *x* and *y* must share all their properties. They must have the same life-history. If that seems implausible in a given case, then the fault (if there is one) lies with the conception of the *kind* that regulates the formulation of the principle **P**.

remarkable creatures that Jack Wilson describes in *Biological Individuality: the Identity and Persistence of Living Entities* (Cambridge: CUP 1999). I am not entirely sure how process-theorists such as Dupré or Pradeu and Guay will prefer to describe such organisms. But what I hope to show is that these creatures need not especially daunt a substance-theorist who embraces the pluralist ontology that I have sought to advocate.

(1) 'A colonial siphonophore begins as a zygote. The zygote divides and forms a larva. The larva's ectoderm thickens and buds off zooids ... [which] remain attached together ... New zooids are budded off from one of the two growth zones located at the end of the nectophore region. Each colony is composed of a variety of zooids that closely resemble the parts of a normal jellyfish. The top of the colony is a gas-filled float. Below the float are the nectophores that move the colony by pumping water ... Their action is coordinated ... The colony can swim and feed like a single organism ... Is a siphonophore colony an individual or is each single zooid an individual?' (7)

(2) 'At one point in the life-cycle of a certain species of cellular slime-moulds, a number of independent, amoeba-like single cells aggregate together into a grex. The grex is a cylindrical mass of these cells that behaves much like a slug. It has a front and a back, responds as a unit to light, and can move as a cohesive body. The cells that compose a grex are not always genetically identical or even related. They begin their lives as free-living single-cell organisms. The grex has some properties of an individual and behaves very much like one.' (8)

(3) 'Blackberry plants reproduce both by sexual means resulting in seeds and also through vegetative growth. Some stands of blackberries are hundreds of years old and trace their origin back to a single sexually produced seed. The seed grows into a plant which send out runners. Some of the runners and roots remain connected underground and others have become detached. What should we count when we count blackberry plants?' (8)

## 9.

I begin with the problem (3). If there is a problem here, it is nothing special to biology. Consider the concept *crown*. It is clear enough how a thing has to be in order to count as a crown, and clear enough what it takes for crown  $C_1$  to be the same as crown  $C_2$ . But there is no universally applicable definite way of counting crowns. The Pope's crown is

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made of crowns. When the Pope wears his crown there is no unique or definite answer to the question how many crowns he has on his head.<sup>10</sup> If we want to count under a concept *f* then either we must choose a concept that does not permit division of what falls under it or else *f* must be further qualified. Is our interest in counting particular genetically uniform stands (colonies) of blackberry, or in counting individual blackberry plants whether or not connected below ground to other plants, or what...? There is nothing reasonable in the idea that reality allows only one choice – one ontology and one ideology, one domain of individuals and one domain of properties of those individuals. Compare the distinction Hilary Putnam proposes between ordinary realism and ‘metaphysical’ realism. See Chapter Two (especially at page 62) of his *Philosophy in an Age of Science*, ed. Mario de Caro and David Macarthur (Cambridge Mass: Harvard University Press, 2012). A reasonable inquirer has to be prepared to attend to these things or to those different things. However palpable the things we refer to may be – no matter how strong their claim to be ‘there anyway’ – they may require the one who attends to them (either optically or in thought or in both ways at once) to look for *this* sort of thing or for *that* sort of thing, whether singular or non-singular. Reality itself need not dictate what we are to heed. Still less will it forbid us to heed one kind of thing and *then* another kind.

### 10.

I revert now to case (1). The idea of an individual or individual organism is the idea of a determinable. To ask whether something X is an individual is to ask whether there is some fully determinate kind *f* such that X is an individual *f*. In the case of the siphonophore colony it is indeed a particular kind of (quasi-jellyfish) creature with a specific principle of activity. There is nothing wrong with *siphonophore* as a specific kind. Let us forget the obsolescent idea that a substance is something that lacks substantial parts and is viable without parts that are substances. Nothing in the idea of a continuant demands this. Among the constituents of a siphonophore are numerous sortally further specified continuants, each of them with its very own principle of activity, co-ordinated and subordinated in

<sup>10</sup> Compare my *Sameness and Substance*, pages 72–3 and *Sameness and Substance Renewed*, pages 74–5.

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important respects – but why not? – to the activity principle of the whole siphonophore.

I venture to think that there is nothing to forbid a similar treatment of the remarkable creature, the *grex*, which is the second puzzle-case.

### 11.

Over the millennia, the philosophy of substance has created all sorts of mysteries and obscurities of its own. My claim is that, slimmed down in the form of a logically informed philosophy of continuants, taking each continuant not as indivisible but as possessed of its own determinate principle of activity, the philosophy of substance is ready and equipped to cohere and combine with any equally clear and coherent philosophy of process, activity and event. There must be room within any such philosophy for the idea of a continuant.

At the outset (see section 2 above), I allowed that Dupré may be more interested in the possibility of a *radical redescription* of biological phenomena than in any scheme for the translation of existing descriptions into a language of pure process. So let me acknowledge that the very most I can achieve by the arguments I have advanced here is to suggest that radical redescription is not so urgent or so necessary as it has appeared.

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