Biological Organization as the True Foundation of Reality*

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The presumptions underlying quantum mechanics make it relevant to a limited range of situations only; furthermore, its statistical character means that it provides no answers to the question 'what is really going on?'. Following Barad, I hypothesise that the underlying mechanics has parallels with human activities, as used by Barad to account for the way quantum measurements introduce definiteness into previously indefinite situations. We are led to consider a subtle type of order, different from those commonly encountered in the discipline of physics, and yet comprehensible in terms of concepts considered by Barad and Yardley such as oppositional dynamics or 'intra-actions'. The emergent organisation implies that nature is no longer fundamentally meaningless. Agencies can be viewed as dynamical systems, so we are dealing with models involving interacting dynamical systems. The 'congealing of agencies' to which Barad refers can be equated to the presence of regulatory mechanisms restricting the range of possibilities open to the agencies concerned.

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1. Introduction – Physics and Mind

The following is where my research into how the mind fits into physics has reached at the present time. Let me say first of all that I think there is a need for a new physics, because there are a few clouds on the horizon with regard to ordinary physics. The standard model works well as far as it goes, but there are things beyond the standard model and it is proving difficult to reconcile theory and experiment. There's also the fact that standard quantum mechanics doesn't give a realist view of nature. An account that would talk about what is happening and not just give a statistical view would be preferable, since if you look just at the statistics you may end up not knowing what is really going on (for example, if you average what is said during lectures you would lose in the statistics the fact that something meaningful is happening). There are a number of reasons for going beyond the current consensus view. There's also the problem of quantum observation, where there are many different views as to what's actually happening: collapse, many worlds, transactions, and so on. That's another problem with the conventional view. The simplest approach I think is to say that one can work with *generalized life*, we are familiar with the phenomenon of life, the subject matter of biology; in the regular view that's really a special case of chemistry, thus life depends on chemistry to a great degree.

I should say that this is not really my own work: it's more a synthesis of what other people such as Barad, Bohm and Yardley have been writing [1-3]. A lot of people have been saying things along similar lines that are consistent with each other, but I'm not sure that anybody has created an integrated picture saying this is how it all fits together, which is what I am trying to do myself.

2. Generalized Life

The simplest approach to ground what I am saying is to say that one is working with *generalized life*. We're all familiar with the phenomenon of life: that's the subject matter of biology, but the life that we are familiar with is, from this perspective, a special case. It depends on chemistry to a considerable degree, in addition to which it is extremely complicated and issues like how does it really work and so on are unclear, and it might therefore be good to look at such issues from a general point of view. One view that I find useful is that of Karen Barad. In her book, *Meeting the Universe Halfway: The Entanglement of*

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Matter and Meaning [1], she talks about a concept called agential realism, the idea that agency, which I'll be defining in a moment, is the foundation of everything, and agencies work together to make phenomena. One can use this concept to unite three different perspectives: physics, biology and semiotics.

Of the three, I guess people at this meeting are most familiar with physics. The defining feature of physics, as we normally understand it, is its use of mathematics. It works with mathematical models: you do calculations, and you verify your theories that way. Biology is rather different: biologists don't normally do the precise computations that physicists do; they mainly focus on *processes*, and how things all fit together. Thus, in biology one approaches the problem of understanding nature in a totally different way.

Physicists in general are much less familiar with the third item in the trio, namely semiotics, the science of signs. This originated in the 19th century in the work of philosopher Charles Sanders Peirce [4], who studied signs and how they work in great detail. Signs are in some ways like pieces of information, which quantum physicists have started considering to be something very important. But signs are something different to this, a major difference being that while the basic characteristic of information involves it going from one place to another with two entities being involved (source and destination), semiotics involves three entities: a sign, the object that the sign relates to, and the interpretation process linking the two, mediated by what Peirce calls the *interpretant*. Further, information transmission is typically a linear process, whereas semiosis is by its nature a nonlinear one, in view of three entities being involved, a difference likely to be relevant to the detailed mechanics.

3. Standard Physics

So regular physics, that is to say the physics found in the regular physics journals, is incomplete without the other two disciplines. These would typically be ignored by physicists, who would normally say that while biology is something they could perhaps contribute to in various ways it is not the main concern of physicists; and again, in the case of semiotics, the view would be that while this subject might be of interest to linguists it is not really the business of physics.

But I think in the new physics that will not be the case.

3.1. Agency

I am now going to show how it all works together, taking into account Barad's concept of *agency* [1]. Her approach is a development of Bohr's philosophy, but she criticises Bohr in that according to her Bohr was focussed on knowledge of reality, not what reality actually is. Bohr says we can't know what reality, is but Barad goes beyond Bohr by regarding *phenomena* as objective reality: we can agree that certain phenomena occur even if we're not too clear how to talk about them, and these are assumed to be the consequences of agencies working together, just as when we design a circuit and want particular phenomena to occur, we cause this to happen by having particular agencies (the transistors and their connecting wires) all work together to produce the phenomena of interest.

Now consider agency to be something that can be characterised mathematically in some way, like a Turing machine. When one has something in mathematical form one can explain what happens just by doing the mathematical analysis.

3.2. Biology – Design Versus Mechanism

Now there's a sense in which human designs are mechanistic while biological ones are not, a point emphasised in Robert Rosen's book *Life Itself* [5]. With human designs, there is normally an explicit statement regarding what your agencies do, whereas in biology the agencies responsible for a process such as balance change over time; the process develops and improves over time. In the process of development, the system itself finds ways for the component agencies to work together to produce the relevant phenomenon, a characteristic theme in biology, leading to what Barad refers to as *intra-action* (action within a phenomenon), as opposed to the usual *interaction*, which is less specific. This gives the situation a top-down character, with higher level processes influencing lower level ones as well as the reverse.

A point I want to make here is that biology uses very specific forms, forms that are universal, like balance and vision. Thus, in biology we find very general schemes, common to many species. Now you do have these very general schemes also in physics, for example crystals with their periodic lattices, but in biology the schemes are extremely complicated. When we ask why is biology like this, the answer is that for an organism to survive at all it has to do specific things and these require complicated machinery: if organisms were less complicated they would not survive.

This leads us to the problem of how can it happen at all. This is the origin of life problem, and I think the answer to it is to generalize biology, as I said in my introduction. Our usual picture of life derives from the life that we see around us, but perhaps there is something more general, which does not depend on chemistry, on very specific molecules. If life exists in a very simple form, it can perhaps evolve to become gradually more complicated. There is a good illustration of this with

weather, which is based on the simple equations of fluid dynamics. That does feature various kinds of phenomena, such as hurricanes and clouds, some quite complicated, which we are aware of just because they persist. Such forms survive in a similar way to the way that organisms survive.

So where can we go from there? The key idea is that systems of this kind may be able to evolve and become complex even in the absence of the chemistry that plays an essential role in ordinary life. What is required basically is for them to be able to evolve strategies for survival, which would depend on the ability of structures to be able to specify (in accord with semiosis) particular behaviours, as we know does happen in the special case of the nervous system with its information processing capacities. Effective evolution requires also two further factors: reproduction, and an encoding system similar to DNA (semiosis enters at this point also). In the case of ordinary life, very complex mechanisms are involved, but these might begin in a simple way (for example, reproduction does not have to be the very precise process utilised currently by life, and merely requires particular organisms to be able to produce copies of themselves), and evolve to forms with more advanced capacities, with new ones being developed from combinations of existing ones, while at the same time existing strategies get implemented in more and more effective ways. There are parallels with language, which becomes progressively more powerful over time.

So that basically is the idea. I defined a basic form of life, illustrated by the weather phenomenon, and mechanisms by which it could become more advanced and complicated. You may say that is all very well: that's a separate discipline; what's it going to do with ordinary physics? One could make the connection by postulating that this deeper form of life might be able to utilise the laws of physics as a means of survival. This implies some ability to control nature, but once you have a language system that can *refer* to what is going on, that can be used to *control* what is going on: we do that all the time. One kind of thing that could happen with enough steps of evolution is a system that can impose more and more order upon nature and produce a subset of nature which looks like our ordinary world, so there is no difficulty in principle in explaining the laws of physics. So, this is a project for the future, which may very well link with more conventional ideas, as well as the kind of ideas being talked about in this conference. Hopefully there will be cross-fertilisation between the two, as your approaches become more biological, and this one more physical.

4. Controversy

And now a controversial idea. One possibility is that if this kind of system can control the laws of physics then it may also have a role in the evolution of life, thereby providing a mechanism able to support the idea of intelligent design. In this connection, there is no *quantitative* proof that Neo-Darwinism is correct; it's not like physics. If somebody did a computation which really did show convincingly that human life might have evolved *without* having to suppose that relevant information is fed in from a deeper level, fine, but the calculation is not there, and we have instead what Popper called *promissory materialism*. It is quite possible instead that some version of the intelligent design concept is correct. Also, less controversially, it quite possible that this kind of approach will be needed to account for such human capabilities as mathematics, where again there is no clear explanation for such skills in conventional terms. I don't think we even have any explanation for how thinking works: we can write programs that simulate thinking, but detailed connections with the neurosciences are not there. I suspect that the truth of the matter is that evolution at this deeper level of physics produces efficient systems of this kind on the basis of natural selection, and a subset of people have the ability to connect with that level, and thereby gain the inspiration needed to do advanced mathematics. Similarly, I think for music (cf. Josephson and Carpenter [6]), where we don't appear to have any good explanation for musical aesthetics, which involves very specific forms that seem to have a special creative power.

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