From Materialism To Physicalism: An Opinionated SketchAbstract: Late 20th-century physicalism – here understood broadly, as a comprehensive view about the nature of contingent reality, rather than narrowly, as a view about the relation of the mental to the physical – is widely regarded as the descendant of materialist hypotheses familiar from the history of philosophy both ancient and modern. This chapter contends that contemporary physicalism differs significantly from historical hypotheses of materialism, significantly enough that the prospects for physicalism cannot be inferred from those for materialism. The chapter brings out these differences by identifying the two main challenges faced by philosophers who want to revive the materialist hypotheses of earlier centuries, and then indicating the author's possibly idiosyncratic view of how these challenges are best overcome. The first challenge is to formulate physicalism adequately, so that it is interesting but neither obviously true nor obviously false; the second challenge is to specify what would count as empirical evidence for an adequately formulated hypothesis of physicalism. The chapter's survey of responses to these two challenges constitutes an opinionated history of central aspects of the past 50 (or so) years of philosophical reflection on physicalism.

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From Materialism to Physicalism

An Opinionated Sketch

Andrew Melnyk

30.1 Introduction

The history of philosophy includes grand hypotheses of materialism. Here is an ancient example, from Lucretius' defense of the Epicurean worldview:

> the whole of nature is essentially composed of two things; for there are bodies and the void, in which the bodies are located and move in all directions.
>
> There is nothing further that you could say is distinct from every body and remote from the void, nothing that would be found to be a third kind of nature.
>
> (Lucretius, *de rerum natura* (mid 1st century BCE), 1.419–21 and 1.430–2; my translation)

Here is a modern example, from Baron d'Holbach:

> The universe, that vast assemblage of everything that exists, everywhere affords us only matter and motion. . . . nature, in its broadest sense, is the great totality that results from the assemblage of the different kinds of matter, from their different combinations, and from the different movements that we see in the universe.
>
> (Holbach, *Système de la Nature* (1770), Ch. 1; my translation)

Lucretius and Holbach fully acknowledged the implication of their respective grand hypotheses that *mental* phenomena are purely material. But the hypotheses themselves were universal in scope, and their implications for the phenomena of *life* must at the time have seemed only slightly less outlandish than their implications for mental phenomena; perhaps 'grandiose' would be a fitter term for such hypotheses than 'grand'.

Contemporary philosophy, however, does not feature materialist hypotheses like these. True, some philosophers endorse hypotheses that they *label* 'materialism'. But these philosophers do not speak, as Lucretius, Holbach, and many others spoke, of 'matter' or of 'bodies' or of 'body'; nor do they claim that everything is 'material' or 'bodily' or 'corporeal'. They claim, instead, that everything is 'physical', and most often label their hypotheses 'physicalism'.[1] Contemporary hypotheses of physicalism evidently *descend* from the grand old hypotheses of materialism; but they descend with *modification*. How much modification? I contend in this chapter that the modification is considerable – considerable enough that the prospects for physicalism cannot be inferred from those for materialism. The differences will emerge as I identify the two main challenges for philosophers who want to revive the materialist hypotheses of earlier centuries, and indicate my own view of how these challenges are best overcome. The first challenge is to *formulate* physicalism adequately; the second is to locate *empirical evidence* for it; each challenge gets its own section.[2]

30.2 The Challenge of Formulating Physicalism

From today's vantage point, perhaps the most serious defect in the hypotheses of materialism familiar from the history of philosophy – a defect that an adequate formulation of physicalism must somehow avoid – is that they appeal crucially to bodies (and to the corporeal) or to matter (and to the material). We have seen that Lucretius' formulation appealed to bodies (i.e., atoms) in the void, and Holbach's to different kinds of matter. The trouble with appeals to bodies (and to the corporeal) is that, to the best of our current scientific knowledge, nothing like Lucretius'

atoms – or later thinkers' corpuscles – exist. These atoms or corpuscles would have had spatial extensions and definite spatial locations, and would have consisted of impenetrable stuff. But today's fundamental physics might easily end up not positing particles at all: the particle interpretation of quantum field theory – the theory that unifies quantum mechanics and special relativity – is highly controversial. But even if fundamental physical particles turn out to exist, they lack spatial extension (because they are point-particles), they don't always have definite spatial locations (because quantum mechanics entails that they are sometimes in superpositions of different spatial locations), and, like quarks or electrons, they do not consist of anything, hence not of *any* kind of 'stuff'. Similarly, the trouble with appeals to matter (and to the material) is that current physics knows nothing of matter in the relevant sense – in the sense of stuff such that portions of it, when they assume the right shape, constitute observable macroscopic objects or unobservable particles. Today's physicists may speak of matter in their most informal expositions (e.g., when teaching college physics); but neither 'matter' nor any synonym appears in the textbook formulations of their theories. To make this point is not to condemn today's quotidian talk of matter or bodies as false or empty; good sense, I presume, can be made of such talk; but no one should suggest that everything in the world boils down to matter or body in our current quotidian senses of 'matter' or 'body'.

As the terminological shift from 'materialism' to 'physicalism' perhaps suggests, the way to avoid this defect in historical hypotheses of materialism is to appeal not to the *material* or the *bodily* but instead to the *physical*. But obviously nothing useful will be achieved if the proposal is understood as merely directing us to everyday uses of the word 'physical' in which its sense is pretty much that of 'material'. The hope of real progress lies in forging a connection with *physics*, the actual, immensely successful, and immensely rich branch of science routinely taught in our universities.[3] To do so, physicalists must assume that physics, or enough of physics, can be given a realist interpretation, so that the vast evidence we have for physical theories can be taken as evidence for the existence of the *entities* that must exist if the theories are true (see Gutting 1982). Such a realist interpretation is, of course, controversial; but if it can be sustained,

then physicalists can claim that the world boils down to *these* entities (or perhaps to just some of them). But these entities need have nothing *further* in common than that they must exist if our best current physical theories are true; there need be no golden thread running through every entity that is physical – no substantive meta-property shared by electrons and the strong nuclear force, say, in virtue of which they are both in some deep sense physical. Indeed, I doubt that such a substantive meta-property exists. Suppose it does not; then though materialism, with its commitment to matter or body alone, can sensibly be called a kind of monism – the view that there is fundamentally just one kind of thing – physicalism cannot.

A further point is worth considering. In 1925, Bertrand Russell asserted that, of the 'two dogmas that constitute the essence of materialism', the second is 'the reign of law', by which (given the context) he clearly meant the truth of causal determinism (Russell 1925, xii). If Russell's assertion is correct, then physicalism differs from materialism in a second important way.[4] For if the physical is characterized by reference to current physics, physicalism may well not be deterministic. The correct interpretation of quantum mechanics remains controversial, but there are live interpretations on which, rather than being deterministic, quantum mechanics is fundamentally statistical (Hoefer 2016). Moreover, it may well turn out that at the level of fundamental physics there is no causation at all, as Russell himself famously argued (Russell 1912; for recent developments, see Frisch 2020).[5]

The boundaries of physics are sharp enough for many administrative and educational purposes, but they are not, of course, perfectly precise. This need not be a problem for physicalists. In trying to formulate a hypothesis of physicalism, we are not trying to identify the one and only hypothesis of physicalism or to perform conceptual analysis on philosophers' use of the term 'physicalism'. We are trying to formulate a hypothesis that is (among other things) neither obviously true nor obviously false, and interesting if true. There is, therefore, room for multiple hypotheses of physicalism, including versions of physicalism that take different stands on where the precise boundaries of physics lie, and versions that treat some proper subset of

physical entities, rather than all of them, as fundamental. What matters in the end is which interesting hypotheses are true, and we should let the world settle that question.

More troublesome for the appeal to physics is Hempel's Dilemma.[6] A simple way to frame the dilemma is as follows: if physicalism is formulated in terms of *current* physics, then because physical theories of previous centuries have often turned out to be false, the physical theories that make up current physics will probably turn out to be false too, and with it any hypothesis of physicalism formulated in terms of current physics. But if physicalism is formulated in terms of *completed* physics, then, since we currently have no idea what completed physics will look like, we won't know what the resulting formulation of physicalism *says*, which means, among other things, that we can't tell whether we have evidence for physicalism. But there are ways to evade Hempel's Dilemma. Perhaps the dilemma's first horn is blunt (Melnyk 2003a, 11–20 and 223–237). Physicalism is an empirical scientific hypothesis about what *everything* is, like the hypothesis that every (chemical) *atom* is a certain system of physical particles but with universal scope. But to *endorse* any scientific hypothesis all that is necessary is to treat the hypothesis as the best that we have come up with so far (i.e., to assign it a *higher* probability than we assign any other formulated hypothesis of comparable explanatory ambition). But we can assign a hypothesis a *higher* probability than its rivals without assigning it a *high* probability, or even a probability greater than .5. So physicalists can endorse physicalism formulated in terms of current physics while accommodating the fact that physical theories in the past have so often come to grief by assigning to physicalism so formulated a probability that is low, but still higher than the probability assigned to any other formulated hypothesis of comparable explanatory ambition. Someone who insists that we must not endorse physicalism formulated in terms of current physics just because it is improbable given the poor track record of physical theorizing is in effect holding physicalism to a higher standard than the one to which we hold scientific hypotheses in general.[7] But there are other promising ways of evading Hempel's Dilemma if this medicine is found too strong.[8]

Let us assume henceforth that we have in hand a satisfactory conception of the physical, whether spelled out directly in terms of a modest extension of current physics, as I have proposed, or in some other way. You might think that we can now just go ahead and formulate physicalism as the claim that everything is physical. But physicalists do not in fact claim that everything is physical – and for good reason. Although physicists expect elephants and glaciers to behave gravitationally – because they both have mass – neither being an elephant nor being a glacier are properties expressed by the predicates of current physics.[9] Indeed, almost none of the properties expressed by the nouns or adjectives in an ordinary dictionary are expressed by the predicates of current physics. On its face, therefore, it is just false to claim that everything is physical – that every entity is a physical entity – if physical entities are construed as those expressed by the predicates of *current* physics (even if modestly extended). Likewise if physical entities are construed as those expressed by the predicates of a *completed* physics; for there is no realistic prospect that a completed physics will include such predicates as 'elephant' and 'glacier'. Physicalism should not be formulated so that it can be refuted by the dictionary.

Not only do today's physicalists not claim that everything is physical; neither was the considered view of yesterday's materialists that everything is material, or that everything is a body.[10] For Lucretius, 'bodies' (i.e., atoms), along with the void, were the only *fundamental* constituents of nature, not the *only* constituents of nature, because he allowed the existence of *composites* of atoms (he mentions elephants at 2.537) that are not themselves atoms. His materialist hypothesis was, in effect, that everything is an atom in the void *or composed (only) of* atoms in the void. Similarly, Holbach allowed the existence of *assemblages* of kinds of matter which were not themselves kinds of matter. His materialist hypothesis was that everything is a kind of matter *or an assemblage (only) of* kinds of matter.

Today's physicalists make progress in formulating physicalism by taking a leaf from the books of Lucretius and Holbach. A formulation of physicalism must exemplify the following schema: every entity is *either* a physical entity in the *narrow* sense that we are assuming can be spelled out by reference to current physics *or* an entity that, though not physical in the narrow

sense, is still physical in the *broad* sense of being in some suitable way *nothing over and above* entities that are physical in the narrow sense. An elephant is surely nothing over and above atoms in the void if it is *composed (only) of* atoms in the void; and it is surely nothing over and above kinds of matter if it is an *assemblage (only) of* kinds of matter.[11] But these appeals, to composition and to assemblage, even if they can be made precise, only solve part of the problem. For only some of the things whose existence it would be implausible to deny, even though they are not narrowly physical, are (like elephants and glaciers) *objects*; others are *properties*. And while it is plausible that *objects* are composed, or are assemblages, of narrowly physical things, no obvious sense attaches to saying that *properties* are composed, or are assemblages, of narrowly physical things, whether *objects* or *properties*. Something else must be said about the broadly physical character of scarcely deniable but not narrowly physical properties.

I am not aware that yesterday's materialists ever explicitly articulated their general strategy for handling the *properties* of composites (or assemblages) of narrowly physical objects, properties that seem not to be narrowly physical. Presumably, however, they took themselves to be committed to asserting the *identity* of these properties with narrowly physical properties, where identity is understood to be a relation between a thing *and itself*, so that, if property *P* = property *Q*, only *one* property is involved. Such claims of property-identity have greater initial plausibility in some cases than in others. Some properties possessed by composites (or assemblages) of narrowly physical objects do seem just to *be* narrowly physical properties, though on a macroscopic rather than a microscopic scale. Thus, the weight of a boulder seems to be the same property as the weight of a Lucretian atom, so that the great weight of the boulder can be owed entirely to the tiny weights of the atoms that compose it. In other cases, however, the macroscopic property does *not* seem to be the same as any narrowly physical property, as with, for example, the sweetness and bitterness of foodstuffs. Yet Lucretius gamely identified sweetness and bitterness with narrowly physical properties of atoms:

> So you may easily see that those things which can affect the senses pleasantly are made from smooth and round atoms, while on the other hand those

> things which always seem bitter and harsh are held together by more hooked atoms and accordingly tend to cut paths into our senses and burst through the body as they enter.
>
> (Lucretius, *De rerum natura*, 2.402–7; my translation)

Here Lucretius seems to identify the macroscopic property of being sweet with the property of being composed of smooth and round atoms. Democritus before him may have taken the bolder step of simply denying the existence of sweetness, bitterness, and other macroscopic properties that don't seem identical with the narrowly physical properties of atoms. That, at any rate, is Sextus' interpretation of Democritus, and the dominant interpretation offered by Galen: we *habitually think* that sweetness and bitterness and the like exist, but in fact only atoms and the void exist (Barnes 2001, 208–209).[12]

Today's physicalists have the advantage over yesterday's materialists that they can mitigate the implausibility of identifying macroscopic properties with narrowly physical properties with which they don't seem – on a priori reflection – to be identical. For today's physicalists can insist that physicalist claims of property-identity are a posteriori (Kripke 1980).[13] Some true identity claims cannot be known just by understanding and reflecting on them – for example, the claim that Mark Twain was Samuel L. Clemens and the claim that having consumption (the disease) is the same property as being infected with *Mycobacterium tuberculosis*; to determine their truth, one must conduct investigations in, respectively, literary history and medicine. How so? An identity claim could only be knowable a priori if understanding the terms flanking the identity sign required associating with each term a reference-determining definite description such that one could work out a priori that the two associated definite descriptions, and hence the two terms, co-referred. But semantic externalism denies that the reference of a referring term is determined by a definite description associated with the term, such that understanding the term requires associating the term with this

description. So semantic externalism about referring expressions entails that the necessary condition for an identity claim to be knowable a priori is not met.[14]

Perhaps surprisingly, however, today's physicalists have typically *not* claimed that the many properties that don't *seem* to be narrowly physical have turned out, or will turn out, empirically to be identical with narrowly physical properties. For they have been persuaded that many, if not all, of the former properties – notably, the properties spoken of in the many sciences other than physics, such as biology and psychology – aren't correlated one-to-one with narrowly physical properties in the way they would be if they were identical with narrowly physical properties (the *locus classicus* is Fodor 1974).[15] So today's physicalists need to find some other way in which properties that don't seem to be narrowly physical – properties that truly *aren't* narrowly physical, in the majority view – can still be in some suitable way nothing over above narrowly physical properties, and hence physical in a broad sense. Not that this need is acknowledged by all physicalists: some of them have thought that it would suffice for physicalism *tout court* – physicalism about objects *and* properties – to claim merely that every *event* (or state-*token*, or property-*instance*) is identical with some narrowly physical event (or state-token, or property-instance).[16]

Two ways have been suggested in which properties that aren't themselves narrowly physical might nonetheless be nothing over above properties that are, and hence broadly physical: (1) these properties might *supervene* on narrowly physical properties or (2) they might be *realized* by narrowly physical properties. I myself favor the appeal to realization, but let me first discuss the proposal to appeal to supervenience.[17] Henceforth, by 'physical' I shall mean '*narrowly* physical', and by 'non-physical' I shall mean 'not *narrowly* physical' – which is, of course, fully consistent with 'broadly physical'. By 'immaterial' I shall mean 'neither narrowly nor broadly physical'. Then the supervenience proposal, very roughly indeed, is that physicalism about non-physical properties is true iff non-physical properties *globally supervene* on physical properties – that is, physicalism about non-physical properties is true iff any two possible worlds exactly alike with regard to the distribution of physical properties are also exactly alike with

regard to the distribution of all properties (including therefore non-physical properties).[18] The formulation in terms of global supervenience is designed to allow for the possibility – indeed likelihood – that a non-physical property is possessed partly in virtue of its bearer's standing in certain physical relations to features of its physical environment or having had a certain physical history. Many philosophers of mind, for example, think that at least some of the content of such mental states as belief and desire is *wide* in the sense that it is determined by features of the subject's environment, so that a child's belief that what comes out of the kitchen tap is water would have had a different content if the stuff that falls from the sky as rain and fills the lakes and rivers had been some compound other than H_2O. And many philosophers of biology think that a particular organism's belonging to one species rather than to another is determined by the organism's *lineage*.

It is a surprisingly tricky business to get a supervenience formulation of physicalism about properties right. A natural first thought is that the formulation should quantify over all *metaphysically* possible worlds, so that it says, in effect, that the way things are physically *metaphysically necessitates* the way they are non-physically. But this claim is too strong to be true, because there seem to be pairs of metaphysically possible worlds that are exactly alike with regard to physical properties but not exactly alike with regard to *all* properties, because one of the worlds contains some immaterial extra. For example, perhaps one of the worlds, but not the other, contains immaterial spirits whose immaterial properties, by playing appropriate functional roles, realize various mental properties absent from the other world. The claim that quantifies over all metaphysically possible worlds is also stronger than is needed for physicalism. Physicalism does not have to deny that *some* possible worlds have a physical nature *and* a nature that is not even broadly physical. The way things are physically doesn't have to exhaust the way things are in *every* possible world, so long as it does so in the *actual* world (and perhaps some close neighbors).

A natural second thought is to suggest that physicalism about non-physical properties is true iff any two *nomologically possible* worlds exactly alike with regard to the distribution of

physical properties are also exactly alike with regard to the distribution of all properties. But this suggested formulation is *too weak* for physicalism. The nomologically possible worlds, of course, are those in which the laws of nature that hold are those (whatever they turn out to be) that hold in the actual world. But some forms of property dualism claim that all mental properties are immaterial and determined by physical properties in accordance with fundamental laws of emergence. If such forms of dualism are true, then physicalism about non-physical properties is false, but a claim of global nomological supervenience would be true. So such a claim is not sufficient for physicalism about non-physical properties.

In fact, a global supervenience formulation of physicalism about non-physical properties needs to quantify over all *physically possible* worlds – worlds in which the laws of physics that hold in the actual world hold. Physicalists want to say that the *physical* way things are necessitates the non-physical way things are; so they must bring physical *laws* into the picture, because physical laws are *part* of the physical way things are. They must also bring in physical laws if they think that some non-physical properties are causal-role properties realized by physical properties that play the right causal roles; for whether physical properties play the right causal roles depends on what the physical laws are.[19] But quantifying over all *physically* possible worlds does not solve the first problem facing the proposal to quantify over all *metaphysically* possible worlds, the 'problem of extras', as Gene Witmer calls it (Witmer 1999). The distribution of physical properties in a world, together with the holding of the actual physical laws, may well necessitate the *presence* of all the non-physical property-instances that the actual world contains; but it doesn't necessitate the *absence* of 'extra' non-physical property-instances that the actual world *doesn't* contain – which would be required for any two worlds exactly alike physically (with the actual physical laws) to be exactly alike non-physically. It may be, however, that any supervenience claim that avoids the problem of extras will do so by *embedding* a condition that suffices *by itself* for the truth of physicalism, thereby making the supervenience claim redundant (Melnyk 2003a, 64n18).[20]

Supervenience formulations of physicalism are no longer popular among philosophers who specialize in questions of comprehensive physicalism (though they remain popular among non-specialists). The problem with supervenience formulations is that a claim of supervenience, even a highly refined one, doesn't seem to be logically sufficient for physicalism, because it doesn't seem to *entail* a suitable sense in which the instantiation of a non-physical property is nothing over and above instantiations of physical properties (given the physical laws). This objection can be and has been made in different ways (Melnyk 2003a, 57–70; Wilson 2005; Melnyk 2016, 214–216), but the crux is this. As Jaegwon Kim repeatedly emphasized, a claim of supervenience only makes a *modal* claim; it asserts a cross-world *correlation* between the physical way things are and the non-physical way things are (Kim 1993).[21] But such a modal correlation could in principle hold between a distribution of physical properties (governed by physical laws) and, on the other hand, properties that are as spectacularly incompatible with physicalism as you like – for example, mental properties as envisaged by Cartesian dualists. The holding of such a modal correlation is therefore consistent with the *falsity* of physicalism about non-physical properties, and hence logically insufficient for it.

Let me turn now to the realization suggestion regarding how properties that aren't themselves narrowly physical might nonetheless be nothing over above properties that are, and hence broadly physical. The hope that a supervenience claim could state a logically sufficient condition for physicalism about non-physical properties rested, I suspect, on a certain unarticulated assumption – that there can be a relation between families of properties of such extraordinary physicalizing potency that, if it holds between the physical properties of our world and the non-physical properties of our world, then, no matter what the *nature* of the non-physical properties, it can civilize them into being nothing over and above physical properties. I doubt, however, that such a relation exists. A mental property that is *identical* with a physical property is certainly nothing over and above a physical property; but that's not because identity *makes* the mental property nothing over and above a physical property; it's because, if the mental property really *is* the physical property, then it has a physical nature and so is *already* nothing over and

above a physical property. Nor does the realization suggestion – that non-physical properties are nothing over and above physical properties because *realized* by physical properties – assume such a relation. For the realization suggestion, as I develop it, includes an explicit claim about the *nature* of non-physical properties: that each non-physical property has a *higher-order essence* in the sense of being one and the same as a certain *higher-order* property.[22] A property *P* is (by stipulative definition) a higher-order property iff for an object to have *P* just is for the object to have some (lower-order) property or other that meets a certain condition, C_P, that is characteristic of *P*; for an object to have higher-order property *Q* just is for the object to have some (lower-order) property or other that meets a different condition, C_Q, that is characteristic of *Q*; and so on for each higher-order property. If a (lower-order) property meets a condition characteristic of a certain higher-order property (e.g., condition C_Q), then it can be said to *realize* the higher-order property. To illustrate: *being poisonous* is plausibly regarded as the higher-order property of having some property or other that sickens any creature that ingests whatever has the (lower-order) property. Because *containing cyanide* meets the characteristic condition for *being poisonous* – because a substance's containing cyanide sickens any creature that ingests the substance – *containing cyanide* can be said to realize *being poisonous*, as, for the same reason, can *containing strychnine*.[23] The realization suggestion then requires numerous claims to the effect that non-physical properties are identical with higher-order properties – claims that are usually a posteriori. In this regard, the example of *being poisonous* may mislead, for its identity with a certain higher-order property can perhaps be known a priori. Usually, however, these claims must be supported in the same way that any scientific identity claim is supported – empirically.

There are multiple *kinds* of higher-order property, corresponding to multiple *kinds* of characteristic condition that lower-order realizing properties might meet. The kind of condition most familiar (from the literature on functionalism in the philosophy of mind) is that of playing a causal role specifiable in everyday (i.e., non-scientific) vocabulary. For example, perhaps *being in pain* is the property of having some property or other that is typically caused by bodily

damage, and that typically causes wincing, moaning, and other pain-behavior, plus a desire for the damage to stop. A second kind of characteristic condition is playing a causal role specifiable only in scientific vocabulary. A third kind of condition is having the biological function of doing so-and-so (see, e.g., Millikan 1984). Further kinds of condition are standing in a certain spatio-temporal or (non-causal) nomological relation to something else, or having had a certain history, or standing in a certain environmental relation, or exhibiting a certain *internal* structure, or being an element within a larger mathematically specifiable structure. And combinations of any of these conditions may constitute further conditions (Melnyk 2003a, 37–42). Finally, though this is not obvious, to serve the purposes of physicalism, all these conditions must, ultimately, be capable of specification in physical or topic-neutral vocabulary (Melnyk 2003a, 22–25).

Physicalism about non-physical properties can now be formulated, at least roughly, as the claim that every actual instance of a non-physical property is realized by some instance of a physical property, given the physical laws, physical background conditions, and physical history (for a precise account of property-instance realization, see Melnyk 2018, 483–484). When formulated in this way, physicalism about non-physical properties turns out to *entail* a certain claim of global supervenience, but not to be entailed by it (Melnyk 2003a, ch. 2). Moreover, though it requires that non-physical properties turn out to be identical with *higher-order* properties, it doesn't require that they turn out to be identical with *physical* properties. Two important consequences follow. First, a non-physical property can turn out to be *multiply realized*; that is, realized on different occasions by different physical properties, and hence not correlated with a single physical property. For example, *being poisonous* is sometimes realized by *containing cyanide* and sometimes by *containing strychnine*. Secondly, at least if *physical reductionism* is taken to be the view that every non-physical property is identical with a physical property, physicalism formulated by appeal to realization is *not* committed to physical reductionism.

The realization suggestion, however, can be developed in a different way. But the alternative development also rests on a conception – in terms of *causal powers* – of the *nature* of

non-physical properties. Given this conception, the realization of a non-physical property *Q* by a physical property *P* can be understood roughly as follows: *P* realizes *Q* iff the causal powers constitutive of *Q* form a proper subset of the causal powers constitutive of *P*. Multiple realization is accommodated, and commitment to physical reductionism avoided, because the causal powers constitutive of *Q* might *also* form a proper subset of those constitutive of a distinct physical property, *P′*.[24]

30.3 The Challenge of Evidencing Physicalism

Over the past 150 years, science has made historically unprecedented progress. Not only have older sciences, such as physics, chemistry, physiology, geology, and astronomy, made immense gains in explanatory and predictive power; specialization in the 20th century has given rise to whole new branches of highly successful science – for example, physical chemistry, biochemistry, molecular biology, the neurosciences, and astrophysics. In light of this progress, the hypotheses of materialism familiar from the history of philosophy inevitably strike us as pitifully ill-supported. Not that their proponents didn't appeal to empirical facts. But an adequate case for a claim as ambitious as materialism could not rest solely on the empirical evidence accessible to common-sense observation in daily life; and the empirical evidence available from the sciences of the day was, by the standards of *today's* sciences, thin gruel (though it was not nothing, and it increased over time). Things are, however, very different for contemporary physicalism, for which the current state of the sciences provides significant evidence – as I shall sketch in due course.

As already noted, physicalism is a scientific hypothesis, albeit one of unusually broad (indeed universal) scope. It is not the sort of scientific hypothesis that posits entities or laws but the sort that claims that entities of one kind are nothing over and above entities of another kind – like the once controversial hypotheses that every (chemical) atom is nothing over and above a certain system of physical particles, and that having an infectious disease is nothing over and

above being infected by a certain microscopic pathogen. It follows that, like these other scientific hypotheses, physicalism can only be supported empirically, through the usual methods of science. Admittedly, physicalism is sometimes described as a *metaphysical* claim. But it can be *both* an unusually broad-scope scientific hypothesis *and* a metaphysical claim if 'metaphysical' just means 'concerning how things are', as opposed to 'concerning how we *know* how things are'. On the other hand, if 'metaphysical' means 'concerning how things are, but ascertainable only by a priori philosophical methods', then I deny that physicalism is a metaphysical claim, and request to be shown a formulation of physicalism on which its truth can be ascertained only by such methods.[25] And if 'metaphysical' has the pejorative meaning (favored by some scientists) of 'meaningful but forever beyond the reach of empirical investigation', then I deny again that physicalism is a metaphysical claim, on the grounds that empirical evidence for it already exists and empirical evidence against it is readily conceivable.

Since physicalism is a scientific hypothesis, we should not expect it to be intuitive or obvious or to admit of mathematical proof. We should hold it to the same evidential standard to which we hold scientific hypotheses in general. What standard is that? As I claimed above, the standard is surprisingly low: to endorse (or accept) a scientific hypothesis, we need only assign it a higher probability than we assign any of its relevant rivals; and we can do so without assigning it a high probability, or even a probability greater than .5. So when I say that the current state of the sciences provides significant evidence for physicalism, I mean only that physicalism is *more* probable than any of its relevant rivals on the evidence provided by the current state of the sciences. That very modest claim is all that physicalists need.

When philosophers decline to accept physicalism, it is sometimes unclear what exactly their positive stance is, so let me distinguish three possibilities:

Stance 1

> There *is* evidence for physicalism (i.e., evidence *E* such that P(Phys/*E*) > P(Phys)), but there is *more* evidence for one of its relevant rivals, so that the probability of this rival exceeds that of physicalism on *total* current evidence.

To defend this first stance, one must specify a relevant rival to physicalism and explain how its probability on total evidence exceeds that of physicalism. One such rival is *near-physicalism* – the view that physicalism is true of every domain *except* the mental, either because the mind is an immaterial object or because some or all mental properties are neither physical nor physically realized. Another is *emergentism* – the view that every object, whether chemical, biological, psychological or whatever, is either a simple or a complex physical system, but that, when physical systems achieve a certain physical complexity, they come to have various causal powers that cannot even in principle be explained in terms of the fundamental forces acknowledged by physics.

Stance 2

> There *is* evidence for physicalism, and indeed the probability of physicalism on total current evidence exceeds that of any of its relevant rivals, but this probability falls short of some threshold that must be met for rational endorsement of physicalism (e.g., it fails to be *high*).

One is well within one's rights to adopt a policy across the board of withholding endorsement of scientific hypotheses whose probability on total current evidence falls below some threshold. One must, however, justify one's discrimination against physicalism if one sets the bar for the rational endorsement of physicalism higher than for the rational endorsement of other scientific hypotheses.

Stance 3

There is no evidence for physicalism.

This third stance – the commonest among non-physicalists, I suspect – puzzles me. How could it be supported? Obviously, since evidence for physicalism would be inductive, it could be inferred from unrestricted inductive skepticism. It could also be inferred from inductive skepticism restricted to hypotheses positing unobservables, since physicalism is committed to physical unobservables. Could it be supported without commitment to either of these unattractive forms of skepticism? Nancy Cartwright seems to reject 'fundamentalism', the thesis that the so-called fundamental laws of physics apply to all physical phenomena everywhere and (more or less) everywhen, on the grounds that it incautiously extrapolates to the rest of the world from the highly contrived experimental situations in which physics makes its extraordinarily accurate predictions (Cartwright 1994). But her view is also unattractive (see Sklar 2003).

Philosophers who take the third stance perhaps do so because they notice that facts alleged to be evidence for physicalism are nonetheless logically consistent with various rivals to physicalism (e.g., emergentism). Their observation is correct, but it doesn't entail that the facts aren't evidence for physicalism: *E* can still be evidence for a hypothesis – can still raise its probability – even if *E* is logically consistent with rivals to the hypothesis. We readily acknowledge the point in daily life. In a murder trial, for example, the discovery that the defendant's fingerprints, and no one else's, are on the murder weapon is evidence that the defendant is guilty, even though the discovery is logically consistent with the rival hypothesis that the defendant is innocent but has been framed. In the same way, the correct observation that the alleged evidence for physicalism is logically consistent with, say, emergentism does not entail that it is not boosting the probability of physicalism. Now philosophers who take the third stance may be combining the correct observation with the assumptions (1) that a hypothesis is supported by evidence only when the evidence rules out every relevant rival and (2) that

evidence rules out a rival only when it is *logically inconsistent* with the rival; for these assumptions entail that genuine evidence for physicalism must be logically inconsistent with physicalism's rivals.[26] But even if assumption (1) is true, assumption (2) is not – or, at any rate, we do not treat it as true in practice. We routinely take a hypothesis to be supported by evidence even though certain rivals are logically consistent with this evidence. For example, we take orthodox Darwinism to be supported by evidence morphological, biogeographical, paleontological, and biochemical, even though we know that (bizarre) creationist hypotheses can be formulated that are logically consistent with this evidence. Presumably we discount these rivals by appeal to super-empirical criteria of theory-choice such as parsimony. This is not to give an 'argument from parsimony' for physicalism. The role that parsimony plays in the empirical case for physicalism is exactly the same as the role it plays in the empirical case for any other scientific hypothesis – to break the tie between observationally equivalent rival hypotheses.[27]

What, then, is the significant evidence for physicalism that – according to me – the current state of the sciences provides? It should not be sought in fundamental physics. I accept that physicalism cannot be true unless every macro-phenomenon has a reductive explanation in terms of fundamental physics. But the extraordinary physical complexity of macro-phenomena means that we cannot expect actually to give such explanations, even if physicalism is true. The evidence I have in mind consists of uncontroversial findings appearing in standard textbooks in such fields as physical chemistry, molecular biology, histology, physiology, condensed matter physics, astrophysics, and geology. These findings aren't *presented* as evidence for physicalism – the textbooks don't comment on physicalism. But they are *interpretable* as evidence for physicalism. What they give us reason to believe is that, in case after case, some behavior or property of a relatively complex system can be reductively explained, roughly in the sense of being explained solely by reference to the system's components, plus the components' properties and relations. It's not that, right now, we can explain *all* the behaviors and properties of *all* such complex systems in this way; but we can, right now, explain *many* behaviors and properties of

relatively complex systems in this way. Since no such behaviors and properties are *known* to be incapable in principle of being explained in this way, the probability is raised that *all* the behaviors and properties of *all* such complex systems could in principle be explained in this way. But if *all* the behaviors and properties of a relatively complex system could in principle be explained solely by reference to the system's components, plus the components' properties and relations, then the most parsimonious view of the system is to construe it, together with its properties and behaviors, as nothing over and above – that is, as being identical to or realized by – a certain system of components (with certain properties and relations); we need not construe the complex system as anything *more*. And these reductive explanations bottom out in systems of *physical* components, with *physical* properties and standing in *physical* relations. So, for example, the explanatory successes of physical chemistry provide evidence that we can account for all the distinctive properties and behaviors of *chemical* systems merely on the assumption that they are realized by certain systems of *physical* entities. The explanatory successes of biochemistry provide evidence that we can account for all the distinctive properties and behaviors of *sub-cellular systems* (organelles and the like) merely on the assumption that they are realized by certain *chemical* systems. The explanatory successes of cell biology provide evidence that we can account for all the distinctive properties and behaviors of *cells* on the assumption that they are realized by certain *sub-cellular* systems. And so on, up through a hierarchy of increasing complexity, for the study of tissue, of organs, of organ systems, of organisms, and of ecosystems.[28]

But modesty becomes a physicalist. Even if this interpretation of textbook scientific findings doesn't exaggerate the extent of reductive successes to date, the genuine track record of successful reductive explanation may not continue, and we may yet acquire overwhelming evidence that some complex systems – organs, or cells, or even molecules – possess causal powers that cannot be ultimately accounted for in terms of currently known physical forces, so that some variety of emergentism is true. It might be argued, for example, that reductive successes to date concern the comparatively simple systems that are easier for us to study, and

where the emergence of such causal powers is not to be expected; so we should not extrapolate to the more complex systems where novel causal powers *are* to be expected. However, I see no particular reason to agree that the emergence of novel causal powers would only 'kick in' in the more complex systems that are harder for us to study because of the intractable computational complexity required to predict their behavior from assumptions about their components. If God favored the emergence of novel causal powers, then he is as likely to have favored them in the hydrogen atom as in the brain.

A second qualification. I do not believe that, as yet, we have the sort of evidence for physicalism about the mental that I claim we have for physicalism about the non-mental. But there are at least two other kinds of evidence for physicalism about the mental. One kind is provided by correlations of various sorts that have been discovered between mental states (including sensations with phenomenal character) and neural states as revealed by fMRI scans. The most parsimonious and hence the best explanation of these correlations is the physicalist hypothesis that mental states are, or are realized by, neural states (see Hill 1991, 22–26; Kim 2005, ch. 5; Bates 2009; McLaughlin 2010; Melnyk 2015). A second kind of evidence is the neurophysiological fact that any human behavior apparently caused by a mental state lies at the end of a chain of neural causes that runs, via motor neurons that produce muscle contractions, backwards into the brain until neural causes are reached that occurred *before* the putative mental cause. Now these neural causes seem not to be *sufficient* for their neural effects. But they do seem to explain these effects to the extent that they can be explained at all (without descending to the micro-physical level); for current neurophysiology textbooks mention no neural effects to explain which it has been found necessary, or even advantageous, to posit immaterial causes. The most parsimonious and hence the best explanation of this state of affairs is that putative mental causes really do cause behavior (e.g., decisions), but that they are, or are realized by, neural states.[29]

I am generally bullish on physicalism, but it remains the case that physicalism cannot be true unless quantum mechanics can be given a realist interpretation and the contradiction

between quantum mechanics and general relativity satisfactorily resolved. These are areas of intense research, of course, so time, I assume, will tell.

Let me conclude, however, on an optimistic note – about philosophy. It is reasonable to wonder whether philosophy, especially when it is viewed over longer periods than the few decades that make up an individual philosopher's career, makes any intellectual progress. The evolution from materialism to physicalism suggests that sometimes, at least when it is linked to the progress of science, it does.

Notes

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1 The pioneering papers in the contemporary rise of physicalism, apparently written independently of one another, were Fodor 1974 and, especially, Hellman and Thompson 1975.

2 I ignore the question of whether *abstracta* fall outside the scope of hypotheses of comprehensive physicalism (but see Melnyk 2003a, 10–11 and Schneider 2017).

3 Or some modest extension of this physics; see Melnyk 2003a, 236n45.

4 His assertion is odd. He cannot have been unaware of the Epicurean swerve (*clinamen*, in Lucretius' Latin), but he does not mention it here.

5 Even if Russell's causal republicanism is true, there might still be causation at non-fundamental levels (see, e.g., Papineau 2013).

6 Carl Hempel first discovered the difficulty (Hempel 1969, 180–183, and 1980, 194–195). But Geoffrey Hellman was, I think, the first to articulate it fully in the context of formulating physicalism (Hellman 1985). I coined the name 'Hempel's dilemma' to honor Hempel, and slightly refined the substance (Melnyk 1997); the name has stuck.

7 Even if current physics it is improbable given the poor track record of physical theorizing, it may not be improbable given *total* evidence, because it is supported by more and better evidence than was past physics.

8 See, e.g., Wilson 2006 and especially Witmer 2018; for skepticism that the Dilemma can be evaded, see Montero 1999; Stoljar 2010. For an older but still useful survey, see Ney 2008.

9 As Roger Teichmann pointed out to me many years ago. Perhaps being an elephant could be expressed by some unimaginably complex predicate *constructible* from the predicates of current physics (see Melnyk 2003a, 78–80).

10 By 'considered view' I mean something other than a slogan or oversimplified formula.

11 Properly refined claims would have to speak of, say, possessing an exhaustive decomposition into parts all of which are atoms in the void.

12 The key fragment from Democritus is traditionally translated, 'By convention sweet and by convention bitter' (see, e.g., Taylor 1999, 8–9); but Sextus and Galen, I assume, took the Greek word translated as 'by convention' (*nomô*) to be related to the Greek verb *nomizô*, which often means to think or deem. The traditional translation is philosophically implausible. Some things *are* conventions, like exchanging gifts at Christmas, and they exist; but I doubt that a thing that is not itself a convention can exist but in a special way, 'by convention'.

13 *Not seeming to be identical* is not the same as *seeming not to be identical*. The latter would require a different discussion.

14 Saul Kripke's 1980 book ends by arguing *against* physicalism, but here I note a way in which its chief semantic doctrine *assists* the physicalist cause. In fact, I think Kripke's semantic externalism also undermines his later argument against physicalism, by removing any reason to expect a priori conceivability to be a reliable guide to metaphysical possibility.

15 The literature discusses this question under the heading of 'multiple realization' – which misleads because the argument in the text does not require adopting the positive view that non-physical properties are *functional* properties that are *realized* by physical properties;

dualists could advance the argument. See Aizawa and Gillett 2009 for an empirical case *for* multiple realization; Polger and Shapiro 2016 warn against overemphasizing the extent of multiple realization.

16 This identity claim, intended as sufficient for physicalism, is often called 'token-physicalism', as opposed to the 'type-physicalist' claim that every *property* (or state-*type*) is a narrowly physical property (or state-type). The late Jaegwon Kim critically examined token-physicalist claims made by Donald Davidson (1980) and Jerry Fodor (1974), and argued on several grounds that they do not qualify as physicalist (Kim 2012).

17 Geoffrey Hellman and Frank Thompson seem to have been the first to formulate physicalism (about properties) by appeal to supervenience, though they speak not of supervenience but (in model-theoretic terms) of *determination*, i.e., of the converse of supervenience (Hellman and Thompson 1975). More accessible treatments are Haugeland 1982; Horgan 1982; Lewis 1983 (361–365). By far the best attempt to formulate physicalism by appeal to supervenience is due to John Post (1987). David Chalmers offers a supervenience formulation of physicalism, prominently acknowledging the influence of Robert Kirk's earlier and unjustly neglected papers on the issue (Chalmers 1996, ch. 2). Kirk restates his formulation in Kirk 2013; he contrasts it with supervenience formulations, but it is clearly a close relative in that it appeals only to a modal relation between physical and non-physical. Frank Jackson also offers a supervenience formulation in Jackson 1998. Most, but not all, of these philosophers think that a *complete* formulation of physicalism – a formulation that covers *objects* (and perhaps events) as well as *properties* – requires an additional claim, say, to the effect that all objects (and perhaps events) are

exhaustively decomposable into fundamental physical objects (or events). Donald Davidson made a (weak) supervenience claim part of his 'anomalous monism' (Davidson 1980; originally published in 1970); but though Hellman and Thompson cite Davidson's paper in their 1975, they do not cite it as the inspiration for their principles of determination.

18 The terminology of 'global' supervenience, along with that of 'weak' and 'strong' supervenience, were introduced by Kim in a series of highly influential papers written during the eighties and reprinted in Kim 1993; for his later thoughts, see Kim 2005. There is no more important figure to read than Kim on the issues discussed in this chapter.

19 I here assume that physical properties are not individuated by the causal roles that they play (contrary to, e.g., Shoemaker 1998); but if they are so individuated, then this rationale for explicitly mentioning physical laws in a formulation of physicalism about non-physical properties lapses.

20 Other technical obstacles must be surmounted by a successful supervenience formulation of physicalism about non-physical properties (see McLaughlin 1995).

21 Despite Kim's groundbreaking exploration of supervenience, he never seems to have been sanguine about the prospects of appealing to supervenience to state a *sufficient*, as opposed to a merely necessary, condition for physicalism.

22 The central insight of the realization approach is that one can formulate physicalism by appeal to the relation of realization presupposed by functionalist views in the philosophy of mind. The development of the insight here is my own (Melnyk 2003a), but I took the

insight in 1991 from Richard Boyd (Boyd 1980), with encouragement from William G. Lycan (Lycan 1981). The insight was independently developed along similar lines by Jeffrey Poland (Poland 1994, ch. 4).

23 So, 'higher-order' doesn't mean the same as 'higher-level', which I take to mean 'non-fundamental'. Whether higher-level properties are higher-order properties is a substantive question.

24 This view of property-realization is due to Jessica Wilson and, independently, Michael Watkins (Wilson 1999). It is most fully developed by Sidney Shoemaker (2007). The underlying conception of properties is due to Sidney Shoemaker (1998). Discussion of how far the two developments of the realization approach really differ may be found in Melnyk 2009.

25 There is a view called 'a priori physicalism' (see, e.g., McLaughlin 2007), but the term is extraordinarily misleading, because a priori physicalism entails neither that physicalism is true nor that, if true, it is a priori! It claims instead that, *if* physicalism is true, *then* there is an a priori conditional claim whose antecedent is a complete description of the actual world in the language of physics, and whose consequent is a complete (positive) description of the actual world in non-physical terms.

26 The two assumptions together amount to vulgar Popperianism (vulgar because Popper rejected any notion of support by evidence). The first assumption is a feature of Philip Kitcher's non-Popperian account of confirmation, with which I sympathize (Kitcher 1993).

27 Compare J.J.C. Smart's similar remarks on Gosse's young-earth hypothesis (Smart 1959, 155–156). Any appeal to parsimony is controversial. I have argued (1) that skepticism about super-empirical criteria is no more credible than Humean skepticism about simple inductive extrapolation, and (2) that parsimony (like simple inductive extrapolation) can be given a reliabilist rationale (Melnyk 2015; Melnyk 2003a, 245–251).

28 The reasoning lightly sketched in this paragraph is elaborated elsewhere (Melnyk 2003a, 238–280, inspired by Oppenheim and Putnam 1958). It does not require that we can actually give reductive explanations of macro-phenomena in terms of fundamental physics.

29 This reasoning is a version (restricted to the case of *neural* effects) of the so-called 'causal argument', or 'argument from the causal closure of the physical', for physicalism, which seems to have originated with Christopher Peacocke (1979, ch. 3.3), but is most famously developed by David Papineau (2002, ch. 1 and appendix). Usually formulated deductively, it can also be formulated inductively (see Melnyk 2003b).