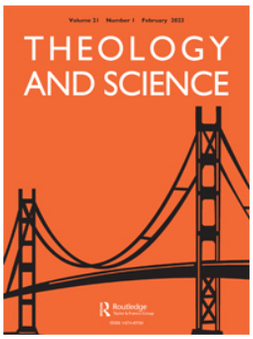

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Does God Act in the Quantum World? A Critical Engagement with Robert John Russell

Emily Qureshi-Hurst

ABSTRACT
Quantum Mechanics and its philosophical interpretation have proved fertile ground for theological reflection, particularly regarding divine action. Pioneer in this field, Robert John Russell, proposes a Non-Interventionist Objective Divine Action (NIODA) in which God acts in and through the quantum process to actualise events as a form of objective special providence. This paper brings into conversation literature that has not been combined before, providing a comprehensive and up-to-date analysis of NIODA. Following this assessment, this paper suggests that there are areas of incompleteness. Both theodicy and relevance for day-to-day human existence remain open questions in NIODA.

KEYWORDS
Quantum mechanics; non-interventionist objective divine action; special divine action; science and religion; Robert John Russell

A Return to Divine Action

Interest in divine action has blossomed over the last twenty years. Theologians are asking whether, and by what means, God acts in the world. Divine action discourse is as old as theology itself, so why the recent resurgence? One might suggest recognition of the failure of twentieth-century neo-Orthodox Protestantism to give divine action adequate attention.[1] Prominent theologian Ian T. Ramsey, for example, noted this failure and urged a return to the issue.[2] Process thought, founded on the philosophy of A.N. Whitehead, took a step towards rectifying the neglect of divine action in the twentieth-century turn away from liberalism. It has often, however, been found theologically wanting, leaving an appetite for an account which better accommodates both Scripture and tradition.[3] The last few decades have also seen a revival of Thomist accounts of divine agency applied to both physical and biological processes, which have opened up new grounds for exploration.[4]

In the Judeo-Christian tradition God is believed to be both eternal creator (Genesis 1, 1) and immanent actor (i.e. Psalm 66, 5). Traditionally, divine action has been divided into general and special providence to echo this distinction. The former supplies our universe, the laws that govern it and the entities within it, and is woven throughout the fabric of Christian Scripture.[5] The latter refers to events that are extra-ordinary and caused by God acting in the world at a specific time and place. Scripture indicates that divine action is more than a deistic general providence; God is present in nature and history. The God

of Israel is depicted as a God who acts, a tradition continued in the New Testament with a focus on the life, death and resurrection of Jesus of Nazareth.[6] For this reason, special providence forms the crux of contemporary debates. Though divine action is established in Scripture, natural philosophy and science have raised questions regarding how this occurs. Natural laws and apparently closed causal systems pose philosophical problems for any account of action from outside these laws and systems.

The recent return to divine action has been catalysed, in part, by an overturning of the Newtonian world-view that prevailed until the twentieth century. Newtonian mechanics seems to portray nature as causally deterministic, thus leaving little room for any divine action that does not break the laws of nature.[7] Determinism holds that for any event *e* at a time *t*, *e* will have sufficient explanation for its occurrence at *t*-1; and, that at time *t*, no event other than *e* could have occurred given the conditions at *t*-1. Every event was understood to have complete causal explanation in (the set of all previous events) + (the laws of nature). General providence is easy to accommodate in a world governed by Classical Physics – God was the first cause, instigator of the initial conditions, and fine-tuner of the constants that set the evolution of the universe, and eventually humanity, into motion. This is articulated by St Thomas Aquinas in the second of his five ways, the argument from efficient causation. Aquinas argues that there is an order of efficient causes, yet nothing may be said to be the cause of itself; thus, extrapolating backwards we must eventually reach a first cause: God. Aquinas understands God to be the first cause, bringing the universe and everything within it into being. Special providence, however, is almost impossible to accommodate without yielding to interventionism.

This led to Hume's famous critique of miracles, the ripples of which have carried through religious thought ever since.[8] Hume defined a miracle as a violation of the laws of nature to bring about an event which otherwise would not, indeed could not, have occurred. Specifically, this event must have occurred as a result of the direct agency of a divine or supernatural being.[9] Following Hume, if nature *is* a closed causal system, then any divine action *must* be interventionist namely, it intervenes in, suspends or breaks existing laws of nature. Hume's critique of such miracles has left a powerful legacy, and many contemporary accounts of divine action have sought to avoid interventionism for Humean reasons. The theological importance of non-interventionism is emphasised by John Polkinghorne:

> to suppose that God habitually acts against the grain of nature would seem to suggest the theological absurdity of God acting against God, since theologically the laws of nature are to be understood as expressing the faithful will of the Creator who ordains them.[10]

On the hypothesis that the laws of nature were set in place by God, and that God has perfectly free creative agency to set in place any logically possible set of natural laws, we can conclude that the laws of nature that govern the universe are exactly as God intended them to be. It seems incoherent to suppose that God would set up laws that he would have to break to realise his divine will.

"The Divine Action Project," co-sponsored by the Centre for Theology and the Natural Sciences and the Vatican Observatory, is a key example of the renewed interest in divine action which focuses on articulating an account which is non-interventionist. The Divine Action Project is presented in a series entitled *Scientific Perspectives on Divine Action*, volumes which emerged over 20 years of an international research

conference programme. The founder and director of the Centre for Theology and the Natural Sciences, Robert John Russell, has made a significant contribution to contemporary divine action debates, and his work merits serious consideration.

Referring to the work of Frank B. Dilley and Nancey Murphy, Russell argues that typically theologians' formulation divine action within a deterministic framework will be split roughly along conservative and liberal lines. The former camp tends to favour interventionist accounts in which God violates the laws of nature to produce special divine acts, whilst the latter prefer immanentist accounts in which God acts in and through natural processes.[11] Russell's explicit aim is to tread a middle path between these two distinct schools, constructing an account of objective divine action in which God acts in the world in special and particular ways, but does this in and through the ontologically open structure of the sub-atomic quantum realm. He proposes a divine action "lying between non-miraculous non-interventionist … one which combines the best of the preceding two categories while avoiding the problems of each of them."[12] God's action need not violate the laws of nature (in a Humean sense) to be objective and impactful.

By designating the quantum realm as the arena for divine action, Russell draws upon cutting edge science to give renewed credence to age-old ideas of providence. If he is successful then Hume's challenge is answered, and the credibility of objective divine action is preserved. Since Planck's accidental discovery of the "quanta" in 1900, substantiated by Einstein's 1905 paper on light quanta (now called photons), the scientific understanding of the nature of sub-atomic reality has undergone a sea-change.[13] This pivotal moment shook the foundations of the Classical, deterministic world-view that had prevailed since Newton and opened up the genuine possibility of ontological indeterminacy. Russell argues that this shift allows a renewed understanding of divine action by making non-interventionism easier to accommodate. Throughout the subsequent discussion I shall examine Russell's proposal for Non-Interventionist Objective Divine Action (NIODA). I will show, however, that due to philosophical qualms with this mode of divine action and potentially unsavoury implications for theodicy, his pioneering proposal is at this point incomplete. In order to iron out some remaining kinks, there is more work to be done.

Nioda and Quantum Physics

Russell states that "the notion of God's acting in the world is central to biblical witness,"[14] pointing to his "wonderful works" (Psalms 107, 21). He is concerned with objective divine action. This must be understood in contrast to subjective divine action, in which God acts uniformly in all events, some of which can be interpreted as "subjectively" significant "when a religious believer attributes to them specific revelatory meaning or distinctive divine agency."[15] He explains objectivity in counterfactual terms: objective acts of God are events that would not have occurred precisely as they did had God not acted in a distinctive or special way in bringing them about. His proposal seeks to ground these theological claims in contemporary science and its philosophical interpretation (namely, the Copenhagen interpretation of QM).

The quantum revolution overturned the classical conception of nature, which was typically interpreted as deterministic. Quantum mechanics, the highly counter-intuitive physics of the atomic and subatomic realm, does not necessarily share this deterministic

structure. Though the quantum seed was unwittingly planted by Planck in 1900, quantum physics took root with Einstein's 1905 paper on light quanta and continued through to the development of the Schrödinger equation in 1926. Quantum Mechanics is a formal system which has many interpretations, most of which are empirically equivalent.

The interpretation with which Russell is working is the Copenhagen interpretation.[16] It holds that at the most fundamental level, nature is ontologically indeterminate. This entails that each quantum event has a necessary but not sufficient causal explanation. Werner Heisenberg discovered that such uncertainty is a feature of the quantum world.[17] The Uncertainty Principle exposes a fundamental difference between quantum and classical mechanics, namely that there are uncertainty relations between pairs of properties such that both cannot be known at the same time, an example being position and momentum. This is due to the wave-particle duality of sub-atomic particles. Sub-atomic entities behave both as particles and as waves, and Heisenberg's Uncertainty Principle claims that the position and momentum of such a particle have no precise value until measurement takes place.

To clarify, whilst particles are understood to have precise locations, waves are disturbances spread out through space which have a wavelength. Wavelength is related to momentum such that a shorter wavelength corresponds to a higher momentum. Knowing the momentum of an electron, for example, would involve measuring the wavelength, whereas knowing the position requires measuring it as a particle. To ascertain the position *and* momentum of an electron, various waves must be combined into a wave-packet: a quantum object with both position and momentum. Certainty about position is lost as the entity is no longer restricted to a specific point, and certainty about momentum is lost as the wave-packet is comprised of waves with various wavelengths. These uncertainties are inextricably linked. The more precisely one property is measured, the higher the uncertainty of the other property becomes.

The Schrödinger wave equation explains the behaviour of quantum objects in terms of a wave function which deterministically evolves through time, until such an act of measurement takes place (a quantum event). Key to understanding "measurement" in quantum mechanics is the notion of superposition. Superposition follows from the mathematics and holds that a quantum object exists in all possible states until it is measured. The wave packet represents the superposition of the quantum object, and the Schrödinger equation describes its behaviour through time. At a measurement event, namely the collapse of a wave function, a range of possible outcomes can occur. The probability of a particle having a specific position is distributed in accordance with nature of the wave-packet.[18] The act of measurement itself affects the state of the thing being measured, causing it to occupy one state out of a possible range. Events actualised at this point can only be predicted within that probability range, and the Copenhagen interpretation claims that this indeterminacy operates on the ontological level.

Russell argues that the fundamental ontological indeterminacy described by the Copenhagen interpretation of Quantum Mechanics shows that natural causation is necessary but not sufficient to determine a quantum event. In a quantum event, God acts directly and objectively in and through the quantum process to actualise one of several possible outcomes. This action can then be manifested in the macro-world through bottom-up causality. Russell argues that "the collapse of the wave function

occurs because of divine and natural causality working together even while God's action remains ontologically different from natural agency."[19]

In claiming this Russell by no means wishes to reduce divine causality to natural causality.[20] God remains transcendent and wholly other. Indeed, it is a feature of the Copenhagen interpretation that there is no causally sufficient explanation for a quantum event in terms of a classical understanding of natural laws. Rather, for Russell, God acts in terms of general providence by creating quantum laws and in terms of special providence by acting together with these laws to continuously create and sustain the world and to act in special events in the world.

A Quantum Quandary?

Before proceeding with theological and philosophical analysis of Russell's NIODA, some brief scientific considerations must be given. It is essential to note that various interpretations of quantum mechanics are available, and NIODA is built upon the widely accepted Copenhagen interpretation championed by Bohr and Heisenberg. An alternative interpretation, known as the de Broglie-Bohm theory (or, "pilot wave model"), describes the wave function as a real, physical wave which guides particles.[21] The particle has a well-defined trajectory determined by the precise values of position and velocity that it possesses but which is hidden from measurement. As these variables are inaccessible to measurement, they are not subject to the constraints of the Uncertainty Principle. This, and other interpretations that make similar claims, are known as "hidden variable theories." Quantum systems are interpreted as ontologically deterministic, with any uncertainty being only epistemic. It is worthy of note that not all interpretations of quantum mechanics allow the sort of indeterminism required for Russell's thesis.

Since the work of John Bell in the 1960s, however, hidden variable theories have generally been out of favour. Bell's theorem demonstrated that any alternative to ontological indeterminacy, namely hidden variable theories, must be non-local if their predictions are to agree with quantum mechanics.[22] Due to the contentious nature of non-locality, this gave many physicists warrant to accept the ontological indeterminacy indicated by the Copenhagen interpretation and others like it. Nevertheless, in an article explaining the pilot wave model, John Bell himself argued that "like it or lump it, it is perfectly conclusive as a counter example to the idea that vagueness, subjectivity, or indeterminism, are forced on us by experimental facts."[23] The Copenhagen interpretation may be favoured, but it is not firmly established fact.[24]

In recent years several further interpretations have been offered, all of which are empirically equivalent. This point is emphasised in a 2013 paper, in which Maximillian Schlosshauer, Johannes Kofler and Anton Zeilinger present the results of a poll conducted on 33 participants in a conference on quantum mechanics. From the fields of mathematics, physics, and philosophy, 33 participants at the forefront of the discipline were asked which interpretation of quantum mechanics they favoured. The authors argue that their study "provides a unique snapshot of current views in the field of quantum foundations."[25] The findings showed that on such fundamental questions the community was deeply divided. 42% of participants named the Copenhagen interpretation as their preferred interpretation; 18% favoured Everett's many worlds interpretation; 24% chose the information-based/information-theoretical approach; 9% said

objective collapse; Quantum Bayesianism and relational quantum mechanics each received 6%; "other" and "I have no preferred interpretation" each scored 12%; and the modal, DeBroglie-Bohm, statistical (ensemble), and transactional interpretations each received 0% of the vote.[26]

As this "snapshot" shows, there is not a significantly favoured interpretation. Though the Copenhagen interpretation received the highest number of votes, it still received less than half. It is not clear that it is in a strong enough position to allow theological conclusions to be drawn. I acknowledge that there was a limited sample size of only 33 participants, but such fundamental disagreement by leaders in the field indicates the extent to which such central problems are unresolved. Quantum mechanics is not a completed totality; one should be cautious when drawing strong metaphysical or theological conclusions from the formalism. It contains many unanswered questions, and future empirical data may vindicate any one of these interpretations. For this reason, NIODA, in so far as it relies on the Copenhagen interpretation, could be seen as resting on shaky ground.

It is for this reason that John Haught asks "whether theology for the sake of its own integrity should ever employ concepts from physics, including contemporary quantum physics, as anything more than analogies?"[27] Tying theology too tightly to specific scientific theories contains significant risk. This point is illustrated by turning to William Paley's 1802 work *Natural Theology*. Paley's aim was to illustrate that belief in God could be substantiated by the natural world. He argued that intricate order and complexity in nature are evidence for the claim that the natural world was designed by an intelligent designer who created each entity for some divinely ordained purpose.[28] Paley used the available scientific data to draw theological conclusions. Yet just half a century later Charles Darwin published *On the Origin of Species* in which he presented his theory of evolution by natural selection. This work offered scientific explanation for features of the natural world which Paley had previously explained as evidence of God's creative design.

My point is not that Darwin's work negated Paley's natural theology. It is that new science was able to fill the space once occupied by Paley's account. Due to scientific developments, the apparent design of specific natural objects in their current form could be given naturalistic explanation. Intelligent design became a superfluous explanation of features which Paley had previously interpreted as indicative of a designer. The science at the core of Paley's argument had been overturned.[29] I include this example to demonstrate that tying theology too closely to science leaves open the very real possibility that the science will change, forcing a re-evaluation of the theology formulated upon it. If new empirical data leads scientists to abandon the Copenhagen interpretation, then Russell's NIODA must be significantly revised.

This objection is not fatal. Alvin Plantinga argues that though most quantum accounts of divine action use the Copenhagen interpretation, there are other collapse interpretations which allow similar arguments to be made. Plantinga looks to spontaneous collapse theories, theories in which the wave-function collapse occurs regularly and spontaneously as opposed to only at measurement effects. Spontaneous collapse theories have a macroscopic system undergoing localisation through collapse every 10^{-7} s.[30] There is nothing physical which causes the collapse to go to the particular value that it does. Yet, Plantinga argues, there could be a *non*physical cause, namely God. His argument then follows a line similar to that of Russell's: Divine Collapse Causation is a form

of special divine action, which, through bottom-up causality and supervenience, allows God to guide the macroscopic world. A detailed analysis of Plantinga's account cannot detain us here. Suffice it to say that he is using an alternative interpretation of quantum phenomenon to the Copenhagen interpretation, and is coming to similar theological conclusions as Russell's.[31] As such, if the Copenhagen interpretation were to flounder, that may not mark the demise of all quantum accounts of divine action.

Such scientific questions remain largely unanswered. There is not a single overwhelmingly persuasive interpretation of quantum phenomena. Russell rightly recognises the hypothetical nature of NIODA due to these hermeneutical uncertainties, stating that if an alternative interpretation of Quantum Mechanics proves correct then this would challenge his formulation of NIODA.[32] Polkinghorne also acknowledges that "an element of hand-waving cannot be avoided, but the key thing is to try to wave one's hands in a suitably promising direction"; with regard to this proposal "there is room for metaphysical manoeuvre."[33] In order to move forward with the analysis, we too can put aside these scientific considerations and tentatively accept that quantum mechanics may offer space for NIODA. These considerations are worthy of note, but if science and religion discourse is to proceed there must be an element of faith in the dominant science of one's historical period. Given this, and if ontological indeterminacy holds, then it appears *prima facie* to allow for divine action in a general and a special sense. But should we accept Russell's premise that bottom-up divine action is a theologically satisfactory picture of God's action?

Problems of Efficacy, Relevance, and Being Too Episodic

An obvious and open question when considering NIODA is: how relevant are quantum effects to human concerns? Nicholas Saunders challenges the efficacy of NIODA as a form of divine action, arguing that "the scale of quantum mechanical events must be a primary consideration."[34] To affect major and detectable change through quantum processes, God would have to determine a vast number of them over a considerable period of time. He asks us to imagine that God wished to annihilate the dinosaurs by redirecting an asteroid which, on its natural trajectory, would have skimmed the Earth's atmosphere. To steer it into a collision with the Earth using quantum adjustments, Saunders explains, would take three million years. This would require, for example, God to begin directing the asteroid long before dinosaurs even evolved. This seems cumbersome and vastly inefficient as a mode of action for an omnipotent being who has supposedly set up these laws in order to work through them. Though this does not challenge the internal coherence of NIODA, it does raise questions about whether an omnipotent being would choose such an unwieldly method.

The problem of relevance is developed by John Haught, who makes the point that whilst quantum processes are *elemental,* they are not ontologically *fundamental,* vis., with regard to the degree of being they possess.[35] He turns to Whitehead who notes that physics always arrives at its understanding of nature only by leaving out "those elements of our experience which stand out clearly and distinctly in our consciousness."[36] Quantum mechanics has distilled reality to a set of equations governing elemental natural processes. In locating divine action in the domain of quantum events Russell aimed to pinpoint God's interaction with the world in the most fundamental processes in

nature. Yet there is a significant problem here, in that quantum events are so far removed from our quotidian existence that it is hard to imagine why they are phenomenologically and theologically relevant. They are physically elemental, not morally, socially or psychologically fundamental.

We cannot, without delicate scientific experiment, perceive quantum effects. Despite indeterminacy at the sub-atomic level, the probability-range in which quantum events occur averages out at higher levels to give the appearance of determinism. The account of special providence the Copenhagen interpretation may facilitate seems to limit God's action to a realm phenomenologically inaccessible to human agents, the very agents for whom God is professed to feel deepest love and concern. The Bible attests that God is intimately connected to each human individual, for example (Psalm 139, 13–14). Any account of divine action that aims to be consistent with Scripture should reflect the intimacy of the divine-human relationship. If quantum effects cannot be directly felt in the social and psychological lives of human agents, then such an account of divine action is not theologically fruitful. This is a serious problem for Russell's hypothesis if he wishes to maintain that this conception of special providence and divine causality has direct and meaningful relevance for the domain of human experience.[37]

Russell does address this. He claims that quantum effects are amplified to have relevance at the macro level, but that the extent to which this occurs is an open question. He gives the example of quantum fluctuations affecting the development and structure of the universe – a truly macro effect indeed. Yet the concern remains, how can this form of divine action manifest in the ordinary everydayness of human existence?

A more directed formulation of this critique is offered by Polkinghorne, who has objected to NIODA on the theological grounds that such an account of God's action is episodic. The events in which indeterminacy is at play are measurement events, as it is here that wave function collapse occurs. In between measurements, the continuous determinism of the Schrödinger equation holds. As measurements only occur from time to time, so too would the divine acts that supposedly occur in and through them. Divine action, he argues, "must surely be assumed to have a more free-flowing character."[38] He argues that Russell limits the flexibility of God's agency.[39] If accepted, then the implications of this critique for Russell's thesis are unfavourable. An episodic account of divine action indicates capriciousness on the part of God, but even more troubling is the attack on God's omnipotence. As NIODA is constrained to quantum events, Polkinghorne maintains that the ability of God to act in and through any natural process is restricted.

Russell responds to the specific charge that God's action is restricted to the domain of measurement events by challenging Polkinghorne's narrow definition of what counts as a measurement event. Russell rejects Polkinghorne's claim that what counts as a measurement event is the set of all events in which a measurement is made by a scientist in a laboratory. Rather than measurement events being defined in this narrow sense, Russell argues that "the key to a measurement is the *irreversibility* of the result regardless of the size-scale of the phenomena involved."[40] Included in this broader class of measurement events are what Russell terms "micro-meso," and "micro–macro" events. The former are events in which a quantum object interacts with a small classical object, such as a photon being absorbed by a dust cloud in interstellar space, and the latter

includes the interaction of quantum objects with larger objects, such as the ocean absorbing sunlight.[41] Thus, the landscape for divine action of this kind is wider and more varied than Polkinghorne claims.

Russell further develops his response to Polkinghorne's charge of being too episodic through the idea of bottom-up causality.[42] The sciences supervene on one another: quantum processes affect organic chemistry, organic chemistry in turn affects molecular biology which affects life. This view of bottom-up causality begins to explain the way in which quantum processes affect the larger-scale processes which supervene on them in a non-episodic sense. His argument is that this occurs in ontologically indeterministic chance in evolution at the level of quantum mechanics underlying genetic mutation. Though there are a variety of factors that affect variation, he argues that "variation per se is ultimately due to genetic mutation."[43] He points to spontaneous mutations, errors in DNA replication and others as quantum sources of genetic mutation. It is through such mutations that God guides the evolutionary process in what Russell calls "theistic evolution."[44] God directly affects quantum processes which lead to indirect effects on populations and species: *creatio continua.* If quantum processes can directly affect organic processes, and therefore life, Russell's is a far less episodic picture of divine action than Polkinghorne claims. Moreover, such divine action is directly relevant to human concerns.

Quantum Biology and the Problem of Theodicy

The general motivation of NIODA is to construct a robust account of theistic evolution in which the hand of God can be understood to guide the evolutionary process without having to break or suspend the laws of nature. If this is the case, then the aforementioned critiques of relevance, efficacy, and being too episodic fade into the background.[45] Such critiques persist only if NIODA is taken as a one-size-fits-all account of divine action in the world. If, however, NIODA is but one piece of a larger puzzle in which other forms of divine action are accommodated, then those problems can be resolved by the inclusion of other, interventionist accounts.[46] It does not matter that NIODA cannot account for response to petitionary prayer, as Russell also believes that interventionist miracles form a part of divine action's rich tapestry; nor does it matter that it is a cumbersome method for enacting change, as it is not the only tool at God's disposal. Following this, the rest of this paper assesses NIODA on its own terms, as a specific account of bottom-up change that is primarily efficacious in the realm of quantum biology. As it turns out, a unique set of problems arises when considering NIODA in the biological realm which, I argue, seriously challenges NIODA's credibility.

Divine action through quantum biology leads to unsavoury implications for theodicy. If God's action in the quantum domain is not episodic, and instead God acts through quantum processes to actualise biological events like DNA mutations, then responsibility for diseases which come from such mutations must also lie with God. Cancer, for example, is caused by mutations in the genes that control cell growth. If responsibility for the quantum processes that cause genetic mutations lies with God, then by Russell's own account of bottom-up causality God is also responsible for the diseases themselves and the physical and psychological suffering they cause. To be consistent, the claim that moral responsibility is carried up the causal chain must apply to both praise and blame. If

God is considered ultimately responsible for the higher-level goods which emerge moving up the causal chain, such as speciation, then *mutatis mutandis* he is also responsible for cancers and other similarly caused diseases. Cancer is one of the primary causes of death in humans and brings with it great pain and suffering; the claim that God is responsible jars with the idea that God is omnibenevolent and is a significant problem for Russell's thesis.[47]

It seems to me that Russell is faced with an unappealing dilemma. Either he accepts Polkinghorne's claim that NIODA is episodic, and that *ex hypothesi* God is capricious and limited, or he rejects it in favour of divine action in and through all events at the quantum level, which filter through the bottom-up causal chain. In the latter case, he faces a serious problem of theodicy. Based on his body of work, it is fair to say that Russell would pick the second horn of the dilemma and face the problem of theodicy.

A particularly cutting articulation of the problem of theodicy is offered by Marilyn McCord Adams and Stewart Sutherland in their article *Horrendous Evils and the Goodness of God.* They define a distinctly problematic class of evils, namely horrendous evils, and claim that these present a unique challenge to the omnipotence and omnibenevolence of God. I contend that the types of illness and disease caused by genetic mutations fall within this class of horrendous evils, and as such a robust response is required if NIODA is to remain palatable. McCord Adams and Sutherland define horrendous evils as "'evils the participation in (the doing or suffering of) which gives one reason *prima facie* to doubt whether one's life could (given their inclusion in it) be a great good to one on the whole.' Such reasonable doubt arises because it is so difficult humanly to conceive how such evils could be overcome."[48] These evils are a particular problem as they overwhelm the positive value in a person's life and leave the individual doubting whether their life has been worth living.

This tragic assessment of one's own life in light of horrendous evils is troubling enough in a general and more vague articulation of a Christian worldview in which an omnipotent and omnibenevolent God exists and creates. The particular issue for Russell's proposal is that God is *directly* responsible for the onset of the disease through his action in genetic mutation. Though most of the examples McCord Adams and Saunders give of horrendous evils are moral evils (namely, caused by freely acting moral agents, as opposed to natural causes) it is not difficult to imagine an example of a biologically caused horrendous evil. Experiencing the loss of both one's parents to Huntington's disease, and then discovering that one has it oneself, might be a source of such overwhelming anguish. Huntington's is a genetic condition that affects brain cells and begins to manifest with radical changes to personality (often the development of violent behavioural characteristics and resulting in the disintegration of one's relationships) and ends in a drawn out and traumatic death. This and other similar examples are potential cases in which biologically caused suffering could engulf the positive value of an individual's life, and thus count as horrendous evils.[49]

Russell does address theodicy, in particular with reference to genetic theistic evolution. He begins by arguing that theodicy must be faced by any theological interpretation of evolution and is not restricted to his approach.[50] Whilst I accept this claim, specific and significant problems of theodicy arise in Russell's account. He argues that God "acts in, with, under and through [physical and biological] processes as immanent creator, bringing about the order, beauty, complexity and wonder of life."[51] This is

both *direct* and *objective*; Russell's project is to explicitly reject attempts to remove God from the detailed history of nature by offering an account of divine action which sees God's hand in every natural event. So, whilst he argues that "disease and death are simply natural prerequisites for the evolution of life," that won't do as theodicy for his particular account of divine action.[52] God is not simply indirectly responsible for the corollaries of the evolutionary process, such as disease and death, by virtue of God's creating and instating the laws by which it unfolds. Rather, God is *directly* responsible for each specific actualisation of disease and death. Russell claims that "God is genuinely, if inscrutably, at work, caring for every sparrow that falls."[53] Yet in a very real sense, given NIODA, God is the *cause* of every sparrow that falls. Is this divine immanence bought at too high a price?[54]

Russell recognises the inadequacy of this response, immediately offering a "more fruitful" response to the challenge of theodicy. This response is a holistic one which "begins with the insight that God created the universe with the evolution of moral agents in mind. In such a universe, suffering, disease, and death, are in some way coupled with the conditions for genuine freedom and moral development."[55] Such responses have the potential to leave a sour taste in the mouth – if suffering, disease, and death, are instrumental for the provision of genuine freedom and moral development then the suffering of innocent individuals must similarly be held as an instrumental good in providing the possibility of those goods to others. McCord Adams and Sutherland point to an important distinction to bear in mind when considering such theodical questions, namely the distinction between God as a provider of global goods and God as a lover of individual creatures.[56] Whilst Russell's "more fruitful" response appeals to the former divine characteristic, in so far as suffering is an indirect but necessary consequence of providing particular global goods, it leaves the latter wholly unaddressed. An individual suffering greatly due to genetic disease may still justifiably ask why a loving and active God caused, or failed to prevent, the cause of *her* suffering. NIODA cannot answer this question satisfactorily.

Ultimately, Russell's final appeal is to the overarching creation-redemption narrative that sits at the heart of Christianity, writing that "the search for an acceptable response to theodicy must move … to a fully-developed theology of redemption."[57] Meaning, the solution to the problem of evil and suffering lies in a theology of the cross. Redemption is promised for humanity and creation more widely, a redemption so glorious that suffering will fade away. Creation may, he argues, only be recognised as fully good in the eschatological future. Though this response leaves many questions unanswered (and much to be desired for those who want a concrete answer as to the meaning of their suffering now), it fits within the wider nexus of Christian beliefs. As Russell points out, "the problem of evil can only be addressed (though never 'resolved') within a theology of redemption and new creation."[58] One wonders, though, whether this is robust enough to respond to the specific concern that God in all God's goodness could cause, by direct action, such evil and suffering in the human and non-human biological sphere.

For NIODA, the problem of individual sufferers looms large. It is precisely the *direct* action of God in the evolutionary process that causes suffering. The specific mutation that caused the onset of terminal cancer in a young mother, for example, is caused through direct divine action. Even if Russell baulks at this conclusion and argues instead that God acts only in *some* instances, then God has refrained from acting (in a

way that God *does* sometimes act) to *prevent* a mutation that caused the onset of disease. On Russell's proposal as it currently stands, either God causes suffering and disease through bottom-up causality in the quantum biological sphere, or God refrains from preventing the onset of disease and the subsequent suffering (which God could do by using the causal mechanism NIODA outlines to stop a genetic mutation occurring in the first place). Either way, the source of suffering is within a domain in which God is causally efficacious and acts regularly. One's opinion on how fatal these matters are for the QM-NIODA project will be formed by one's wider theological commitments, but it seems to me that NIODA places God at the heart of the problem of evil. Whilst this is a brave acknowledgement of Creaturely responsibility for the sufferings that befall creatures, particularly as a result of genetic mutations, more must be done in order to allay fears that NIODA's God is at best capricious, and at worst cruel.[59]

Concluding Remarks

Throughout the above discussion, it has emerged that several objections can be levelled against Russell's proposal, each of which denote an area for further development. First, NIODA relies on the veracity of the Copenhagen interpretation. Quantum formalism is, as of yet, empirically neutral. Future developments in the field may mean that NIODA was, to use the Matthean parable, a house built on sand (Matthew 7, 24–27). Despite this, in the field of science and religion we must work within existing scientific frameworks; this requires a level of uncertainty, and Russell has chosen a well-respected interpretation with which to work. Furthermore, there are alternatives such as that offered by Plantinga which may offer a different quantum route to such an account of divine action. Neither Russell's proposal, nor NIODA more generally, is fatally wounded by this critique.

Second is the relevance for the deepest human concerns. Both the locus of, and the length of time needed for, quantum divine action feels removed from our quotidian existence. Psychological and social relevance is of utmost importance in a Christian framework, and in this regard NIODA could be found wanting. To remain entirely consistent with the biblical claims that God is love (1 John 4:8) and that human beings are the most important creatures to God (Genesis 1, 26), there is more work to do. Perhaps, however, what this critique reveals is the inadequacy of NIODA as a stand-alone account of divine action. As it was never devised as such, I expect proponents will not feel too discouraged by this. Standing alone, NIODA falls. But alongside a clearly articulated account of the puzzle of which it is a piece, it may yet be consonant with the Christian theology it is intended to serve. Whether this is the case depends on Russell's response to the most serious set of concerns, namely those raised by theodicy in the context of quantum biology. The claim that God is intimately involved with all events places direct responsibility for certain diseases, and the physical and psychological suffering caused, at God's feet. In order for NIODA to resonate with the claim that God is omnibenevolent, there is much more work to be done.

Given the previous assessment, key ways in which NIODA could be strengthened emerge. First, further explanation is required of how this formulation of NIODA fits into a wider and more comprehensive system of providence, which account for areas in which quantum mechanics has no perceptible affect. Russell himself notes R Dodds'

reference David Bartholomew, John Polkinghorne, and Philip Clayton as all claiming that quantum events cannot have macroscopic effects.[60] NIODA would benefit from fleshing out in this area if the challenge of relevance is to be adequately met.

Most importantly, concerns relating to theodicy loom large. Though Russell articulates that NIODA must fit within the broader creation and redemption narratives of the Christian faith, I contend that the scale of suffering caused by disease must be met with an equally robust theodicy which explains why this mode of divine action is acceptable. Russell must be more specific when dealing with the devastating consequences that such direct and objective divine action in the quantum realm can bring about. The previous critiques notwithstanding, Russell's work has been pioneering, original, and deeply thought provoking, and he deserves our thanks for getting this discussion underway.

Notes

1. In particular, the work of Karl Barth.
2. Ian T. Ramsey, *Models for Divine Activity* (London: SCM Press, 1973).
3. Process thought's emphasis on divine becoming and the almost inevitable consequence of pantheism/panentheism is often believed to be inadequate.
4. For example, Armand Maurer, "Darwin, Thomists, and Secondary Causality." *Review of Metaphysics* 57 (2004): 491–515 and Tom Settle, "The Dressage Ring and the Ballroom: Loci of Double Agency." In *Facets of Faith and Science Vol. 4*. (London: Pascal Centre for Advanced Studies in Faith and Science, 1996).
5. One example of many is Job 12:9–10.
6. For a detailed account, see Terence E. Fretheim, "The God Who Acts: An Old Testament Perspective." *Theology Today* 54 (1997): 6–18.
7. Russell cites Maxwell's electromagnetism and Einstein's General Relativity as further examples of deterministic physics. Robert John Russell, "What We Learned from Quantum Mechanics About Noninterventionist Objective Divine Action in Nature – and Its Remaining Challenges." In *God's Providence and Randomness in Nature: Scientific and Theological Perspectives*, ed. Joshua M. Moritz and Robert John Russell (West Conshohocken, PA: Templeton Press, 2018). For details of physics' complicated relationship with determinacy over time, see Charles Hoeffer, "Causal Determinism." In *Stanford Encyclopaedia of Philosophy* (2016).
8. David Hume, *An Enquiry Concerning Human Understanding*, ed. Tom L. Beauchamp (New York: Oxford University Press, [1748] 2000).
9. Paul Russell, "Hume on Religion." In *Stanford Encyclopaedia of Philosophy* (2017) offers a useful summary.
10. John Polkinghorne, *Quantum Mechanics: Scientific Perspectives on Divine Action* (University of Notre Dame Press, 2001), 188.
11. Frank. B. Dilley, "Does the God Who Acts Really Act?" *The Anglican Theological Review* 47 (1965): 66–80; Nancy Murphy, *Beyond Liberalism & Fundamentalism: How Modern and Postmordern Philosophy Set the Theological Agenda* (Valley Forge, PA: Trinity Press International, 1996), both cited from Russell, "What We Learned from Quantum Mechanics About Noninterventionist Objective Divine Action in Nature".
12. Russell, "What We Learned from Quantum Mechanics About Noninterventionist Objective Divine Action in Nature".
13. See Kragh, Helge. 2000. "Max Planck: The Reluctant Revolutionary." *Physics World* 13, no. 12 (2000): 31; Albert Einstein, "On a Heuristic Point of View About the Creation and Conversion of Light (Wikisource Translation)." *Annalen der Physik* 17 (1905): 132–48.
14. Robert John Russell, "Does 'the God Who Acts' Really Act? New Approaches to Divine Action in the Light of Science." *Theology Today* 56 (1997): 43–65, 46.

15. Robert John Russell, "Quantum Physics and the Theology of Non-Interventionist Objective Divine Action." In *The Oxford Handbook of Science and Religion* (Oxford: Oxford University Press, 2006), 579–95, 581.
16. For further details, see Jan Faye, "Copenhagen Interpretation of Quantum Mechanics." In *The Stanford Encyclopaedia of Philosophy* ([1997] 2014).
17. Russell, "Quantum Physics and the Theology," 586.
18. Shaun Henson, "Throwing Dice? Thoughts of God in a Quantum World." In *Abraham's Dice: Chance and Providence in the Monotheistic Traditions* (Oxford: Oxford University Press, 2016) 300.
19. Russell, "Quantum Physics and the Theology," 586.
20. Objections to this end have been advanced in Michael Dodds, *Unlocking Divine Action: Contemporary Science and Thomas Aquina* (Washington, District of Columbia: Catholic University of America Press, 2012). Russell responds in Russell, "What We Learned from Quantum Mechanics About Noninterventionist Objective Divine Action in Nature".
21. John Stewart Bell, "On the Impossible Pilot Wave." *Foundations of Physics* 12 (1982): 989–90, 992.
22. John Stewart Bell, "On the Einstein Podolsky Rosen Paradox." *Physics* 1 (1694): 195–200, 199.
23. Bell, "On the Impossible Pilot Wave," 993.
24. Of course, it is debatable whether any scientific theory can ever be called "firmly established fact."
25. Maximillian Schlosshauer, Johannes Kofler, and Anton Zeilinger, "A Snapshot of Foundational Attitudes toward Quantum Mechanics." *Studies in the History and Philosophy of Modern Physics* 44 (2013): 220–30, 1.
26. Ibid, 8.
27. John F. Haught, "Is Physics Fundamental? Robert Russell on Divine Action." *Zygon* 45 (2010): 213–20, 216.
28. Alister McGrath, *Darwinism and the Divine: Evolutionary Thought and Natural Theology* (Oxford: Wiley-Blackwell, 2011), 94.
29. The interaction between Paley's natural theology and Darwin's theory of evolution by natural selection is complex and requires close consideration of Paley's argument. The analysis required is outside the scope of this essay. Such discussion may be found in Anne M. Clifford, "Darwin's Revolution in the Origin of Species: A Hermeneutical Study of the Movement from Natural Theology to Natural Selection." In *Evolution and Molecular Biology: Scientific Perspectives on Divine Action* (The Vatican Observatory, 1998), 281–301.
30. Alvin Plantinga, *Where the Conflict Really Lies* (New York: Oxford University Press, 2011), 115.
31. In fact, Russell argues that if God determines the outcome of a collapse then the distinction between Plantinga's account and Russell's is negligible, and Plantinga's is a form of QM-NIODA. If anything, this strengthens the case for NIODA, as it provides an alternative quantum framework to the Copenhagen Interpretation within with such divine action is possible. Russell, "What We Learned from Quantum Mechanics About Noninterventionist Objective Divine Action in Nature," 156–60.
32. Robert John Russell, "Divine Action and Quantum Mechanics: A Fresh Assessment." In *Quantum Mechanics: Scientific Perspectives on Divine Action*, ed. Philip Clayton Robert John Russell, Kirk Wegter-McNelly, and John Polkinghorne (Vatican City State; Berkeley Vatican Observatory; Center for Theology and the Natural Sciences, 2001), 301–5; Robert John Russell, *Cosmology from Alpha to Omega: The Creative Mutual Interaction of Theology and Science* (Minneapolis: Fortress Press, 2008); Russell, "What We Learned from Quantum Mechanics About Noninterventionist Objective Divine Action in Nature".
33. Polkinghorne, *Quantum Mechanics*, 190.
34. Nicholas Saunders, "Does God Cheat at Dice? Divine Action and Quantum Possibilities." *Zygon* 35 (2000): 517–44, 540.
35. Haught, "Is Physics Fundamental?", 217.

36. Alfred North Whitehead, *Science and the Modern World* (The Free Press, [1925] 1967), 162.
37. Which he may not.
38. Polkinghorne, *Quantum Mechanics*, 189.
39. Plantinga's account avoids this particular objection.
40. Russell, "What We Learned from Quantum Mechanics About Noninterventionist Objective Divine Action in Nature".
41. Ibid. Both examples are Russell's own.
42. This is supported by a recent Ted talk Jim Al-Khalili, "How Quantum Biology Might Explain Life's Biggest Questions." TED (talk, 2015). In this talk, Jim Al-Khalili examines the emerging discipline of quantum biology, suggesting potential areas of biology which are affected by uantum processes. One example Al-Khalili gives is the potential effect of quantum tunnelling on DNA mutations.
43. Robert John Russell, "Special Providence and Genetic Mutation: A New Defense of Theistic Evolution." In *Evolution and Molecular Biology: Scientific Perspectives on Divine Action* (Vatican Observatory, 1998), 191–224, 206.
44. Ibid, 220.
45. Though they do not vanish entirely.
46. One cannot help wondering, however, why Russell has taken the time to construct such an intricate and thoughtful non-interventionist account of divine action if he believes that God can, and does, act in the world in interventionist ways anyway.
47. There is a plethora of examples of genetic diseases which level the same charges at NIODA's credibility. Cancer was chosen here due to its high prevalence.
48. Marilyn McCord Adams, and Stewart Sutherland, "Horrendous Evils and the Goodness of God." *Proceedings of the Aristotelian Society* 63 (1989): 297–323, 299.
49. I cannot emphasise enough that I do not wish to imply that all those who experience genetic diseases have the positive value of their life engulfed. I merely wish to point out that such illnesses can create circumstances of extreme suffering, which may or may not lead the individual to make such an assessment of their life. Indeed, even if a sufferer does believe their life has overall positive value for them (as I hope is the case for everyone), they may still legitimately ask why their disease was directly caused by the objective action of a benevolent God.
50. An excellent recent assessment of the issue of evolutionary theodicy can be found in Bethany Sollereder, *God, Evolution, and Animal Suffering: Theodicy Without a Fall* (Abingdon & New York: Routledge, 2019), 125–55, particularly, her chapter on special divine action.
51. Russell, "Special Providence and Genetic Mutation," 191.
52. Ibid, 222.
53. Ibid.
54. Russell does not directly address this problem; rather, he wants to situate his account of divine action within a larger framework of a theology of redemption, including references to Jürgen Moltmann's idea of the suffering God. He is working with the belief that God created the universe with the evolution of moral agents in mind, and in such a universe "suffering, disease and death are in some way coupled with the conditions of genuine freedom and moral development." Russell, "Special Providence and Genetic Mutation". It is not within the scope of this essay to address this wider theodicy. A detailed refutation of this response to the problem of evil is given in J.L. Mackie, "Evil and Omnipotence." *Mind* 64 (1955): 200–12.
55. Russell, "Special Providence and Genetic Mutation," 222.
56. McCord Adams and Sutherland, "Horrendous Evils and the Goodness of God," 302.
57. Russell, "Divine Action and Quantum Mechanics," 318–20.
58. Russell, "Special Providence and Genetic Mutation," 223.
59. Russell has pointed to a chapter by Thomas Tracy which tackles these issues, particularly the suffering of individual creatures, head-on. I leave it up to the reader to decide whether the solutions Tracy outlines satisfy the concerns I have outlined here. Thomas Tracy, "Evolution, Divine Action, and the Problem of Evil." In *Evolutionary and Molecular Biology,*

Scientific Perspectives on Divine Action, ed. Robert John Russell, William R. Stoeger, s. J., and Francisco J. Ayala (CTNS/VO, 1998), 526–30, and particularly page 529.

60. Russell, "What We Learned from Quantum Mechanics About Noninterventionist Objective Divine Action in Nature".

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