



Contents lists available at ScienceDirect

Studies in History and Philosophy of Biological and Biomedical Sciences

journal homepage: www.elsevier.com/locate/shpsc

Essay Review

Kant's anti-mechanism and Kantian anti-mechanism

Robert Hanna

Dept. of Philosophy, Univ. of Colorado at Boulder, USA
 Dept. of Philosophy, Univ. of Luxembourg, Luxembourg

When citing this paper, please use the full journal title *Studies in History and Philosophy of Biological and Biomedical Sciences*

Kant's organicism: Epigenesis and the development of the critical philosophy. Jennifer Mensch; Univ. of Chicago Press, Chicago, IL, 2013, p. 256, Price US \$45.00 cloth, ISBN: 9780226021980.

1. Introduction

It is well-known that in the *Critique of Pure Reason* (1781, 1787), the *Prolegomena to Any Future Metaphysics* (1783), and especially the *Metaphysical Foundations of Natural Science* (1786),¹ Kant is a self-described *Newtonian mechanist* about the natural spacetime world, in which, as human animals, we must live, move, and have our being.

But as early as 1763, in “The Only Possible Argument in Support of a Demonstration of the Existence of God,” Kant explicitly rejected the *preformationist conception* of biological generation and embryogenesis, according to which creatures pre-exist in their basic forms or structures, and require only the mechanical addition of bulk in order to develop. Instead, he defended the *epigenetic view*, whereby the basic forms or structures of creatures themselves are emergently generated by the spontaneous but also rule-governed operations of a vital source of some kind. He even went so far as to assert that:

it would be absurd to regard the initial generation of a plant or an animal as a mechanical effect incidentally arising from the universal laws of nature (2:114).

Moreover, at the very beginning of his Critical period, in 1771, Kant wrote that

the real principle of reason [is grounded] on the basis of *epigenesis* from the use of the natural laws of reason (17: 492).

Sixteen years later, in 1787 in the B edition of the first *Critique*, Kant described his system of transcendental idealism as “a system of the **epigenesis** of pure reason” (B167). In the *Prolegomena* he asserted

the identity (or at least the strong continuity) of mind and life: “life is the subjective condition of all our possible experience” (4: 335). In the Introduction to *Metaphysical Foundations*, he denied that there could ever be a mechanistic science of psychology (4:471). In the second half of the *Critique of the Power of Judgment* (1790), he not only asserted that “the mind is for itself is entirely life (the principle of life itself)” (5: 278) and also that

it would be absurd for humans ever to . . . hope that there might yet arise a Newton who could make comprehensible even the generation of a blade of grass according to natural laws (5: 400),

but also worked out a number of fundamental concepts and methodological themes in the philosophy of biology, including the notion of a living organism, or self-organizing system, the various distinct kinds of teleology, and the special role of teleological concepts and teleological thinking in the natural sciences. Finally, in the unfinished “Transition” project in the *Opus postumum*, Kant also hypothesized the dual emergence of natural mechanisms and organismic life (including mind) alike from a single ontologically neutral but also non-static material substrate, the dynamic aether (21: 206–233, and 241).

So Kant's commitment to Newtonian mechanism is, at the very least, somewhat conflicted. Indeed, it is arguable that Kant is at bottom an *anti-mechanist*. This is the upshot of Jennifer Mensch's excellent and fascinating philosophical–historical study, *Kant's Organicism*, which

starts by tracing the history of the life sciences as Kant would have come to know them, focusing especially on those philosophers and life scientists whose works directly engaged Kant during his intellectually formative years. Once Kant's connection to the life sciences has been established, the remainder of the book moves to an examination of the exact nature of the influence of these sciences on the emerging critical system.

E-mail addresses: robert.hanna@ext.uni.lu, robert.hanna@colorado.edu

¹ For convenience, I refer to Kant's works internally, that is, infratextually in parentheses. The citations include the corresponding volume and page numbers in the standard “Akademie” edition of *Kant's works*: *Kants gesammelte Schriften*, edited by the Königlich Preussischen (now Deutschen) Akademie der Wissenschaften (Berlin: G. Reimer [now de Gruyter], 1902-). For references to the first *Critique*, I follow the common practice of giving page numbers from the A (1781) and B (1787) German editions only.

When viewed from the perspective of the life sciences in this manner, Kant's theoretical philosophy becomes reframed as a philosophical project whose development was deeply influenced by the rise of organicism. (Mensch, pp. ix–x)

The thesis of *organicism*, in turn, “can be defined by its view of nature as something that cannot be reduced to a set of mechanical operations” (Mensch, p. 1).

2. Kant's anti-mechanism

Kant's Organicism contains an Introduction, which spells out the basic points of Kant's organicism, especially his commitment to the concept of biological epigenesis as a model for his Critical theory of cognition, and also seven chapters, which I will briefly summarize one-by-one.

Chapter 1, “Generation and the Task of Classification,” describes the intellectual state-of-play in natural history in the 17th and early 18th centuries. The first players are the mechanist corpuscularian Boyle, and Locke:

Locke was both a nominalist regarding species determination and a realist in believing that there were inner features contributing to species as well. In a similar fashion, Locke was both comfortable with a mechanical portrait of animal functioning and cognizant of the need for “inner principles” and “transformative forces” when it came to understanding the processes of organic life. And all this contributed to Locke's views of both nature and the proper task of classification. Reviewing Locke's early considerations of organic processes against the backdrop of corpuscular ontology reveals his sensitivity to the problems facing Boyle in the case of organic life. While Locke remained committed to the essential features of corpuscular science, he was nonetheless hesitant in the face of a straightforward endorsement of mechanical accounts of generation. (Mensch, pp. 27–28)

A similar hesitation as between mechanism and anti-mechanism can be found in the work of the second major player, Leibniz, who, heavily influenced by the Dutch microscopist Leeuwenhoek, took the view that “individuals were composed of living monads arranged hierarchically under a dominant entelechy or soul” (p. 29). In the *Monadology*, anticipating both the Turing test and also Searle's Chinese Room argument, Leibniz famously argued, by means of a thought-experiment whereby the goal-directed conscious processes of mind cannot be reduced to the external behaviors of an enormously complicated mill, that mentality cannot be reduced to physical mechanical operations. But at the same time, Leibniz also thought of the living monads as *spiritual automata* pre-programmed by a 3-O (i.e., omniscient, omnipotent, and omnibenevolent) God, the supreme monad, and endorsed preformationism.

One philosophical moral of this part of the story, I think, is that the very idea of mechanism is a hybrid that combines (i) *physical causal necessitation under general natural laws*, (ii) *Turing-computability*, and (iii) *natural determinism*, but although physical causal necessitation under general natural laws is sufficient for Turing-computability and determinism, it is not necessary. According to the Leibnizian account, there can be non-physical automata. Therefore we need to distinguish between (a) *causal mechanisms* (e.g., Coke machines) which are necessarily physical, and (b) *formal mechanisms* (e.g., computer programs of all kinds, in so far as they are realizable on a Turing-machine) which, although they are indeed physically realizable, are not necessarily physical: in principle, disembodied Cartesian souls could run Turing-computable sequences. Kant is at least implicitly aware of this important distinction between causal mechanisms and formal mechanisms,

because in the *Critique of Practical Reason* he explicitly rejects the reduction of all spontaneous activity, including life, but also especially including free will, to the operations of Leibnizian spiritual automata, deriding the latter as “the freedom of a turnspit” (5: 97).

Chapter 2, “Buffon's Natural History and the Founding of Organicism,” traces the origins of organicism to Georges Buffon's highly influential epigenesist treatise, *Natural History*, the first three volumes of which appeared in 1749:

With Buffon natural history . . . became an attempt to grasp a living nature, to grasp species across time and, as a consequence, to base the classification of species upon genealogy. This marked a dramatic transformation in the history of a discipline that until then had been first and foremost a science oriented by its search for the means of discovering nature's divisions and, for that reason, not at all by the patterns of its underlying unity. (Mensch, p. 50)

Strictly speaking, Buffon's version of epigenesis is still compatible with mechanism, whether causal or formal. And the full theory of epigenesis would have to await the further postulation, in the 1780s, of organic vital forces or emergent vital forces, “like Caspar Wolff's *vis essentialis* and Johan Blumenbach's *Bildungstrieb*” (Mensch, p. 36)—which of course anticipate later more famous 19th and 20th century vitalist notions like Schopenhauer's *Wille zum Leben* and Bergson's *élan vital*. Nevertheless, the theoretical ground was prepared for Kant's organicism.

Chapter 3, “Kant and the Problem of Origin,” provides an account of Kant's pre-Critical work on cosmological and biological questions of origin, and shows how this work not only smoothly fused with, but also primed, his Critical concern with the origins, scope, and limits of cognition and knowledge. As Mensch puts it, there was

an intimate connection, in Kant's view, between attempts to discover a “principle of life” within natural organisms and the search for something beyond the limits of the everyday world. (Mensch, p. 61)

In other words, Kant found a paradigm case of the burning need for his Critical distinctions between *phenomena and noumena* on the one hand, and between *the transcendental and the empirical* on the other hand, in the debate about the origins of life:

It was the unity of purposes within organic life, the fact that organisms could be both self-sustaining and vigilant regarding the need for repair, that made natural products amazing, not the mechanical operations themselves. For Kant it was thus the principle of life, the capacity for a being's generation and self-organization that needed explaining, and recourse to neither supernatural nor purely mechanical grounds of explanation could satisfy that need. (Mensch, p. 64)

Basically, what is humanly cognizable and knowable about life (the organicist phenomena) are the non-mechanical, spontaneous activities of the perceivable organism, not some vital substance with an intrinsic non-relational essence hiding behind the appearances (the organicist noumenon). Correspondingly, what explains the non-mechanical spontaneous activities of the *minded* organism is just the functional postulation of a non-empirical, innately-specified capacity, or faculty, to generate representations in precisely *those* self-consciously introspectible ways when triggered by sensory input (the transcendental), and not determination by merely sensible, contingent, mechanically-operating facts (the empirical).

Chapter 4, “The Rebirth of Metaphysics,” get us to the heart of the matter. As every careful reader of Kant's first *Critique* knows, the Critical philosophy has both a negative part, *the critique of pure reason*, and also a positive part, *transcendental idealism*. More

precisely, Kant holds that all rational human cognition and knowledge is necessarily limited to all and only sensible objects and facts, and that any attempt to have knowledge beyond those limitations by reason alone is fated to collapse into fallacy or contradiction, even though at the same time our felt need to transcend the limits of sensibility is an essential and natural feature of our reason that is ultimately practical and moral, not theoretical or speculative (=the critique of pure reason). He also holds that all the proper objects of human cognition are strictly mind-dependent appearances or phenomena, not mind-independent things-in-themselves or noumena (=cognitive idealism), and that necessarily the essential structures of phenomena conform to the innately-specified cognitive capacities of rational human animals for generating representational contents (=representational transcendentalism), so that necessarily the world we cognize has the very same structures as our minds—hence, we can know such necessary structural facts about the world a priori (=synthetic a priori truth and knowledge) and any sort of global epistemic skepticism or epistemic luck is metaphysically impossible (=transcendental idealism).

Above all, what organicism contributes to this basic Critical framework is the thesis that the *transcendental* aspect of cognition is to be understood in terms of the model of biological *epigenesis*, which gets between the philosophical rock of mystical rational platonism and preformationist rationalist innatism on the one hand, and skeptical naturalist empiricism on the other (Mensch, pp. 80–91). What is innate for Kant is only the procedurally rule-governed active capacity for generating representations and for free agency, neither the representations themselves nor the moral principles themselves: in short, Kant's "system of the **epigenesis** of pure reason" is *constructivist-proceduralist innatism*. As Mensch later rightly puts it,

[t]he only thing innate to the mind [for Kant], therefore, was its deep sense of possibility, of the mind as a site of spontaneity and freedom, of freedom that could be perfected or realized in the creation of itself and its experience through the act of cognition. (Mensch, p. 108)

Chapter 5, "From the Unity of Reason to the Unity of Race," argues that Kant's concern, in the Transcendental Deduction of the Pure Concepts of the Understanding, or Categories, and more generally in the second half of the first Critique, with the transcendental unity of experience and with the systematic unity of reason, is matched by and fully reflected in his views on the unity of species and races.

Chapter 6, "Empirical Psychology in Tetens and Kant," presents a case for claiming that J.N. Tetens's empirical psychology, as worked out in his 1777 book, *Philosophical Essays on Human Nature and its Development*, in which he explicitly characterizes the human mind as a medium for "evolution through epigenesis" (Mensch, p. 112), provided an organicist conception of mental activity that highly influenced Kant, although Kant rejected Tetens's empiricist-naturalist psychologism, and replaced it with anti-naturalist, rationalist apriorism.

And finally, chapter 7, "Kant's Architectonic: System and Organism in the *Critique of Pure Reason*," develops and defends the thesis that not only Kant's pure general and transcendental logic, but also the underlying conception of rational systematicity that guides his dialectical logic, are all grounded on a deeper "organic logic" of teleological development and conceptual integration. According to this "organic logic," holistic purposive schemes in nature, theory, and morality are all immediately grasped by what Kant in the third Critique calls an "intuitive understanding." Although Mensch does not explicitly say it, it is very easy to see how this Kantian "organic logic" is the fundamental segue to Hegel's absolute idealism, and

indeed, precisely this philosophical story has been brilliantly recently worked out in great detail by Eckart Förster in *The Twenty-Five Years of Philosophy*.²

3. Contemporary Kantian anti-mechanism

I have no criticisms of Mensch's excellent and fascinating book, but only some follow-up reflections inspired by it.

Kant's organicism, as Mensch's book so effectively shows, captures Kant's brilliant insight that mechanical principles and facts cannot explain what I have been calling *the organicist phenomena*:

- (i) natural teleology or organismic life, including plants and animals,
- (ii) any organism with proprioceptive enantiomorphic awareness of the difference between its right side and its left side (or top and bottom, or front and back, etc.), or an awareness of the difference between its own past, present, and future: the feeling of egocentrically-centered (here) embodied orientation in a global space-structure with intrinsic directions, and egocentrically-centered (now) asymmetric duration in a global time-structure, i.e., the feeling of organismic, conscious life, whose phenomenal characters are all modes of pleasure or pain,
- (iii) human mentality, including consciousness, intentionality, imagination, conceptualizing, judging, and inferential reasoning,
- (iv) human spontaneity, agency, and source-incompatibilist free will, and
- (v) human rationality, especially including its being inherently guided by non-instrumentally normative principles.

But at the same time, Kant himself could never fully advance beyond the thesis that organicist concepts have only a *regulative* use, not a *constitutive* use. Why not? It seems to me that Kant was needlessly bedazzled by the very ideas of Newtonian mechanics and Newtonian mechanism, as jointly constituting a hyper-successful research program in 17th and 18th century natural science. *Over-impressed* by this (admittedly still very impressive) Newtonian program, Kant could not see that the existence of a natural world which fundamentally contains significantly many causal-mechanical and formal-mechanical deterministic processes is perfectly consistent with the manifest organicist fact that the natural world *also* fundamentally contains significantly many *non-mechanical, non-deterministic* processes in it, including teleological processes, mental processes, and rational processes, as well as the inherent non-instrumentally normative principles guiding the specifically rational processes. Indeed, we already know from Gödel's second incompleteness theorem that formal-mechanical processes of Turing-computable *proof* presuppose non-mechanical semantic processes of non-Turing-computable *truth-determination*. So universal formal mechanism is provably false. Why then should we accept universal *causal* mechanism, especially when one of its necessary conditions is the supposed universality of formal mechanism? In other words, what I am proposing is that, with the organicist phenomena as a starting-point, we can postulate that the natural world is fundamentally *dual aspect*, and that it is at once mechanical-deterministic in one of its fundamental dual aspects, and also non-mechanical-non-deterministic (in a word, *organicist*), in the other of its fundamental dual aspects, including the irreducible existence of both causally non-mechanical processes and also formally non-mechanical processes.

² See also Hanna (2013a).

So, quite apart from Kant's own needless deference to the Newtonian research program, we can, in a fully Kantian spirit, put forward the radical thought that there is a fully *constitutive* use of organicist concepts, *insofar as they are required by a transcendental inference to the best explanation of all the organicist phenomena*. Or, to borrow a recent lovely formulation by Thomas Nagel in *Mind and Cosmos* (for which, predictably, he has received a torrent of angry criticism from scientific naturalists³), we can put forward the radical Kantian thought that "rational intelligibility is at the root of the natural order."⁴ In any case, here is the basic line of reasoning behind that radical Kantian thought.

Kant's fundamental philosophical problem, the one that he struggled with throughout his long philosophical career, is this: How can the existence of non-mechanical, non-deterministic facts that are necessary for the purposes of morality, be made consistent and coherent with the thesis that necessarily, all the natural objects studied by physics (i.e., the "objects of experience") are mechanical and deterministic? Since all organisms, including conscious rational human organisms, or human persons, are non-mechanical and non-deterministic, then Kant's fundamental problem becomes focused like a laser beam on this specific formulation of his fundamental problem: How can the existence of living conscious rational human animals, i.e., human persons, capable of genuine incompatibilistic free will, necessary for the purposes of morality, be made consistent and coherent with the thesis that necessarily, all the natural objects studied by physics (the "objects of experience") are mechanical and deterministic?

As every reader of Kant's first *Critique* knows, for Kant, there are two basic kinds of objects:

- (i) *phenomena*, namely spatiotemporal objects directly accessible to and knowable by human sensory intuition and sense perception, that are constituted by relational properties, especially including relations to actual or possible human sensible minds, and
- (ii) *noumena*, namely non-spatiotemporal, humanly sensorily inaccessible, unperceivable, and unknowable objects, which may or may not exist, but even if they do exist, are constituted by intrinsic non-relational properties, and are at best barely consistently thinkable by means of concepts.

But what many readers of the first *Critique* have *not* noticed is that equally important for Kant is the distinction, exclusively within the domain of phenomena, between:

- (ia) *undetermined* objects of empirical intuition, a.k.a., *appearances*, and
- (ib) *fully determined* objects of empirical intuition, empirical concepts, empirical judgments, and pure *a priori* concepts of the understanding, a.k.a. *objects of experience*.

For Kant, as a Newtonian mechanist and also a LaPlacean determinist about physical nature insofar as it is correctly described by physics, *mechanism necessitates natural determinism*, and conversely, *natural determinism entails mechanism*. So all the actual and possible objects of experience are mechanical and deterministic.

But here's the rub: all and *only* the actual and possible objects of experience are mechanical and deterministic, but *not* all the actual or possible appearances. Since the total set of pure *a priori* concepts of the understanding specifies a world of objects inherently governed by Newtonian mechanistic principles and laws, then, although all the fully determined objects, i.e., the objects of experience, are inherently governed by Newtonian mechanistic principles and laws, and therefore are *deterministic* and not free, it does *not* follow that all the *undetermined* objects, i.e., the appearances, are either mechanical—whether causal-mechanical or formal-mechanical—or deterministic.

In other words, since for Kant the sensible intuitability of an object, independently of concepts, is the criterion of the object's real possibility, then it is either actual or at least really possible that at least *some appearances* are non-mechanical and non-deterministic, and that they are cognitively accessible by means of *essentially non-conceptual sensible intuitions*.⁵

Let us call such essentially non-conceptually sensibly intuitable appearances, insofar as they actually exist, or were they to exist, *rogue objects*, since they fall outside the Categories and the system of transcendental principles, or at least fall outside Kant's *causal-dynamical principles* (i.e., the Analogies of Experience) and therefore outside the deterministic causal laws of nature.⁶ The actual existence or real possibility of rogue objects would mean that the phenomenal natural world, i.e., the manifest world, the world of Wilfrid Sellars's "manifest image,"⁷ actually or really possibly includes some *appearances* that are also not *objects of experience*, namely the rogue objects, and that we can access these rogue-object phenomena only through essentially non-conceptual intuition. These non-mechanical, non-deterministic rogue-object phenomena, in turn, would include *all and only the organicist phenomena*, as specified above, and this would in turn directly imply that the phenomenal natural or manifest world includes some objects that are also *not* objects of mechanistic physics, mechanistic chemistry, and mechanistic biology, and therefore also that mechanistic natural science is *not*, to borrow Sellars's famous phrase, "the measure of all things."⁸ So *scientific* or *physicalist* naturalism, whether reductive or non-reductive, would be false, and mechanistic natural science would apply to all and only the natural objects and facts to which it applies, but not to all actual or possible natural objects and facts. In short, mechanistic natural science would have *philosophical limits within nature itself*.

Contrary to scientific or physicalist naturalism, then, the thesis of *liberal* or *organicist-idealist* naturalism would be true. More precisely, the liberal naturalist, or organicist-idealist naturalist, thesis says that the manifest world fundamentally contains the real existence or real possibility of organismic life, the feeling of life, mind, source-incompatibilist free will, persons, human rationality, and non-instrumental normativity as basic organicist facts of nature, along with the basic formal-mechanical and causal-mechanical physical facts, and that the basic kind of item is *dynamic systems*, or *dynamic processes*, both mechanical/deterministic and non-mechanical/non-deterministic, such that the mechanical/deterministic kind presupposes either the actual existence or the real possibility of the non-mechanical, non-deterministic kind. Bluntly put: *source-incompatibilist free will and non-instrumental rational human normativity are facts of organismic life, and partially*

³ The standard criticisms of Nagel (when they aren't simply ad hominem) are (i) that he is ignorant of recent and contemporary work in evolutionary biology, and (ii) that he completely overlooks the distinction between reductive and non-reductive biological (or more generally, scientific) naturalism. I think that these worries are nothing but philosophical red herrings, intentionally or unintentionally employed in order to avoid facing up to the main point that Nagel is trying to make. See Hanna (online paper, 2014).

⁴ Nagel (2012, p. 17).

⁵ Hanna (2005, 2008, 2011a, 2013b, (in press) chap. 2).

⁶ See Hanna (2011b, 2013c, unpublished MS).

⁷ See Sellars (1963b).

⁸ Sellars (1963a).

constitutive of physical nature. Or in Nagel's words again, "rational intelligibility is at the root of the natural order." This, in turn, would solve Kant's fundamental problem, not by appealing to anything supernatural, but instead by liberalizing our concept of physical nature.

As I have said, I think that Mensch's *Kant's Organicism* is an excellent and fascinating philosophical–historical study, well worth reading for any Kant-scholar. It also provides a rich source of stimulating ideas for contemporary Kantian philosophers.

References

- Förster, E. (2012). *The twenty-five years of philosophy* (B. Bowman, Trans.). Cambridge, MA: Harvard Univ. Press.
- Hanna, R. (2005). Kant and nonconceptual content. *European Journal of Philosophy*, 13, 247–290.
- Hanna, R. (2008). Kantian non-conceptualism. *Philosophical Studies*, 137, 41–64.
- Hanna, R. (2011a). Beyond the myth of the myth: A Kantian theory of non-conceptual content. *International Journal of Philosophical Studies*, 19, 321–396.
- Hanna, R. (2011b). Kant's non-conceptualism, rogue objects, and the gap in the B deduction. *International Journal of Philosophical Studies*, 19, 397–413.
- Hanna, R. (2013a). Forward to idealism: On Eckart Förster's *The twenty-five years of philosophy*. *Kantian Review*, 18, 301–315.
- Hanna, R. (2013b). Kant, Hegel, and the fate of non-conceptual Content. *Hegel Society of Great Britain Bulletin*, 34, 1–32.
- Hanna, R. (2013c). Kant's theory of judgment. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy* (Fall 2013 Edition). Available online at URL = <<http://plato.stanford.edu/archives/fall2013/entries/kant-judgment/>>.
- Hanna, R. (in press). *Cognition, content, and the a priori*. Oxford: Oxford Univ. Press.
- Hanna, R. (online paper, 2014). Nagel & me: Beyond the scientific conception of the world. Available online at URL = <https://www.academia.edu/4348336/Nagel_and_Me_Beyond_the_Scientific_Conception_of_the_World>.
- Hanna, R. (unpublished MS). Blind intuitions, rogue objects, and categorial anarchy.
- Kant, I. (1902-). *Kants gesammelte Schriften*. Königlich Preussischen (now Deutschen), Akademie der Wissenschaften (Eds.), Berlin: G. Reimer [now de Gruyter].
- Nagel, T. (2012). *Mind and cosmos*. Oxford: Oxford Univ. Press.
- Sellars, W. (1963a). Empiricism and the philosophy of mind. *Science, perception, and reality* (pp. 127–196). New York: Humanities Press.
- Sellars, W. (1963b). Philosophy and the scientific image of man. *Science, perception, and reality* (pp. 1–40). New York: Humanities Press.

If you have an idea for a Special Issue that you would like to propose, welcome to submit via the following ways. Selected Journal:*
Biomedical Sciences. Or click [here](#) to select another journal that is more appropriate for your research field. Special Issue Title
Biomedical sciences are a set of sciences applying portions of natural science or formal science, or both, to develop knowledge, interventions, or technology that are of use in healthcare or public health. Such disciplines as medical microbiology, clinical virology, clinical epidemiology, genetic epidemiology, and biomedical engineering are medical sciences. In explaining physiological mechanisms operating in pathological processes, however, pathophysiology can be regarded as basic science. What do biomedical sciences graduates do? The top three medical professional jobs include nurses (11%), biochemists and medical scientists (9%) and laboratory technicians (7%). Destination.Â Find out what other biomedical science graduates are doing 15 months after finishing their degrees in What do graduates do? Graduate destinations data from the Higher Education Statistics Agency. Find out more.