

Eliseo Fernández

# From tendencies to purposes

Peirce between Aristotle and Kant

**Abstract:** In this article, Fernández examines a remarkable convergence of ideas in Peirce’s mature thought: the Aristotelian notion of causal powers or capacities and its possible combination with some ideas about finality that Kant advanced to make sense of the notion of purpose in the behavior of organisms. He argues that this proposed synthesis deserves to gain relevance in light of new investigations aimed at clarifying issues concerning causality and explanation in science, especially in biology. After reviewing new developments and interpretations concerning the notions of mechanism, teleology, and purpose, especially in regard to their origins in the Kantian tradition, Fernández concludes this trailblazing study by hypothesizing that the characteristic “finality” of biological teleology (manifest in the very idea of purpose) results from the interaction of two basic types of causation: *efficient causation* and *semiotic causation*. This a standpoint that incorporates ideas from Peircean semiotics to characterize and justify biological teleology.

**Keywords:** biological teleology; causality; efficient causation; finality; mechanism; semiotic causation

---

**Corresponding editor:** Cary Campbell, Simon Fraser University, Vancouver, Canada, e-mail: clc25@sfu.ca

## 1 Introduction

Much has been written on the importance of the notions of habit and purpose in the philosophy of Peirce, but until now not much work has been directed to address the way in which these original Peircean conceptions can unify important elements of the Aristotelian tradition with ideas originating in Kantian philosophy. It is to be hoped that this situation may change in the near future, as a result of new trends, in the wake of an extraordinary resurgence of Kantian and Aristotelian ideas in today’s philosophy of science.

I would like to contribute to this task by examining a remarkable convergence of ideas in Peirce’s mature thought, which previously had scarce

connection to each other. I am referring to the Aristotelian notion of causal powers or capacities and its possible combination with some ideas about finality that Kant advanced to make sense of the notion of purpose in the behavior of organisms. This proposed synthesis deserves to gain interest and relevance in light of new investigations aimed at clarifying issues concerning causality and explanation in science, especially in biology.

The argumentation is organized as follows. Firstly, I will review a group of philosophical positions much discussed at present. Notwithstanding some manifest differences among these views, they share a common conceptual core, in that they all offer accounts of physical or biological causation in terms of *dispositions, powers, capacities, or tendencies*. Secondly, I will briefly consider recent reevaluations and reconsiderations of the import of Kantian ideas on Peirce's thought. Thirdly, I will review new developments and interpretations concerning the notions of mechanism, teleology, and purpose, especially in regard to their origins in the Kantian tradition. Finally, I will sketch a fledgling synthesis of some of these issues, inspired by ideas discernible in Peirce's late thought and aimed at clarifying or solving some difficult philosophical problems in the application of the ideas of finality and purpose in biology.

## 2 Dispositions, Aristotelian powers, and explanatory mechanisms

By means of his notion of *habit* Peirce was able to retrieve and generalize a view of physical causation rooted in Medieval Aristotelianism. According to this notion, natural entities and processes have built-in causal dispositions or tendencies that drive them to act repeatedly in the same well-defined manner each time specific circumstances occur. For instance, a sample of nitroglycerine kept in a glass jar remains inactive under normal circumstances, but if triggering circumstances occur (such as a strong blow with a hammer), a powerful explosion ensues. In completely different circumstances, this same substance manifests very different causal dispositions. For instance, when injected into a subject with angina pectoris, it acts as a potent vasodilator.

Peirce generalized this conception of causal disposition through his notion of habit, conceived as a self-generalizing tendency. This is a tendency to acquire new tendencies, along with the repeated manifestations of previous tendencies, each time the precipitating circumstances are themselves repeated. Habits tend to generalize themselves:

[...] all things have tendency to take habits. For atoms and their parts, molecules and groups of molecules, and in short every conceivable real object, there is a greater probability of acting as on a former like occasion than otherwise. This tendency itself constitutes regularity, and it is continually on the increase [...] It is a generalizing tendency; it causes actions in the future to follow some generalization of past actions; and this tendency is itself something capable of similar generalizations; and thus is self-generative. (CP 1.409, 1890)

In current philosophy of science, a great number of authors put forward conceptions aimed at explaining physical causation in terms of ideas quite similar to that of Peirce's habit. Instead of the term *habit*, numerous articles and books on this subject use words such as *dispositions*, *tendencies*, *powers*, *propensities*, *natures*, or *capacities*, quite often as nearly synonymous. With rare exception (I do not know of any examples) these authors ignore Peirce and his notion of habit.

It is impossible to fully consider here the common features of *dispositionalist* conceptions of causation, much less to discern often-subtle differences among them. Therefore, I restrict my account to communicating the gist and flavor of these positions as far as possible through a few illustrative quotations:

According to a standard characterization of dispositions, when a disposition is activated by a stimulus, a manifestation of that disposition typically occurs. For example, when flammable gasoline encounters a spark in an oxygen-rich environment, the manifestation of flammability — combustion— occurs. (McKittrick 2010)

Instead of strict laws of nature, governing the behaviour of objects, a dispositionalist emphasizes that things have real causal powers. They behave the way they do in virtue of their own dispositional properties, not because of external laws. (Mumford and Anjum 2011)

Aristotelian powers, we maintain, are part of the basic ontology of nature – at least as nature is pictured through the lens of modern science. We defend these powers not on general metaphysical grounds but rather show their importance for making sense of contemporary scientific practice. (Cartwright and Pemberton 2013)

I think it is unfortunate that the advocates of the dispositionalist view of causation ignore Peirce's contributions; his ideas are forerunners to their current accounts and in some respects, superior, in my opinion. Several of Peirce's original ideas – his universal categories, his notion of real possibility, or his contention that the notion in greatest need of explanation is precisely that of law— have obvious affinities with dispositionalist ideas, and could contribute to their development.

In the work of some authors, including Nancy Cartwright and John Pemberton, the dispositionalist view becomes allied to *mechanism* (a position not to be confused with “mechanicism,” as I discuss later). This is a philosophical stance that sets store in the central role of explanatory mechanisms in scientific practice.

### 3 Peirce and the Kantian tradition

Relations between Peirce’s thought and the Kantian tradition seem confusing and enigmatic.<sup>1</sup> On the one hand, Peirce reiterates his admiration for Kant and recounts that his philosophical initiation was concurrent with a deep and protracted study of the Critique of Pure Reason. On the other hand, he often expressed serious disagreements and occasionally vehement rejection regarding basic ideas of that philosopher. Peirce said that in his youth he was “a passionate devotee of Kant” (CP 4.2, 1898); but early on there appear growing discrepancies, especially about the employment of logic:

In my studies of Kant’s great Critic, which I almost knew by heart, I was very much struck by the fact that, although, according to his own account of the matter, his whole philosophy rests upon his “functions of judgment,” or logical divisions of propositions, and upon the relation of his “categories” to them, yet his examination of them is most hasty, superficial, trivial, and even trifling, while throughout his works, replete as they are with evidences of logical genius, there is manifest a most astounding ignorance of the traditional logic, even of the very *Summulae logicales*, the elementary school-book of the Plantagenet era. (EP2, 424, 1907)

Peirce acknowledged and valued his debt to Kant. This includes ideas that inspired his discovery of the three universal categories, and also his use of Kant’s schematism, which underpins some of his greatest discoveries, such as theorematic reasoning and the existential graphs. Peirce rejected repeatedly and vehemently some Kantian stances (transcendentalism, the role of intuition, the trenchant dichotomies between the analytic and the synthetic and between *a priori* and *a posteriori* notions, etc.). This rejection takes on a peculiar character. Instead of jettisoning them, Peirce transforms and somehow

---

<sup>1</sup> This topic has been the object of numerous valuable studies. Here I will concentrate on the recent work of Gabriele Gava and John Kaag. For lack of space I cannot consider other important contributions, such as those of Chauviré 1987, Chevalier 2014, Christensen 1994, Haack 2007, and Laserre 2008, which have influenced this paper. I have also omitted references to the work of Karl-Otto Apel and its influence, recently discussed in Crelier 2012.

generalizes these ideas by embedding them into new conceptions that retain positive elements from the rejected ones. He achieves this by combining the rehabilitated elements with other notions that previously appeared incompatible or altogether alien to them. I will consider only two examples of these transformations of Kantian ideas by Peirce: *abductive inference* and the idea of *purpose*.

## 4 Two different readings of the transcendental method

In a recent book, *Peirce's account of purposefulness: A Kantian perspective* (Gava 2014), and in several articles, Gabriele Gava offers incisive and controversial theses on the Kantian roots of some of Peirce's conceptions and seeks to show that a subtle continuity between Kant's transcendental philosophy and Peircean pragmatism can be adumbrated from a particular standpoint (see, e. g., Gava 2008, 2011a, 2011b, 2014).

Gava discerns two different attitudes to the influence of Kantian notions on Peirce's thought. They relate to two alternative readings of the term "transcendental" and lead to different standpoints on the nature and employment of transcendental arguments. The most common interpretation is the "justificatory" version, in which transcendental philosophy is seen as a mentalist position directed to justifying mental representations against skeptical arguments, starting from indubitable truths inferred from principles that are true *a priori*.

To a great extent, Peirce shared this interpretation of Kantian transcendentalism, which emphasizes precisely those notions he found most objectionable: infallibilism, apriorism, the unknowable, the discontinuity between matter and mind, etc.

Gava proposes an *alternative interpretation* according to which Kant does not need to appeal to a deduction from indubitable principles, since transcendental philosophy takes its departure from experience and abstracts from experience elements that render possible the intelligibility of our representations. Gava's words: "What Kant discerns is not a general fact about the world, but of our ability to provide explanations in science and everyday life. He thus provides a kind of second-order investigation of the elements that are common in our knowledge" (Gava 2011a).

It is not feasible here to review the numerous arguments this author advances to ground his vision of Peirce as a thinker who continues and expands

the transcendental project. I therefore illustrate their tenor with a single example: his treatment of the Peircean notion of *prescision*.

Peirce discerns three kinds of abstractive separation in thought that can be applied progressively to ideas or elements of experience: *discrimination*, *prescision*, and *dissociation*. We can discriminate the idea of red from that of blue and the idea of color from the idea of surface, and vice versa; but we cannot discriminate the idea of red from that of color. We can, on the other hand, *prescind* the idea of surface from that of color — we can imagine a colorless surface. But it is impossible to prescind the idea of color from the idea of surface — we cannot imagine a color without extension. Lastly, we can *dissociate* red from blue, but it is impossible to dissociate surface from color or vice versa.

Gava thinks that Peirce's use of precision is an instance of the application of the transcendental method. This application is fundamentally important for Peirce, who uses precision repeatedly, starting with its seminal employment in *A new list of categories* (EP1, 1–10, 1868) for establishing the three universal categories.

Gava remarks that Kant employs a method quite similar to this in establishing the conditions of possibility for knowledge. He cites, for instance, from the *Critic of pure reason*, “In regard to appearances in general one cannot remove time, though one can very well take the appearances away from time” (CPR A31 B46).

## 5 Peirce, Kant, and the exercise of the imagination

Another important reevaluation of the relationship between Peirce's thought and the Kantian tradition has recently come to light in the incisive work of John Kaag. His arguments complement those of Gava and share affinities, in spite of differences of opinion and perspective. In his recent book, *Thinking through the imagination: Aesthetics in human cognition* (Kaag 2014) and in several articles (e.g. Kaag 2005, 2015), this author has explored in depth another dimension of this subject: the important role of the imagination in human cognition, for both Kant and Peirce.

There is something strange in the fact that Peirce took no notice of the new ideas that Kant advanced in the *Critique of the power of judgment*. It seems that

Peirce never cited this work (except for a rather trivial instance<sup>2</sup>) and it is possible that he did not read it. This is in remarkable contrast to his deep knowledge of other works by Kant, especially to his detailed studies of the First Critique. But it is precisely in the Third Critique – a work under intense scrutiny and subject to novel interpretations at present<sup>3</sup> – where we find new Kantian ideas that are closer to those of Peirce.

Kaag explores most of the Kantian corpus but concentrates on the Third Critique, where we find ideas, especially those concerning the imagination, that Kant had not developed before, and which in some cases he took up again in the *Opus Postumum*. Through the analysis of the so-called *reflective judgment*, this work brings together fundamental themes that at first blush would have scarce relationship to each other: the esthetical judgment, artistic creation, the cognitive functions of the imagination, and the employment of teleological causation in explaining the nature and functioning of organisms.

In previous works, and especially in the First Critique, Kant had limited the power of judgment to the emission of *determinative judgments*, i.e. to statements that subsume particular concepts or experiences as instances of general ideas or rules that are known beforehand. The *Critique of the power of judgment* introduces the *reflective judgment*. It fulfills an inverse function: given some singular experiences or ideas, reflective judgments have the role of finding concepts or universal rules capable of subsuming them as particular instances. For reasons that would be too complicated to summarize here, Kant concludes that, while determinative judgments are capable of expressing scientific truths with objective validity, reflective judgments can only reach subjective validity and have a merely heuristic function in scientific argumentation. Both determinative and reflective judgments require a mediating link between universals and particulars, between the functions of the intellect and the data of sensorial experience. The imagining faculty supplies, according to Kant, this mediating nexus through the application of transcendental schemata (see, e.g., CPR A18, B177). This creative activity of the imagination, at work already in the First Critique, takes up new functions in the *Critique of the power of judgment*, which Kaag describes and connects to embryonic forms of important Peircean

---

<sup>2</sup> In a recent article Kaag remarks that he has found an incidental mention of this work in one of Peirce's manuscripts (Kaag 2015).

<sup>3</sup> The last two decades have seen an extraordinary surge of interest in the Third Critique and its interpretational problems. Many of the numerous books and articles dedicated to these topics are relevant to current discussions on the role of teleology in biology. For some examples see footnote 1.

conceptions. He shows, in particular, how the workings of the transcendental imagination anticipate aspects of the Peircean notion of abduction:

I will argue that abduction expands the scope of logic. Once this scope is broadened beyond the deductive-inductive dyad that has traditionally characterized it, abduction reveals itself as logical. Not coincidentally, a similar situation obtains between the imagination and the faculties of understanding and sense. Imagination performs epistemological functions that neither understanding nor sense can accomplish. It compensates for and mediates the constraints of these two faculties. (Kaag 2014: 77)

After expounding on his interpretation of the role of the imagination in artistic creation in the *Critic of the power of judgment*, Kaag concludes that the function of the esthetical judgment leads Kant toward a radical revision of his ontology that could eventually lead to transcending the discontinuity between the human mind and nature, and thereby point to a rapprochement to Peirce's ideas.

## 6 Kantian organicism, “natural purposes,” and teleology

Besides the current reconsiderations we have reviewed so far regarding relations between the Kantian tradition and Peircean tenets, there is in progress at present another profound reevaluation of Kant's ideas. This reassessment is motivated by new issues related to the functioning and evolution of organisms and to processes of self-organization in dissipative systems in general. These investigations have occupied numerous researchers in recent decades<sup>4</sup> and here we are limited to summarily mentioning a few of them with the intention of showing their relations to some Peircean conceptions.

Kant envisioned living beings as “natural purposes” (*Naturzwecke*), as structures that display an intrinsic orientation toward purposes. We encounter organisms as autonomous wholes intrinsically endowed with the principles of their own organization. Within them the form and existence of their parts depend on their relations to the whole. The parts of an organism are integrated as a unit because they are reciprocally cause and effect of their form (CPJ § 65).

---

<sup>4</sup> In Goy and Watkins 2014 there is an excellent collection of contributions by some of the most prominent authors on the subject of the relevance of Kantian thought to biology. A special issue of *Studies in History and Philosophy of Science* (Part C) 37(4), 2006, was dedicated to this theme.

According to Kant this reciprocal interaction that characterizes organisms cannot be rendered intelligible in terms of mechanical causation, since it has no counterpart in any known form of causality. On the other hand, he thinks organisms become intelligible to us by analogy to a form of causality we find within ourselves. This is the causality we apply to explain our own behavior and that of other free agents that undertake goal-directed actions. It is also the causality through which we understand the functioning of the instruments and machines we design in order to expand the horizon and scope of our purposes.

Kant thinks this intelligibility, gained through analogy, is unable to supply genuine scientific (mechanical) explanations. Nevertheless, he admits it as a regulative principle that generates heuristic clues for the discovery of organic phenomena. From this point of view, the teleology that we find so evident in living beings does not reside objectively in nature but is rather a projection we cast over nature from inside our subjectivity. It acts as a condition of possibility for partially understanding organic phenomena in spite of intrinsic deficiencies within our cognitive faculties.

Peirce vigorously opposed this Kantian restriction to mechanical explanations in science with arguments that are based on the consideration that such a limitation makes it impossible to explain the rise of growth, variety, and novelty in nature. His arguments had little impact until much later, when the internal development of physics in the twentieth century made it necessary to expand the notion of cause much beyond the frame of Newtonian causality.

During the past century, cybernetics, and later research on complex systems far from thermodynamic equilibrium, led to the advocacy of new forms of causation. Under the rubric of *self-organization* these investigations promoted a rediscovery of the Kantian view of the organism as a whole unified by the reciprocal causation of its parts. Stuart Kauffman, a distinguished researcher in this field, makes frequent use of the expression “Kantian whole” in discussing his theories on the origins of “protocells” from “collectively autocatalytic sets” (see, e.g., Kaufmann 2014).

The validity of teleological explanations remains an issue debated by biologists and philosophers of science. To conclude this paper, I would like to propose a perspective for understanding biological teleology that is based on a combination of ideas from Aristotle, Kant, and Peirce.

## 7 Mechanisms and biological phenomena

Current investigations on causal explanations in biology are often animated by a desire to emancipate this discipline from its historical subordination to the conceptual resources and explanatory schemes of physics. Among these schemes, the so-called “nomological- deductive” model is prominent. According to this model to explain scientifically one must deduce a statement expressing the fact to be explained (*explanandum*) from a suitable conjunction of statements (the *explanans*). The explanans joins a statement of a general law to a statement concerning particular facts. These particular facts have the role of the initial conditions in Newtonian dynamics.

For several reasons this explanatory scheme has limited application in biology. Among its limitations can be mentioned the scarcity of laws of great generality in biology and the scheme’s ineffectiveness in dealing with complex interactions between different levels of a hierarchically organized whole. At present, numerous researchers favor an alternative view that grounds causal explanations in the discovery of *mechanisms*.

Well-known advocates of this view characterize a mechanism as

[...] a structure performing a function in virtue of its component parts, component operations, and their organization. The orchestrated functioning of the mechanism is responsible for one or more phenomena. (Bechtel and Abrahamsen 2005: 423)

According to Andersen,

Generally, mechanisms are constituted by a coordinated sequence of causal interactions between component parts organized in such a way that the mechanism’s functioning is what produces or gives rise to the phenomenon for which the mechanism is indicated as an explanation. (Andersen 2012: 2)

Causal explanations invoking mechanisms are ubiquitous in the life sciences, and it is important to note that their employment does not entail endorsement of a mechanist position where biological phenomena are ontologically reduced to phenomena explained by Newtonian mechanics (mechanicism). In the past, the mechanist position and mechanicism have been often conflated, and this erroneous identification likely led to the vitalist reaction (the postulation of “vital forces” different from physical forces).

I think this notion of explanatory mechanism may help us to reformulate Kant’s view of natural purposes. I would like to propose a standpoint that incorporates ideas from Peircean semiotics to characterize and justify biological teleology.

## 8 Teleology and life

Kant's philosophy of nature features (except for certain reconsiderations first suggested in the Third Critique) a Cartesian discontinuity between nature and the human mind. To justify our freedom in framing our purposes, Kant had to appeal to a noumenal reality trenchantly separated from the natural world. In contrast, Peirce embraces an evolutionary continuity seamlessly connecting nature to the sphere of human purposes.

The notion of purpose has a fundamental role in Peirce's mature thought. It is intimately bound to the very definition of pragmatism and to other important Peircean tenets such as, for example, his ethics. As stated by Hedy Boero, in Peirce "[...] Ethics ceases to be a science concerning moral conduct or duty, and is defined for the first time as a science of purposes, whose proper object is the ultimate end of the person, or the *summum bonum*" (Boero 2014, 260).

Peirce contends that human purposes have their evolutionary roots in final causation, which is present at all levels in nature:

It is, as I was saying, a widespread error to think that a "final cause" is necessarily a purpose. A purpose is merely that form of final cause which is most familiar to our experience. (CP 1.211 1902)

I believe that Peirce at times does not distinguish sufficiently between elements of what he calls ideal or final cause, which he contrasts to the efficient cause of mechanical phenomena. I refer to the fact that semiosis is a species of formal cause. Formal causes are different from the final causes shown in the processes he calls "finious" – i.e., irreversible physical processes that tend asymptotically toward a final state. This confusion issues from the fact that semiosis also has a *telic* character. But the sign has a *telos* different from that of the final causes of physics. *The telos of semiosis is the creation of an interpretant*, and this is achieved by the transmission of a form.

I think that the characteristic finality of biological teleology, which is manifest in the idea of purpose, results from the interaction of two basic types of causation: efficient causation and semiotic causation.<sup>5</sup>

In recent articles (Fernández 2015a and 2015b), I explain in detail this interaction in simple organisms as a coordination of mechanisms orchestrated

---

<sup>5</sup> Jesper Hoffmeyer has for a long time advocated a conclusion that is very close to this one but is not based on a distinction between formal and final causes. This is lucidly stated in connection with his seminal notion of semiotic scaffolding. See, e.g., Hoffmeyer 2007.

by extra- and intracellular signals, using the concepts of *regulation* and *modulation*.

## References

- Andersen, Holly. 2012. The case for regularity in mechanistic causal explanation. *Synthese* 189(3). 415–432.
- Bechtel, William and Adele Abrahamsen. 2005. Explanation: A mechanist alternative. *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 36. 421–441.
- Boero, Hedy. 2015. Towards the silvery peak: some keys to the evolution of Peirce's Ethics. *Cognitio: Revista de Filosofía* 15(2). 257–274.
- Cartwright, Nancy & John Pemberton. 2013. Aristotelian powers: Without them, what would modern science do? In Ruth Groff & John Greco (eds.), *Powers and capacities in philosophy: The new Aristotelianism*, 93–112. New York: Routledge.
- Chauviré, Christiane. 1987. Schématisation et analyticité chez Peirce. *Archives de philosophie* 50(3). 413–438.
- Chevalier, Jean-Marie. 2014. Peirce lecteur de Kant. *Academia*. At [https://www.academia.edu/12367900/Peirce\\_lecteur\\_de\\_Kant](https://www.academia.edu/12367900/Peirce_lecteur_de_Kant).
- Christensen, C. B. 1994. Peirce's transformation of Kant. *The Review of Metaphysics* 48(1). 91–120.
- Crelier, Andrés. 2012. Reflexión y lenguaje. Perspectivas de la transformación pragmático-transcendental de la filosofía kantiana. *Revista de Filosofía y Teoría Política* 43. 11–43.
- Fernández, Eliseo. 2008. Signs and instruments: the convergence of Aristotelian and Kantian intuitions in biosemiotics. *Biosemiotics* 1(3). 347–359.
- Fernández, Eliseo. 2014. Peircean habits, broken symmetries, and biosemiotics. In Vinicius Romanini & Eliseo Fernández. (eds.), 79–94. *Peirce and biosemiotics: A guess at the riddle of life*. Dordrecht, Netherlands: Springer.
- Fernández, Eliseo. 2015a. Evolution of signs, organisms and artifacts as phases of concrete generalization. *Biosemiotics* 8(1). 91–102.
- Fernández, Eliseo. 2015b. Nomological machines and semiotic scaffolding. Paper presented at the Fifteenth Annual Gathering in Biosemiotics. Aalborg University, Copenhagen, 30 June to 4 July 2015. Available at: [http://www.lindahall.org/media/papers/fernandez/NOMOLOGICAL\\_MACHINES\\_AND\\_SEMIOTIC\\_SCAFFOLDING\\_E\\_F.pdf](http://www.lindahall.org/media/papers/fernandez/NOMOLOGICAL_MACHINES_AND_SEMIOTIC_SCAFFOLDING_E_F.pdf).
- Gava, Gabriele. 2008. The purposefulness in our thought: A Kantian aid to understanding some essential features of Peirce. *Transactions of the Charles S. Peirce Society* 44(4). 699–727.
- Gava, Gabriele. 2011a. Peirce's "precision" as a transcendental method. *International Journal of Philosophical Studies* 19(2). 231–253.
- Gava, Gabriele. 2011b. Does Peirce reject transcendental philosophy? *Archiv für Geschichte der Philosophie* 93(2). 195–221.
- Gava, Gabriele. 2014. *Peirce's account of purposefulness: A Kantian perspective*. New York: Routledge.

- Goy, Ina & Eric Watkins, (eds). 2014. *Kant's theory of biology*. Berlin/New York: Walter de Gruyter.
- Haack, Susan 2007. La legitimidad de la metafísica: el legado de Kant a Peirce, y el de Peirce a la filosofía de nuestros días. *Anuario filosófico* 40(89). 471–494.
- Hoffmeyer, Jesper. 2007. Semiotic scaffolding of living systems. In: Barbieri, Marcello (ed.), *Introduction to biosemiotics: The new biological synthesis*. Dordrecht, Netherlands: Springer: 149–166.
- Kaag, John J. 2005. Continuity and inheritance: Kant's "Critique of Judgment" and the work of C. S. Peirce. *Transactions of the Charles S. Peirce Society* 41(3). 515–540.
- Kaag, John J. 2014. *Thinking through the imagination: Aesthetics in human cognition*. Oxford: Oxford University Press.
- Kaag, John J. 2015. The lot of the beautiful: Pragmatism and aesthetic ideals. *British Journal for the History of Philosophy* 23(4). 779–801
- Kant, Immanuel. 1999. *The critique of pure reason* [CPR]. Trans. and ed. Paul Guyer and Allen Wood. Cambridge: Cambridge University Press.
- Kant, Immanuel. 2000. *Critique of the power of judgment* [CP]. Ed. Paul Guyer, trans. Paul Guyer and Eric Matthews. Cambridge: Cambridge University Press.
- Kauffman, Stuart A. 2014. Prolegomenon to patterns in evolution. *BioSystems* 123. 3–8.
- Leserre, Daniel. 2008. La teoría de los signos en Peirce y los elementos de una semiótica en Kant. Paper presented at the III Jornadas "Peirce en Argentina", 11–12 September 2008. Available at: <http://www.unav.es/gep/III/PeirceArgentinaLeserre.html>
- McKittrick, Jennifer 2010. Manifestations as effects. In Anna Marmodoro (ed.), *The Metaphysics of powers: Their grounding and their manifestations*, 73–83. New York: Routledge.
- Mumford, S. & R. L. Anjum. 2011. *Getting causes from powers*. Oxford: Oxford University Press.
- Peirce, Charles S. 1931–1958. *Collected papers of Charles Sanders Peirce*. [CP]. Vols. 1–8. C. Hartshorne, P. Weiss, A. W. Burks (eds.). Cambridge, MA: Harvard University Press.
- Peirce, Charles S. 1992, 1998. [EP]. *The essential Peirce*. The Peirce Edition Project (ed.). Bloomington: Indiana University Press.

## Bionote

### Eliseo Fernández

Eliseo Fernández (1935–2017) was born and educated in Argentina. For almost five decades, he worked at the Linda Hall Library of Science and Technology as a scientific consultant and taught at the University of Missouri in the physics department. He lectured and published widely on topics in the philosophy and history of science and on the thought of C. S. Peirce. Among the founders of biosemiotics, he was also a leading contributor to this journal.