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Not only has biology become the new trend when discussing the nature of science, its ontological scope and its methodology, overthrowing the prominence that physics has long claimed in this domain, but it has also become commonplace for continuing traditional philosophical discussions, such as those related to determinism or the existence of God. This is what Antonio Diéguez, a highly renowned Spanish philosopher known for his proposals on scientific realism and naturalism, seeks to lay bare for us in his last book *De la mano de Darwin. Ensayos sobre naturalismo y realismo en filosofía de la biología* (*Hand in hand with Darwin. Essays on naturalism and realism in philosophy of biology*). From start to finish, Diéguez presents the so-called “science of life” as a renewed promise amid diverse philosophical challenges.

Chapters one through five elevate philosophy of biology’s standing in philosophy of science, beginning with its interdisciplinary proclivity and its affinity for methodological pluralism. In

the first chapter, Diéguez points out that philosophy of science today ranks among the most dedicated endeavors to unite Snow’s two cultures—the scientific and humanistic ones—, an effort bolstered further by philosophy of biology through debates such as those over the adaptationist program or the significance of epigenetic inheritance processes in evolution. However paradoxical it may seem, specialization within philosophy of science has led to greater interdisciplinarity, in the same way that specialization within contemporary scientific fields has yielded many fertile syntheses, among them molecular biology, physical chemistry and cognitive paleoanthropology (p. 1).

Concerning methodology, Diéguez stresses that biology, a science in the strictest sense, is far from being a derivative application of physical laws. Much against the wishes of Logical Positivism, an image of the scientific method imposed from physics is untenable. In fact, biological practice makes it all the more clear that there is

no such thing as “the” scientific method, but rather, we find ourselves before a plurality of methods impossible to encompass under a single, simple formula (p. 7). The reliance on ends or functions as causal factors, for example, is entirely absent in physics, and yet, it is central to the biologist’s work. Admittedly, many biologists disavow this, fearing a relapse into the “outdated” idea of teleology, but (and here Diéguez quotes Haldane), teleology is to the biologist like a lover without whom one cannot live, but with whom one does not want to be seen in public (p. 8).

The next few chapters draw attention to philosophy of biology’s key part in debates surrounding scientific realism and naturalism. Chapter two, for instance, transposes the classic realism versus antirealism debate into biology, where it has been strangely underexplored. Since the existence of theoretical entities such as genes, species and ecosystems is rarely questioned, given their marked accessibility for observation or intervention (very unlike what holds for quarks and neutrinos), biology may look like a safe haven for realism, not only epistemologically (theory realism) but also ontologically (entity realism). And in many ways, it is. Indeed, biology resists realism’s classic

critiques: Kuhn’s incommensurability of rival theories, Laudan’s pessimistic meta-induction, and Duhem, Quine, and van Fraassen’s underdetermination by empirical evidence. Kuhn’s seminal work, *The Structure of Scientific Revolutions*, abounds with cases of incommensurability, yet they all draw solely from physics and chemistry. Biology shines in this work by its absence, Diéguez notes (p. 14). Even though, already entering the 21st century, authors such as Marcel Weber finally attempt to identify and study incommensurable theories in biology, they fail to fully demonstrate that incommensurability, for translation between the taxonomic systems they address remains feasible. The search for biological theories that are both explanatorily successful and devoid of reference has fared no better. Unfortunately for the pessimistic induction argument, the only examples that seem to satisfy these conditions—the humoral theory, vitalism, and the theory of spontaneous generation—do not really belong to biology as a consolidated science. As for underdetermination, the Synthetic Theory of Evolution stands alone, without any serious competitor of equal empirical strength.

However, it so happens that scientific realism's most beloved argument, the "miracle argument", which refers to striking matches between theoretical predictions and experimental data, proves much more successful in physics than in biology. Furthermore, while it is true that the theories formulated in the field of biology might initially seem to tilt the scales toward realism, epistemological problems specific to this science have aroused hopes among antirealists. Certain theoretical pluralists, for instance, have harbored skepticism toward bedrock concepts such as those of a species or a gene, on the assumption that their lack of univocity provides a clear incentive to doubt their existence. But, however compelling these antirealist arguments may sound, the boldest, most refined one in philosophy of biology has come, according to Diéguez, from Alexander Rosenberg, who has offered an instrumentalist reading of evolution in which its probabilistic nature is treated as epistemic rather than ontological. In this light, our author attests that biology has, by no means, remained aloof from philosophy of science's enduring realism-antirealism duel.

Although the prior discourse already bears profound implications for

philosophy of science, Diéguez does not pause there. Instead, in the third chapter, the most technical one of all, but also the most personal (p. xi), he plunges even deeper into the epistemological and ontological challenges that biology poses for scientific realism. He does so by confronting the apparent dichotomy between explanation and understanding. This is undoubtedly a daring move, for as we know, the devil is in the details. Nevertheless, daring as it may be, his move proves necessary. Diéguez contends that the idea of understanding is central to how models are used in biology, thereby "inverting" the interpretation philosophy of science has conventionally made of the explanation-understanding relation. Most philosophers nowadays agree that a distinctive feature of biology as a science is the use of models instead of laws to explain natural phenomena, and, for our author, the idea of understanding could shed light on such a seemingly perplexing particularity. In the canonical Received View, scientific explanation hinged on resolving the "why" of a phenomenon's occurrence, positing a deductive, nomological perspective of causation. Yet, this paradigm falters against the backdrop of flourishing scientific models that venture instead into more speculative "how-possibly",

“how-actually”, and “how-plausibly” questions (p. 34). Diéguez cites the example of the lipid bilayer model of the cell membrane: rather than showing *why* the cell membrane functions selectively, allowing the flow of certain substances and not others, the model elucidates *how* it *plausibly* functions this way. For that reason, the essence of scientific explanation is most aptly grasped under a broad sense of the term, as an answer to a question in science that bestows on us a better understanding of the part of reality that is being represented.

Against the methodological divide long carved by the anti-positivist, hermeneutic tradition in philosophy, which counterpoises causal, mechanistic explanation to interpretive understanding when demarcating natural and social sciences, Diéguez argues that these two processes are heavily intertwined. Indeed, human actions are unintelligible unless understanding is invoked, but so are objective situations, functions, working mechanisms, relations between things, etcetera (p. 35). It is along this vein that Diéguez deems explanatory models in biology a territory where our understanding stands as a core, deliberate end, quite frequently irrespective of facticity and yet

compatible with realism (much to our surprise).

Let us not forget that Diéguez, as well as being one of Spain’s most prominent scientific realists (perhaps even worldwide), is also a distinguished naturalist. Certainly, the naturalist side to his philosophy of science also permeates these chapters, with biology consistently taking center stage. Chapter 5, in particular, defends naturalism against Thomas Nagel’s objections to the evolutionary account of the mind and against the cosmic teleology he proposes in its stead. Nagel claims that natural selection cannot fully explain the origin of mind unless it resorts to ad hoc, suitable mutations, which are impossible by pure chance alone given life’s relatively short timeline. For him, expounding on the origin of mind demands proof of why the emergence of a being with our cognitive abilities is likely, whereby he finds solutions elsewhere, arriving to the conclusion that creationist doctrines hold greater promise in this matter than the theory of biological evolution. Furthermore, Nagel insists that reducing subjective consciousness to physical laws is untenable, convinced that this dismisses any naturalistic explanation of the mind. However, neither is science bereft of the

capability to unravel improbable events—as Diéguez observes, factors such as developmental biases render Nagel’s position very hollow, nor is the evolutionary naturalist compelled to endorse psychophysical reductionism. With this, our author once again manages to demonstrate the philosophical potency of naturalism, once again naturalism defeats a challenge that, at first glance, might seem insurmountable.

The philosophical implications of biology go even beyond the field of philosophy of science, and Diéguez shows absolutely no hesitation in bringing them to light in the following chapters. He does so in a formidable way, by delving into philosophical issues that have long shadowed us and putting them up to date. One of these is the classic conflict between freedom and determinism, the conflict that Luis de Molina sought to resolve in his famous *Concordia* and that Kant addressed in his well-known third antinomy. Specifically, in chapter 6, Diéguez probes the extent to which genetic determinism represents a contemporary form of this conflict. Common misconceptions regarding the notion of heritability and AI-driven genetic diagnosis, to state a few, have repeatedly culminated in flawed, deterministic assumptions. The idea

underlying genetic determinism, that genes serve as blueprints that encapsulate all key instructions for an organism’s development, completely distorts the reality of biological processes. Etiologically speaking, genes alone lead nowhere. To deem them causes of anything, their interplay with environmental factors must be taken into account. Attempts to pair complex, often value-laden traits like delinquency, alcoholism, or homosexuality one-to-one with individual genes are everyday fare in the press, yet such tendencies embody drastic and potentially dangerous simplifications (p. 85). Genes are not “an inexorable destiny”, Diéguez asserts (p. 88). Were genetic determinism to prevail, we would devolve into Thomas Huxely’s conscious automata, absolved of any responsibility, of any guilt, for our free will would be nothing but an illusion.

Another of those philosophical issues concerns the question of whether God exists and science’s say on this. At first sight, God and science may strike one as worlds apart, perhaps irreconcilable. Yet reality reveals a starkly different picture. From Albertus Magnus to Georges Lemaître, we have seen numerous scientists emerge from monasteries, and many others, despite

not wearing clerical attire, have looked to science for evidence of God's existence. Newton himself, father of modern physics, unifier of terrestrial and celestial mechanics, sought to prove in his *Principia* the existence of a divine power, cause and creator of motion. Even so, is science really in a position to answer this question? In *De la mano de Darwin*, Diéguez responds with a categorical no, relegating the idea of God strictly to philosophy while criticizing various ways in which biology has been used for theological ends. He holds that no initiative of appealing to scientific phenomena so as to demonstrate whether God exists is truly scientific. Rather, they are all inherently philosophical, for what draws conclusions here is not science, but the "philosophical interpretations" of some of its theories (p. 97).

According to the Intelligent Design argument, for example—which is ultimately nothing other than a variant of Aquinas' Fifth Way—the field of biology harbors phenomena of "irreducible complexity", impossible to explain through evolution by natural selection, a process in which the complex arises from simpler states. The bacterial flagellum, the coagulation cascade, our moral behavior, and a long etcetera, like Paley's watch upon the

sand, are phenomena so complex and refined that they could only have been the doing of God, the supreme architect. Nevertheless—and here comes Diéguez's objection—the magic of spontaneous variation is that it creates the appearance of design where there really is none. Thus, the analogy of the watch collapses, along with the Design argument's authority. Now then, this argument has not been natural theology's most powerful tool for reincarnating itself in current discussions about the existence of God. In our author's eyes, that prestigious role belongs to the Fine-Tuned Universe argument, which states that the universe seems to be arranged expressly to make life possible. Had the physical constants, the cosmos' initial conditions, or the laws of chemistry varied even slightly, the result would have been an entirely inhospitable setting. Diéguez rules out this argument as well, for nearly the whole universe is hostile to life (p. 108). For him, both these arguments, despite posing as "scientific", are philosophical in nature. They could never prove the existence of the Christian God of Aquinas, the watchmaker God of Paley, or any similar deity in the way that Dalton proved the existence of the atom or Watson and Crick proved the existence of the double-helix structure of DNA. All they do is

infer that existence from the apparent inexplicability of certain phenomena that arise within the sciences, once again falling into the historically recurring “God of the gaps” trap (p. 110).

All throughout the book, Diéguez reveals just how far the science of biology has come in today’s philosophical inquiries. Biology, that science ignored at the beginnings of philosophy of science, that science found nearly at the end of Comte’s pyramid of the sciences and outright disqualified as strict science by Popper, is now realists

and naturalists’ new excavation site. That science utterly absent from treatises on free will and so repudiated by creationists, is now a sought-after response to fatalism and the great bulwark of natural theology. *De la mano de Darwin* treasures an endless array of twists like these, sure to astonish anyone. But more crucially, its implications for philosophy of science and philosophy at large make it essential reading for anyone venturing through those waters.

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