the third wave of innovation, often challenged the established principles of standard setting – which were very time-consuming and not fit for the fast-developing new technology – and with time carved out an increasingly important niche in the ecosystem of standard-setting bodies. The ISO did not manage to gain a strong foothold in regulating this important technological field and moved into a completely new arena: the development of standards for managerial (ISO 9000 series), environmental and social issues.

Yates and Murphy offer a solid, illuminating, readable and well-documented account of the workings of groups of engineers and of institutions which have huge impacts on everyday life but do not receive strong attention in the historical study of science and technology. The focus on engineering standards and the ISO unfortunately largely disregards areas such as food and agricultural quality standards, which are governed by a range of other multilateral bodies such as the *Codex Alimentarius* Commission or UNECE, and which can affect the livelihoods of large numbers of people, in particular in developing countries. Amy A. Quark has described the highly contested nature of quality standards for cotton (*Global Rivalries: Standards Wars and the Transnational Cotton Trade*, 2013). She shows how, since 1870, the 'mastery' of such standards has moved from UK traders to the United States Department of Agriculture, where fibre science arose as the arbiter of quality, and how China has recently emerged as new contender attempting to achieve more control over the definition and measurement of cotton quality. In Yates and Murphy's account the role of standards as tools, often based on contested science, for mediating rivalries in a globalized world is not very prominent. It may be the case that standards for screw threads or for the avoidance of radio interference show little overt politicization – perhaps such standards are so fundamental for the general functioning of modern societies that there is little appetite for continuous contestation.

Yates and Murphy offer a welcome complement to the existing literature on standards by focusing on the often nitty-gritty details of standard setting and lifting out of obscurity a large group of engineers who appear to be truly motivated by advancing what they perceive as the public good and not particular corporate or national interests.

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Ian Duncan, **Human Forms: The Novel in the Age of Evolution**. Princeton, NJ: Princeton University Press, 2019. Pp. 304. ISBN 978-0-6911-7507-2. £30.00 (hardcover).
doi:10.1017/S0007087420000291

Ian Duncan's work focuses on the eighteenth and nineteenth centuries, when both novels and natural philosophy viewed humanity as a subject of investigation. Duncan states that his work was inspired by Nancy McLane's *Romanticism and the Human Sciences* (2000) and attempts to do for novels what McLane's work did for poetry. After an introduction, Duncan's work has two philosophical chapters (1, 3) and three worked-example chapters (2, 4, 5), with notes and bibliography comprising around a hundred of the three hundred pages of this monograph.

Chapter 1 focuses on the 1780s debate between Kant and Herder over whether human nature finds 'its vocation only in the species but not in the individual' (p. 33). Duncan notes that one of Kant's criticisms of Herder was that his arguments on the natural history of man were fictional, in that they relied more on imagination and poetry than on philosophical analysis. This charge of natural history being a fusion of fact and fancy continued throughout the period as practitioners such as Buffon and Rousseau strove to show they were knowledge producers rather than inventors even as they adopted fictional tropes. As Duncan argues, 'Kant's critical reason may have won the local engagement … but Herder's flight into conjecture, charging the natural history of man with a biological drive, would seem to have won the war' (p. 52).

Chapter 2 then focuses on how these ideas were taken up in Goethe's *Wilhelm Meister's Apprenticeship* (1795–1796), Stäel's *Corinne, or Italy* (1807) and Scott's *Waverley* (1814). In the novel *Wilhelm Meister*, Goethe follows the development of a man and his discovery of a vocation according to purely human means. Duncan brings out the sexism implicit in the period's equating of humanity with men but not with women (see also Dorothy L. Sayers's 1938 essay *Are Women Human?*). Stäel sought to correct this sexism by taking one of the women Goethe had used to develop Wilhelm and placed her as the heroine of her novel *Corinne*. However, Duncan notes that *Corinne* 'narrates a collision between the ideals of *Bildungsroman* and a hardening repertoire of novelistic topoi – masculine vocation, national destiny, the marriage plot – as these are coalescing into a set of norms for nineteenth-century practice' (p. 57). Scott took another path: he used national history from the recent past as the developmental force for another impressionable man, Edward Waverley. For Scott, national history mediated the natural and personal histories, which therefore enabled it to resolve the tension between the individual and species 'by recasting [this tension] as an empirical discrepancy between temporal states' (p. 73).

Chapter 3 focuses on the figure of the orangutan as the focus for the debates around species change and the formation of human nature. Lamarck's *Zoological Philosophy* (1809) had been reprinted following the dispute between Cuvier and Geoffroy Saint-Hilaire over whether morphological variation was to be explained functionally or by transformism. As Duncan notes, the Kant–Herder fault lines were being reused with one (Cuvier) charging the other (Geoffroy) of 'forsaking properly scientific procedure and resorting to literary tricks of analogy and conjecture' (p. 92). The orangutan appeared in a number of novels at this time and Duncan focuses on Scott's *Count Robert of Paris* (1831) with Sylvan, an eight-foot-tall orangutan inspired by Frankenstein's monster, and Hugo's *Notre-Dame de Paris* (1831) with his character Quasimodo, a 'monster' (p. 88) worthy of study by Geoffroy. By the end of *Notre-Dame*, Quasimodo is the most human of them all, whereas Sylvan displays many human traits and passions despite being an orangutan. Both authors leave their readers asking what, if anything, makes humanity unique or unified.

Chapter 4 focuses on a single novel by Dickens, *Bleak House* (1853), and Dickens's use of transformist theories in the creation of his characters (or monsters). Duncan notes Dickens's approval of Chambers's *Vestiges of the Natural History of Creation* (1844), in terms of both its ideas and its style, mixing facts with conjectural flourishes. In *Bleak House*, Duncan argues, Dickens has no human characters, but everyone is deformed in some way by their circumstances. Duncan provides snippets from the cast of character–monsters to prove his point: a longer worked example would clinch the argument. Chapter 5 concludes by reviewing Eliot's *The Mill on the Floss* (1860), *Middlemarch* (1872) and *Daniel Deronda* (1876) to highlight Eliot's use of scientific vocabulary. For *The Mill on the Floss*, Duncan highlights that the heroine is the one with the greatest species consciousness, rather than the surrounding men; in *Middlemarch*, Eliot dramatizes the moment of understanding by arguing that literal technical terms facilitate the imaginative, which enables comprehension of theories; in *Daniel Deronda*, Eliot makes use of the pangenesis hypothesis to explain how Daniel felt so attuned to his Jewish racial heritage. Duncan concludes his work with Eliot's 'Shadows of the Coming Race' (1879), in which evolutionary processes produce creatures without consciousness or life.

Running in the background, with occasional appearances, is the question of theology or world view. Much of the material covered by Duncan can be seen as a reaction against Christianity. Put simply, the Christian world view sees humans as both creatures (not unique) and image bearers of God (unique). When any of Duncan's protagonists sought to remove God from their theories of humanity, they removed the uniqueness bestowed on humanity by being God's image bearers. However, the thought of only being a creature, and not unique, so troubled Buffon and Rousseau that they attempted to reconstruct a uniqueness for humanity apart from God

(pp. 37, 41–43). The Lutheran Cuvier founded a Bible society, Scott was an ordained Presbyterian elder, Dickens was a liberal Anglican, whereas Eliot translated German higher criticism and Geoffroy was a deist. It would be well worth a future project to explore these connections between *a priori* world views and approaches to the natural history of humanity, but that would make for another book.

In conclusion, Duncan's work is readable and well researched, with Chapters 1 to 3 being particularly strong in demonstrating the interplay between natural philosophy, fiction, facts and imagination.

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Martin Beech, **Going Underground: The Science and History of Falling through the Earth**. New Jersey, London, Singapore, Beijing, Shanghai, Hong Kong, Taipei, Chennai and Tokyo: World Scientific, 2019. Pp. xi + 276. ISBN 978-9813-2790-3-2. £35.00/$38.00 (paperback).
doi:10.1017/S0007087420000308

Inspired by a problem posed in a 1924 issue of *English Mechanics and the World of Science*, Martin Beech has written a book covering a variety of geophysical notions related to the shape, density and internal structure of Earth. Humans have never penetrated much below Earth's surface, so Beech spends most of his time discussing thought experiments, particularly those that involve bodies falling through the interior of Earth. Along the way Beech touches on numerous discoveries, speculations and fictional expositions related to Earth's structure.

The first few chapters lay out what Beech calls 'Cymro's problem', which involves describing the motion of a body falling along a tunnel through a uniform spherical Earth, and its solution via Newtonian mechanics. Beech then segues into a discussion of the geology and temperature of Earth's interior, from Athanasius Kircher's fire caverns to the realization that Earth is heated internally by the decay of radioactive nuclei. The next set of chapters focuses on three Astronomers Royal: Nevil Maskelyne, John Flamsteed and George Biddell Airy (in that non-chronological order). It seems that Maskelyne may have originated Cymro's problem with a question published in the *Ladies Diary* in 1781, and may have been inspired to do so because of a deep well Flamsteed had dug at Greenwich for use in observing stellar parallax around 1679. Airy comes into the story because in 1826 he attempted to measure differences in the period of a pendulum, on Earth's surface and at the bottom of a mineshaft, in hopes of determining Earth's density, but Beech quickly moves on to Henry Cavendish's more successful experiments and a digression on the period of a pendulum with a length that exceeds Earth's radius.

The following chapter presents an argument against flat-Earth theories, though it is unlikely that any of Beech's readers will subscribe to such theories, and if they do they may not find his argument against them fully convincing. Beech then discusses literary accounts of Earth's interior from Verne to Burroughs to Flammarion. Then begins a series of chapters devoted to the history of physics and astronomy with connections made, whenever possible (and in some cases straining possibility), to Cymro's problem. Beech discusses ancient Greek attempts to determine the size of Earth, medieval ideas about motion, Galileo's *Two New Sciences* and *Dialogo* (in that order), the debate between Hooke and Newton over the path of a body falling through Earth, Edmond Halley's proposal that planets may be hollow (to explain their densities), and the efforts of Maupertuis and others to measure the shape of Earth. Beech makes sure to mention Maupertuis's proposal to dig a tunnel to Earth's core (and Voltaire's ridicule of that idea), but he neglects to mention Galileo's idea that falling bodies follow a semicircular path ending at Earth's centre.

The next several chapters connect Cymro's problem to various areas of engineering, mathematics and physics. Beech discusses proposals for using gravity tunnels as a transit system (doomed because of air resistance), the relation between Cymro's problem and the famous brachistochrone