11

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In this case, symbols are used for general notes and the numbers are used for citations.

part of a page from *The Devils Details - a history of footnotes*, Chuck Zerby

Eden of scholarship.

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* The reviewer is full of admiration for *Barnacles in Nature an*
Unfortunately, he appears to place responsibility for the posit
footnotes upon Heron-Allen instead of upon the publisher, w
properly belongs. See George Sarton, "Edward Heron-Allen,"
(May 1929), pp. 340–1.

51. Hilaire Belloc, *On* (New York: George H. Doran, 1923).

† The simplicity of many of Belloc's titles may be significant.
tion to *On*, he published *On Anything*, *On Everything*, *On Someth*
Nothing & Kindred Subjects. A general disdain for ornamentatio
kind may account for his particular dislike of footnotes.

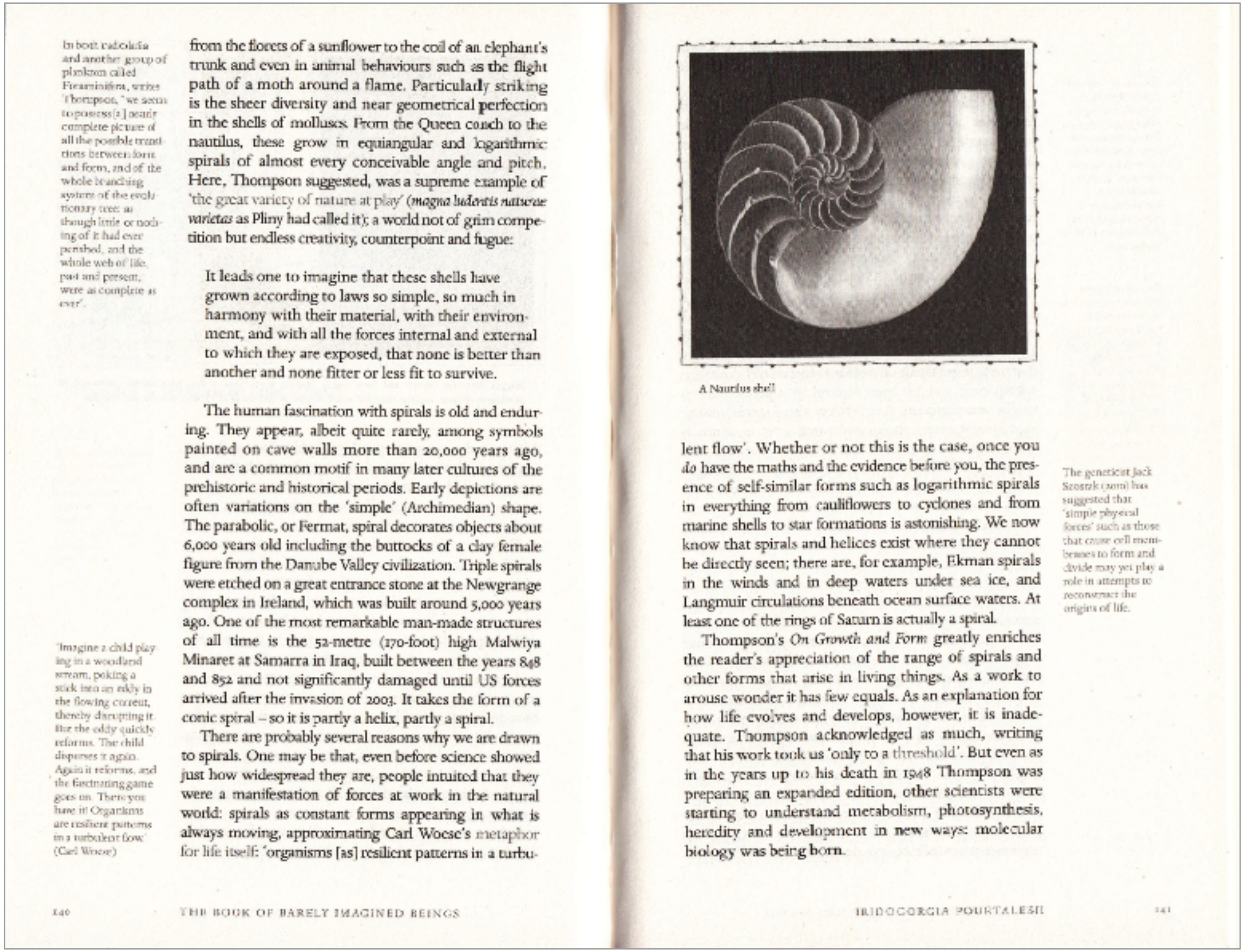
52. Hilaire Belloc, *On* (New York: George H. Doran, 1923), p. 4

53. Ibid.

54. Ibid., p. 43.

Sidenotes may not need the reference numbers or symbols as long as they can be near to the context within the text block.

Here as a sample spread from *The Book of Barely Imagined Beings*, Casper Henderson.



In both radiolaria and another group of plankton called Foraminifera, writes Thompson, "we seem to possess [a] nearly complete picture of all the possible transitions between form and form, and of the whole branching system of the evolutionary tree: as though little or nothing of it had ever perished, and the whole web of life, past and present, were as complete as ever'.

from the florets of a sunflower to the coil of an elephant's trunk and even in animal behaviours such as the flight path of a moth around a flame. Particularly striking is the sheer diversity and near geometrical perfection in the shells of molluscs. From the Queen conch to the nautilus, these grow in equiangular and logarithmic spirals of almost every conceivable angle and pitch. Here, Thompson suggested, was a supreme example of 'the great variety of nature at play' (*magna ludentis naturae varietas* as Pliny had called it); a world not of grim competition but endless creativity, counterpoint and fugue:

> It leads one to imagine that these shells have grown according to laws so simple, so much in harmony with their material, with their environment, and with all the forces internal and external to which they are exposed, that none is better than another and none fitter or less fit to survive.

The human fascination with spirals is old and enduring. They appear, albeit quite rarely, among symbols painted on cave walls more than 20,000 years ago, and are a common motif in many later cultures of the prehistoric and historical periods. Early depictions are often variations on the 'simple' (Archimedian) shape. The parabolic, or Fermat, spiral decorates objects about 6,000 years old including the buttocks of a clay female figure from the Danube Valley civilization. Triple spirals were etched on a great entrance stone at the Newgrange complex in Ireland, which was built around 5,000 years ago. One of the most remarkable man-made structures of all time is the 52-metre (170-foot) high Malwiya Minaret at Samarra in Iraq, built between the years 848 and 852 and not significantly damaged until US forces arrived after the invasion of 2003. It takes the form of a conic spiral – so it is partly a helix, partly a spiral.

'Imagine a child playing in a woodland stream, poking a stick into an eddy in the flowing current, thereby disrupting it. But the eddy quickly reforms. The child disperses it again. Again it reforms, and the fascinating game goes on. There you have it! Organisms are resilient patterns in a turbulent flow.' (Carl Woese)

There are probably several reasons why we are drawn to spirals. One may be that, even before science showed just how widespread they are, people intuited that they were a manifestation of forces at work in the natural world: spirals as constant forms appearing in what is always moving, approximating Carl Woese's metaphor for life itself: 'organisms [as] resilient patterns in a turbu-

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A Nautilus shell

lent flow'. Whether or not this is the case, once you *do* have the maths and the evidence before you, the presence of self-similar forms such as logarithmic spirals in everything from cauliflowers to cyclones and from marine shells to star formations is astonishing. We now know that spirals and helices exist where they cannot be directly seen; there are, for example, Ekman spirals in the winds and in deep waters under sea ice, and Langmuir circulations beneath ocean surface waters. At least one of the rings of Saturn is actually a spiral.

The geneticist Jack Szostak (2011) has suggested that 'simple physical forces' such as those that cause cell membranes to form and divide may yet play a role in attempts to reconstruct the origins of life.

Thompson's *On Growth and Form* greatly enriches the reader's appreciation of the range of spirals and other forms that arise in living things. As a work to arouse wonder it has few equals. As an explanation for how life evolves and develops, however, it is inadequate. Thompson acknowledged as much, writing that his work took us 'only to a threshold'. But even as in the years up to his death in 1948 Thompson was preparing an expanded edition, other scientists were starting to understand metabolism, photosynthesis, heredity and development in new ways: molecular biology was being born.

IRIDOGORGIA POURTALESII 141

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