Chapter 15: Hypernotes

☞WWW☜ 15:1

Figure 1a is taken from Weyl (1952 Fig 4), who describes it as Sumerian, although it is in fact modern, but based on an Assyrian sculpture of about 870 BC. Weyl's image was a head-piece in Swindler (1929), who says it was drawn by one of her students, Miss Mary Wyckoff, whose initials can be seen in the bottom right hand corner. It seems to be a composite of several Assyrian bas-reliefs from the palace at Nineveh, now in the British Museum, WA 124583 and WA 124576, although neither is precisely the same in the details. Weyl tries to restore a symmetry to the picture by suggesting that one figure is simply the other rotated, although there is then the problem that the wings and the feet will have also altered their relationships, which are properly symmetrical in the drawing. There is little agreement on the nature of the tree (which may be a distant relation of the palm), or the cone held in the right hand (which may be a male flower for fertilising palm trees or a pine cone held for purely symbolic reasons), or indeed the overall meaning of the ceremony which is taking place (Reade, 1998).

My figure 1b was created by cutting out the left half of figure 1a, flipping it horizontally, and then pasting it back onto the original left half. This also happens to remove the original artist's signature.

☞WWW☜ 15:4

The quotation from *The magic mountain* continues in the same vein as Richard Feynman, "Hans Castorp felt he understood now the reason why the builders of antiquity purposely and secretly introduced minute variation from absolute asymmetry in their columnar structures"

I can't help hearing Feynman tell this story to his students at the end of their first term, as they go off for their Christmas vacation — a perfect way to send them back to their homes from across the States, seeing the relationship between physics and the wider life.

In his lectures Feynman builds on Kepler's disappointment that the orbits of the planets were merely ellipses and not the more perfectly symmetrical circle: “So our problem is to explain where symmetry comes from.. Why is nature so nearly symmetrical? No one has any idea why.” (Feynman, Leighton, & Sands, 1963 p.52-12).

The idea of a purposely introduced asymmetry is widespread, for instance it being claimed that in Persian carpets there is always a detail that breaks the symmetry, for only God is perfect.

☞WWW☜ 15:5

There is clearly also a whole set of other pairs which could be added in to a table such as this as well, perhaps best captured by the psychoanalytic distinction of anal retentiveness and anal expressiveness (Kline, 1972).

The distinction Carlyle makes is well seen in the other comments he makes about Voltaire's style:

> "[Voltaire's] objects do not lie round him in pictorial, not always in scientific grouping; but rather in commodious rows, where each may be seen and come at, like goods in a well-kept warehouse. ... Compare, for example, the plan of the *Henriade* to that of our so barbarous *Hamlet.* The plan of the former is a geometrical diagram by Fermat; that of the latter a cartoon by Raphael. The *Henriade*, as we see it completed, is a polished, square-built Tuileries: *Hamlet* is a mysterious star-paved Valhalla and dwelling of the gods..."

The analogy with the Tuileries is interesting in that it is precisely the one which the physicist Frank Close uses as the metaphor at the start of his *Lucifer's legacy* (2000).

☞WWW☜ 15:6

Jacques Monod, who won the Nobel Prize for Physiology in 1965, put it thus: "For without invariants, without order, without symmetry, science would not only be dull; it would be impossible" (Monod, 1969 p.27). One is tempted to add that if there were only symmetry, only order, then science would be either trivially easy or frustratingly banal. Just as life seems to hover in that space between complete regularity and total chaos, as Stuart Kauffman (1993) has suggested, so science also seems to inhabit that same location.

☞WWW☜ 15:8[1]

The possibility that chiral simple molecules can impose their asymmetry on large-scale macromolecular systems has been revived also with the finding that when calcite is crystallised in the presence of D- or L-ascorbic acid, then large-scale asymmetries are apparent in the crystals (Orme et al., 2001). It has been suggested that such factors may even be responsible for the presence of asymmetries in the shells of foraminifera (Addadi & Weiner, 2001). This seems to provide a separate mechanism by which, in principle, Chothia's gap can be bridged.

☞WWW☜ 15:9[2]

The handedness of proteins can be somewhat confusing. There is no doubt a protein made of D-amino acids would be the mirror-image of one made of L-amino acids – as can be seen in chapter 6. The point at issue here, though, is that any particular protein is as likely to be left-handed in its overall conformation as it is to be right-handed, even though it is made up of L-amino acids. However even if one arbitrary protein is right-handed, and another happens to be left-handed, if they were made of D-amino acids they would be left-handed and right-handed respectively. See the discussion of the paper of Chothia (1991).

---

[1] **☞WWW☜** not included in the notes in the book.

[2] **☞WWW☜** was inadvertently omitted from the notes in the book.

☞WWW☜ 15:10

The quotation, from *The Ring and the Book* (I:828) (Altick, 1971), which is of course meant in an entirely different way, imposes a greater humility in the face of the enormity of the questions asked:

> "... how heart moves brain, and how both move hand,
> What mortal ever in entirety saw?"

It cannot be stressed enough here that although there is an evolutionary link between the asymmetry of the heart and the asymmetry of the brain, that is not to say there is a link within the development of the individual organism (since handedness and situs are not linked). The association is phylogenetic not ontogenetic.

☞WWW☜ 15:11

Elytis (1911-1996) won the Nobel Prize for Literature in 1979.

References

Addadi, L. & Weiner, S. 2001, "Crystals, asymmetry and life", *Nature*, **411**, 753-754.

Altick, R. D. 1971, *Robert Browning: The ring and the book,* Harmondsworth: Penguin.

Chothia, C. 1991, "Asymmetry in protein structures," pp. 36-57 in *Biological asymmetry and handedness (Ciba foundation symposium 162)*, G. R. Bock & J. Marsh, eds., Chichester: Wiley.

Close, F. 2000, *Lucifer's legacy: The meaning of asymmetry,* Oxford: Oxford University Press.

Feynman, R. P., Leighton, R. B., & Sands, M. 1963, *The Feynman lectures on physics. Vol I: Mainly mechanics, radiation, and heat,* Reading, MA: Addison-Wesley.

Kauffman, S. A. 1993, *The origins of order: Self-organization and selection in evolution,* New York: Oxford University Press.

Kline, P. 1972, *Fact and fantasy in Freudian theory,* London: Methuen.

Monod, J. 1969, "On symmetry and function in biological systems," pp. 15-27 in *Symmetry and function of biological systems at the macromolecular level*, A. Engström & B. Strandberg, eds., Stockholm: Almqvist and Wiksell.

Orme, C., Noy, A., Wierzbicki, A., McBride, M. T., Grantham, M., Teng, H. H., Dove, P. M., & DeYoreo, J. J. 2001, "Formation of chiral morphologies through selective binding of amino acids to calcite surface steps", *Nature*, **411**, 775-778.

Reade, J. 1998, *Assyrian sculpture,* London: British Museum.

Swindler, M. H. 1929, *Ancient painting: From the earliest times to the period of Christian art,* New Haven: Yale University Press.

Weyl, H. 1952, *Symmetry,* Princeton, NJ: Princeton University Press.