Two heads good

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Mark S. Blumberg

FREAKS OF NATURE
And what they tell us about development and evolution
326pp. Oxford University Press. £12.99 (US $22.95).
978 0 19 921305 4

In 1998 the Spanish biologist Pere Alberch died in his sleep at the age of forty-three, nine years after having written a remarkable essay called "The Logic of Monsters". Alberch, who spent much of his short career tinkering chemically with the limb buds of salamanders to alter their number of toes – creating monsters, if you will – made an insistent case for the multitude of non-genetic factors at work in the shaping of an organism, and, later on, in letting it adapt and function in its world.

Biology is about the system, not just the programming, but the system is often ignored by scientists and laymen alike in favour of an almost magical understanding of how DNA acts. In *Freaks of Nature*, Mark S. Blumberg chafes at the palette of terms that have come to dominate the language of development: "genetically programmed, hardwired, predetermined, scripted". Alberch's distaste for the same may have cost him tenure at Harvard, where he was criticized for not being "more genetic", according to his obituary writers.

Blumberg uses the subjects of this book – conjoined twins, men without penises, two-faced cats, Alberch's salamanders, and people born without legs – to advance separate but related arguments. The first is that the development of an embryo entails complex chemical and physical processes involving temperature and gravity, along with proteins, toxins and myriad other molecules, of which DNA is but one. These "elaborate and complex, tortured and convoluted" processes, Blumberg laments, were intimately explored for centuries, then sidelined ever since the discovery of DNA. Yet there are myriad forms for which no gene can take credit. Two-headed ducks are the result not of mutations but of being jostled *in utero*; temperature, not chromosomes, will determine the sex of a crocodile; the free martin, a sterile and hermaphroditic cow, results from hormones having passed over from a male twin.

Nor, Blumberg's second argument goes, should genes be blindly invoked in such behavioural matters as learning to walk, since "there is no need to hardwire that which is learned through experience". Blumberg's monsters (he resurrects the cringe-inducing terms "freaks" and "monsters" as an alternative to "mutants", since genes aren't always in play) are able to thrive thanks not to hardwiring but the opposite – innate flexibility – and discover ways to walk expertly on their hands, or coordinate graceful movements with a conjoined twin.

The inability to place monsters in a proper evolutionary context is actually a good deal older than DNA-centredness, Blumberg notes throughout *Freaks of Nature*. Charles Darwin, who didn't know the term "gene", was dismissive of monsters as abrupt accidents in a pattern of continuous and near-infinite variation. It was Pere Alberch who reconsidered the Darwinist position; the "infinite" external forces of natural selection had to be constrained, Alberch believed, by internal rules of development. Monsters, Alberch argued, offer a window on to these rules, as "they represent forms which lack adaptive function while preserving structural order. There is an internal logic to the genesis and transformation of such morphologies, and in that logic we may learn about the constraints on the normal".

So what is the normal, Blumberg asks, but a more familiar kind of accident? "The embryo's potential to produce two heads is no less ancient, and no less fundamental, than its potential to produce just one", he writes. It makes sense, given this perspective, that Blumberg cautions against surgical interventions for people whose abnormalities are not harmful to their health; better, he says, to wait and see what the body thinks up. He is impressed by the late Johnny Eck, a legless circus performer of great agility, and the well-adjusted Hensel twins, living teenage girls who share a lower body. Even people born with ambiguous genitalia can lead fulfilling sexual and emotional lives, says Blumberg, who seems to regard surgeons who would "correct" the sex of an ambiguous baby – or even perform sex changes on adults – to be butchers. This extreme position is only the logical extension of Blumberg's arguments, but one wishes he had interviewed some conjoined twins, hermaphrodites, and hand-walkers himself before painting quite so rosy a picture of their lives.

This is a quibble about an otherwise elegant effort. All writers of popular natural history books will these days be compared to the late Stephen Jay Gould, usually in the exaggerated praise on their dust jackets, but with *Freaks of Nature* a comparison seems apt. Gould, before Blumberg and Pere Alberch, harboured serious concerns about genetic absolutism and the underplaying of X factors in evolutionary developmental biology. As a writer and historian of science, Blumberg does not lead readers into the tunnels of mystery and imagination that Gould once did, but he knows a few good alleys, and there is a Gould-like sense of justice underpinning his approach.

Anyone expecting a profound exploration of what it's like to be a monster will be disappointed by *Freaks of Nature*. Yet this careful book offers something better: a reassessment of a scientist who died young and under-appreciated, a forceful repudiation of "an unfortunate tradition of scrutinizing development primarily through a genetic lens", and a rare journey into what Blumberg's nineteenth-century forebears called "the secret work-room of Nature", a room that has been locked and neglected for too long.