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ICHTHYO

THE ARCHITECTURE OF FISH

X-Rays from the Smithsonian Institution

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Essays by Jean-Michel Cousteau, Dr. Daniel Pauly, and Dr. Lynne R. Parenti

X-Rays by Sandra J. Raredon



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BEAUTY FOR FISHES

Dr. Daniel Pauly

Beauty may be in the eye of the beholder, but there is more to beauty than subjective whimsy. In the Renaissance, beauty—following notions dating from ancient Greece—was thought to result from certain numbers or ratios, for example the golden ratio or divine proportion (1.618 . . .) observed in many biological structures. By identifying these numbers or ratios in the shape of living organisms, including humans, we could thus access the mind of God and celebrate his sense of beauty.

Beauty and Evolution

These notions held sway until 1859, when Darwin's *Origin of the Species* appeared. *Origin* allowed us to see, when viewing an organism, not a creature (an organism created), but an evolved being. In this and subsequent work, Darwin also enabled us to see beauty as an evolved by-product of either natural or sexual selection. Both are the legacy of ancestors, which, having secured fertile mates, successfully reproduced, that is, produced offspring capable of securing a fertile mate, and so on.

In animals, natural selection both generates and requires a sense of beauty, which is used for choosing mates. For females in particular, it is important that they choose correctly, given that in most species, producing offspring is quite costly. Moreover, neither male nor female can predict the conditions to which their offspring will be exposed. It is better, therefore, to avoid extreme traits and adaptations.

Animals, including us, do this by “averaging” the features of their potential mates and extracting a mean. Those with the features closest to this mean are seen as beautiful and desirable. They are less likely to be subject to external evolutionary pressures and more likely to survive. This is well documented in humans, and also in animals such as butterflies and fish, which have a sense of beauty and beautiful visions of prospective mates in their little brains. Thus, evolutionary success leads us to believe that “beauty is but skin deep.”

The implication is that beyond the surface integument of organisms, all there is to be seen is ugliness. This is

suggested in predictable TV shows, where the jaded medical examiner shocks rookie cops with the horrors of an opened-up body. But there are other ways of looking behind the skin, notably the discovery of X-rays in 1895 by Wilhelm Conrad Röntgen. X-rays make accessible to our eyes the internal structure of organisms, their symmetries, and the pattern of their lives.

Pattern Recognition: Evolution and Beauty

We enjoy discovering patterns in images and data, particularly when they are extracted from noisy background data. The reason, obviously, is that we evolved that way, as discovering patterns increased one’s chance of survival. For example, patterns in the soil reveal the presence of edible roots, and the flight patterns of vultures indicate the location of a meaty carcass at the horizon.

Our pattern recognition system, however, is not honed to any specific patterns, and this enables us to appreciate patterns that have no survival value in evolutionary terms—hence our appreciation of the arts. A symphony is layered,

and the recognition of one pattern leads to the recognition of another, deeper pattern: pattern upon pattern, an endlessly layered onion. It is the same for the X-rays of the fish in this book.

What do we see when we look at these fish? We see symmetries, always bilateral, often complex. For example, a flying fish (see page 81) has bilateral symmetry and two pairs of wings, like a bird riding on a bird. Then we see the repetitive pattern of the ribs, some, but not all, continued in fin rays. These are in groups—the dorsal might consist of two sets of rays, and the anal fin reproduces only part of that pattern.

Beyond the symmetries and patterns, we gradually discern functions: a head with strong jaws to grasp strong prey or, on another fish, long buccal tubes with a tiny mouth at the end. Their owner surely eats little things. We begin to see the body as an afterthought, following on the mouth. These fish live only to eat, especially as the X-rays do not see the gonad that will

produce the next generation of these voracious creatures.

Beauty is not skin deep. It is accessible through any of the onion's layers, with the internal layers informing those outside of the beauty inside. Also, beauty in animals is embodied in symmetries, which lead their possessors to be selected and their genes to be passed along in the course of evolution.

And no, beauty is not in the eye of the beholder. It is, if anywhere, in our brains, which reward us with finding patterns and symmetries, the art in the science of this collection of fish, and in this book. ■

