Asymmetry: symptom of pollution, inbreeding

Obvious lack of symmetry in living creatures is extremely rare. Only a few animals develop so as to favour the left or right, perhaps the best example being the male fiddler crab, which grows an enormous pincer on one side and a diminutive one on the other.

One good reason for staying symmetrical involves locomotion. If one leg were longer than another, or a wing were larger than its mate, the animal would go round in circles!

Occasionally, though, individual exceptions do make an appearance. Such monsters may sport a leg where an antenna should be, or have an extra head, limb, or toe.

Nuclear radiation or mutagenic chemicals can readily give rise to these abnormalities, but sometimes they arise apparently by chance.

More commonly, however, we observe that Nature's over-riding symmetry can be broken in much more subtle ways: the coat markings on a dog; flecks in the colouring of our eyes; even our faces have their 'better' side.

Scientists have now taken notice of differences between left and right, wondering what could have caused them.

Remarkably, investigations have shown that minor deviations from symmetry can be related to stresses the animal is under from pollutants in its environment during development. For example, some Californian fish species have been found to show increasing anatomical asymmetry (in details of scales, fins, and gills) as the concentration of DDT in the water increased.

Recently, Mr Geoff Clarke and Dr Max Whitten, of the CSIRO Division of Entomology, and Dr Geoff Brand of the Marine Science Laboratories at Queenscliff, Vic., published evidence that departures from symmetry can be induced by genetic stress too. They found that inbreeding in a marine micro-crustacean, *Tisbe holothuriae*, also leads to asymmetry.

The researchers quantified the creature's asymmetry by counting the number of bristles on certain sections of its legs (see the illustration). Sometimes it had more on the left than the right; sometimes the opposite. The average difference was the measure they scored.

As the graph shows, the asymmetry score increased as the animals bred (by inbreeding) over several generations. Apparently, inbreeding leads to stress during the animal's development.

Mr Clarke thinks he and his colleagues may be working with a very sensitive tool for examining potentially deleterious influences on development in living organisms. It seems that an effect can be detected long before such influences are severe enough to result in grotesque or fatal effects.

Mr Clarke and Dr Brand plan to see whether the approach can be used for early detection of pollution of the marine environment by heavy metals.

To test the creature's response, they have begun studies with fixed concentrations of cadmium. If a consistent relationship emerges, it may be possible to monitor heavy metal pollution by sampling populations of *T. holothuriae* from their coastal habitat, and examining them for symmetry.

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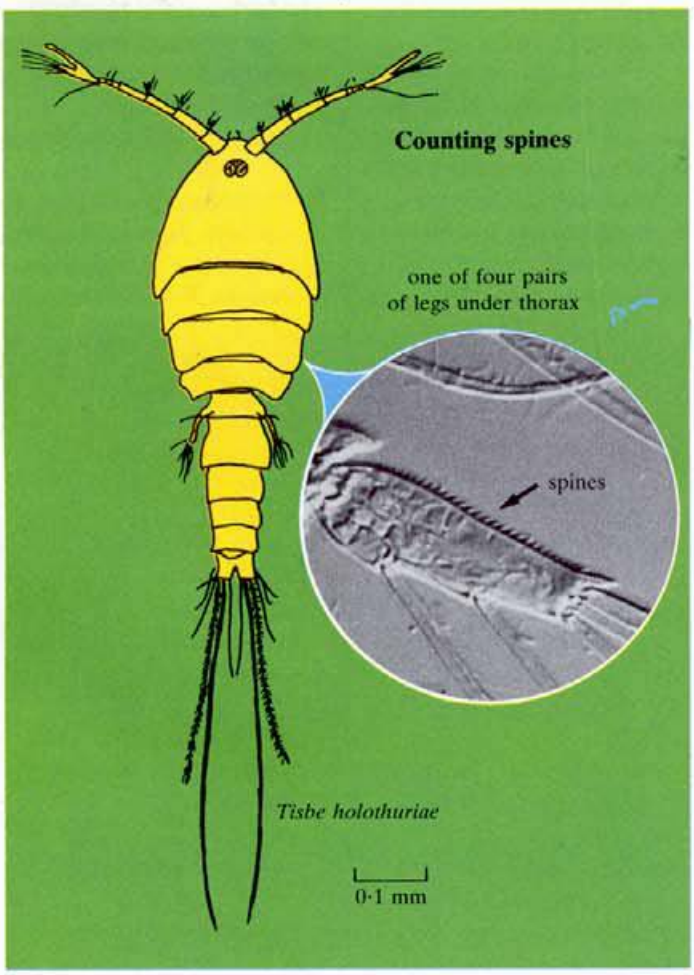
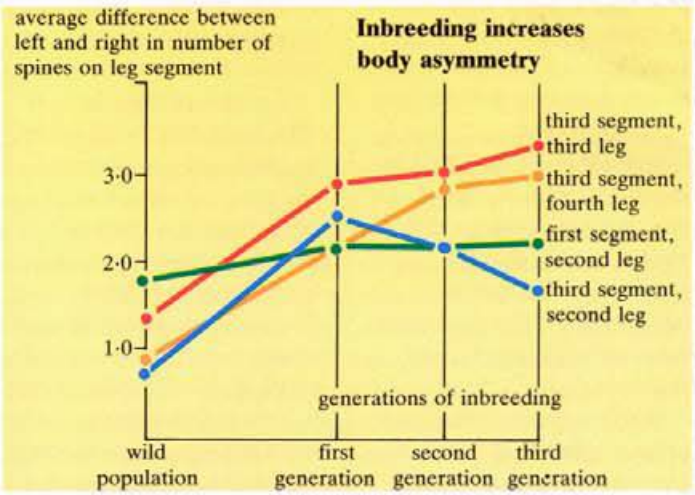


To measure asymmetry, the researchers looked for the difference in the number of spines between left and right legs.



As populations of *T. holothuriae* are inbred, successive generations show greater asymmetry in some body characteristics. Somehow, the genetic stress disturbs development.

Fluctuating asymmetry: a technique for measuring developmental stress caused by inbreeding. G.M. Clarke, G.W. Brand, and M.J. Whitten. *Australian Journal of Biological Science*, 1986, **39**, 145–53.