

Shapes of Time: Fossil Development and Evolution or Darwin's Forgotten Insights

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(This is the report of a lecture given to the Ashmolean Natural History Society of Oxfordshire on the occasion of the Darwin Dinner on the 7th March 2009: report written by F Watkins)

Dr McNamara began by discussing developmental change and embryology. He quoted Ernst Haeckel who said, "Ontogeny is the short and rapid recapitulation of phylogeny", meaning that the developmental journey of an organism, including the embryo stage, bears morphological similarities to the evolutionary path which has led to that organism.

In 1922 Walter Garstang introduced the concept of "paedomorphosis". This is the retention of traits in adults, which were previously only seen in juveniles of a species. Its opposite, where organisms mature beyond adulthood is known as peramorphosis. Both forms are examples of heterochrony.

Paedomorphosis can be produced by growing more slowly, growing for a shorter time or starting to grow later. We saw pictures of an example of paedomorphosis from the fossil record, a trilobite which shows characteristics of a larval form of another trilobite, *Olenellus*. Another example was *Sinosauroptryx*, a dinosaur from the early Cretaceous which showed downy feathers.

An example of peramorphosis was *Tyrannosaurus* which grew very quickly and for a longer time leading to its massive skull and generally large size.

Sometimes paedomorphosis is arrived at by artificial selection. For example, the earliest domestic dog skull resembles that of a wolf pup. It is possible that the character which was selected for was docility. In other cases it takes the form of neotony, as with the axolotl, a salamander which has not gone through the metamorphosis into an adult stage which is usual for an amphibian. Sometimes, the paedomorphosis is associated with sexual dimorphism as with the angler fish where the female develops normally but the male is tiny and spends its life attached to the head of the female.

Sometimes a species can exhibit both paedomorphic features and peramorphic ones. This is true for the rhea whose downy wings are paedomorphic and whose extremely well developed legs are peramorphic. Even *Tyrannosaurus rex* had rudimentary arms despite its mostly peramorphic characteristics.

Finally, Dr McNamara discussed humans. He argued that we are mostly peramorphic with our large skulls but that we do have paedomorphic characters, our reduced jaws and teeth and reduced gut.

Throughout his talk Dr McNamara made it clear that Darwin had noted and drawn conclusions from this kind of phenomenon.

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