Generic vs genetic approaches to early animal evolution

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Abstract

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Of some 119 eukaryotic clades, 36 contain multicellular forms, representing at least 21 different origins. Yet only three of these clades exhibit complex cellular differentiation and morphogenesis, and all three possess various developmental tools required for development. Were a strictly structuralist approach to early animal evolution correct, complex multicellularity should be more widespread. Some advocates of structuralist approaches have claimed, for example, that the organisms preserved as fossils in the mid-Cambrian Burgess Shale shared the same genome, with their widely varying morphologies (arthropods and lobopodians to cephalochordates) the result of different physical forces. Such claims are decisively refuted by comparison of the genomes of living descendants of Cambrian clades. Such speculations greatly damage the substantive issues raised by structuralism and any effort to reconcile genetic and generic approaches. Although there is little doubt that physical forces have an impact on the developing embryo, particularly in the folding of sheets and tissues, the structualist approach to development has been far less successful than comparative and experimental genomics. The difficulty in achieving reconciliation between these two approaches stems in part from the fact that most experimental (rather than comparative) approaches necessarily make uniformitarian assumptions about our ability to project results back some 550 million years, assumptions which are likely invalid. Synthetic experimental evolutionary approaches may prove more useful.

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