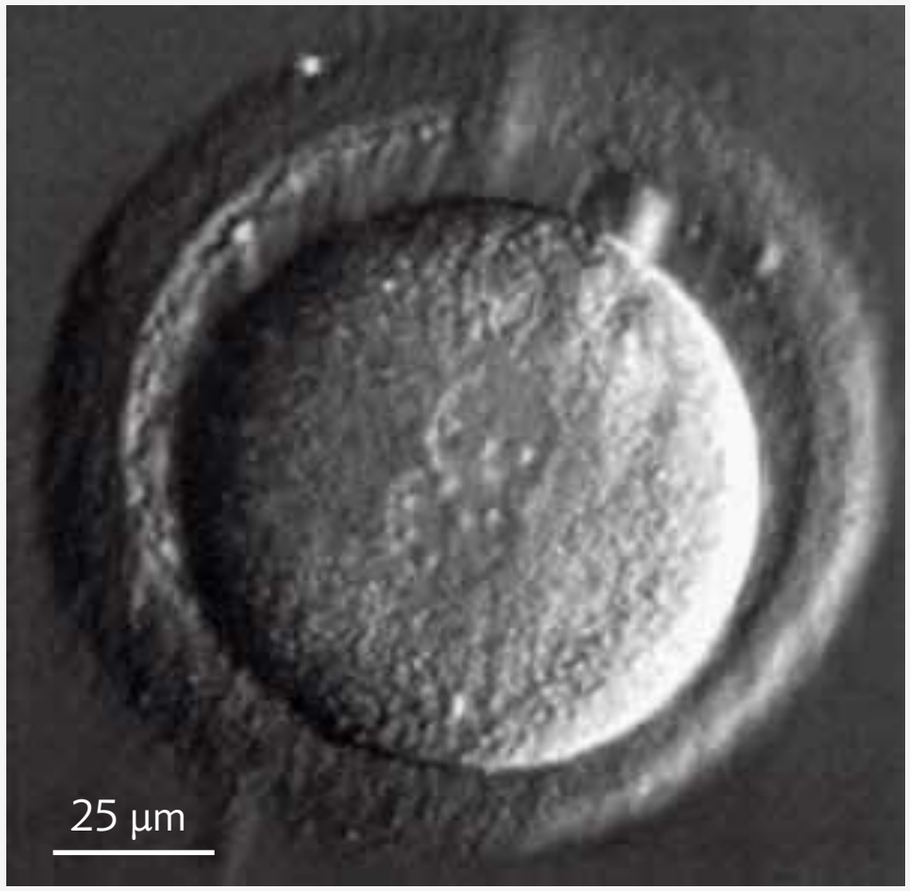
BE 159

Signal transduction and mechanics in morphogenesis

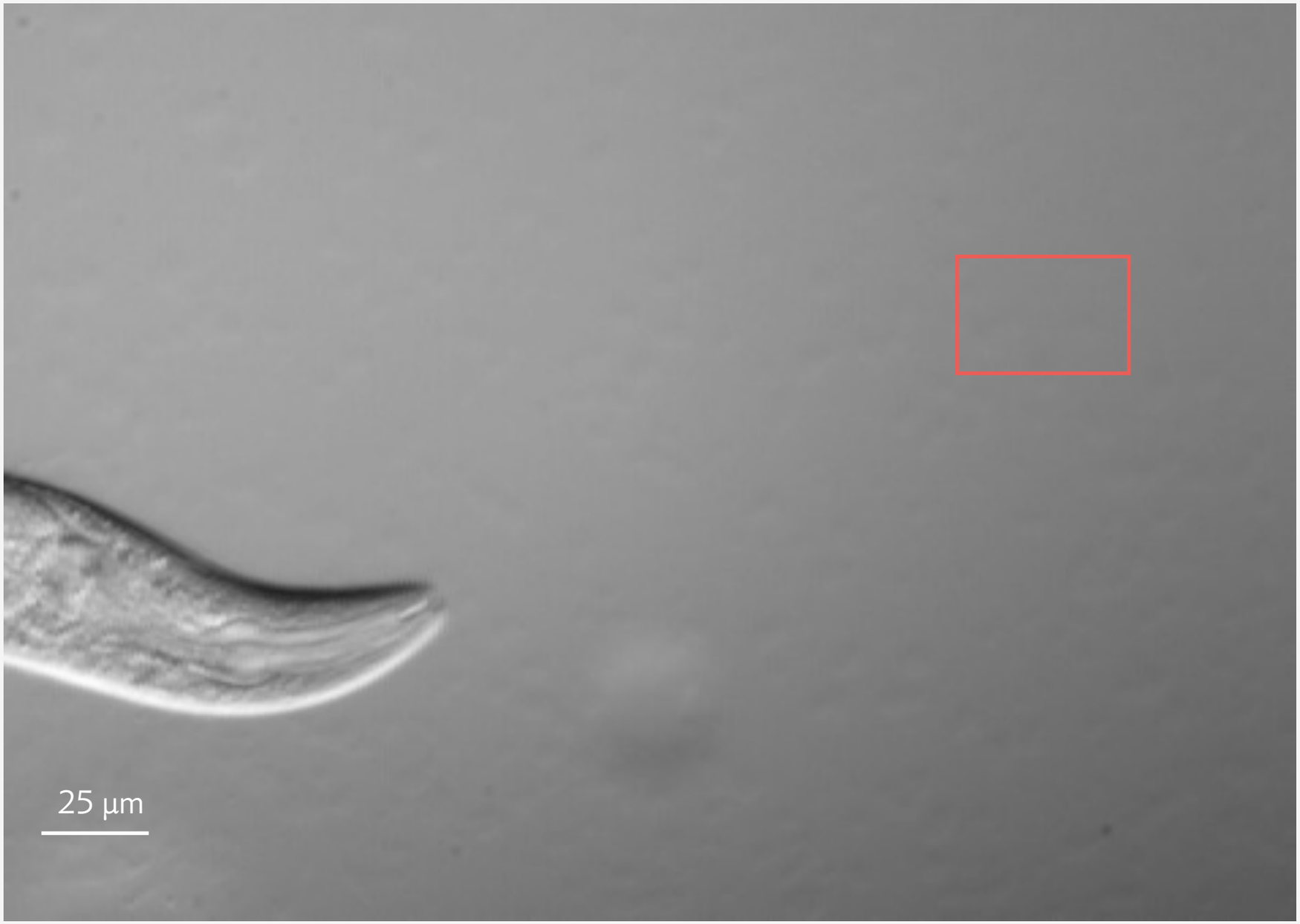
Winter term, 2016

Problem of developmental biology: how an organism gets its shape



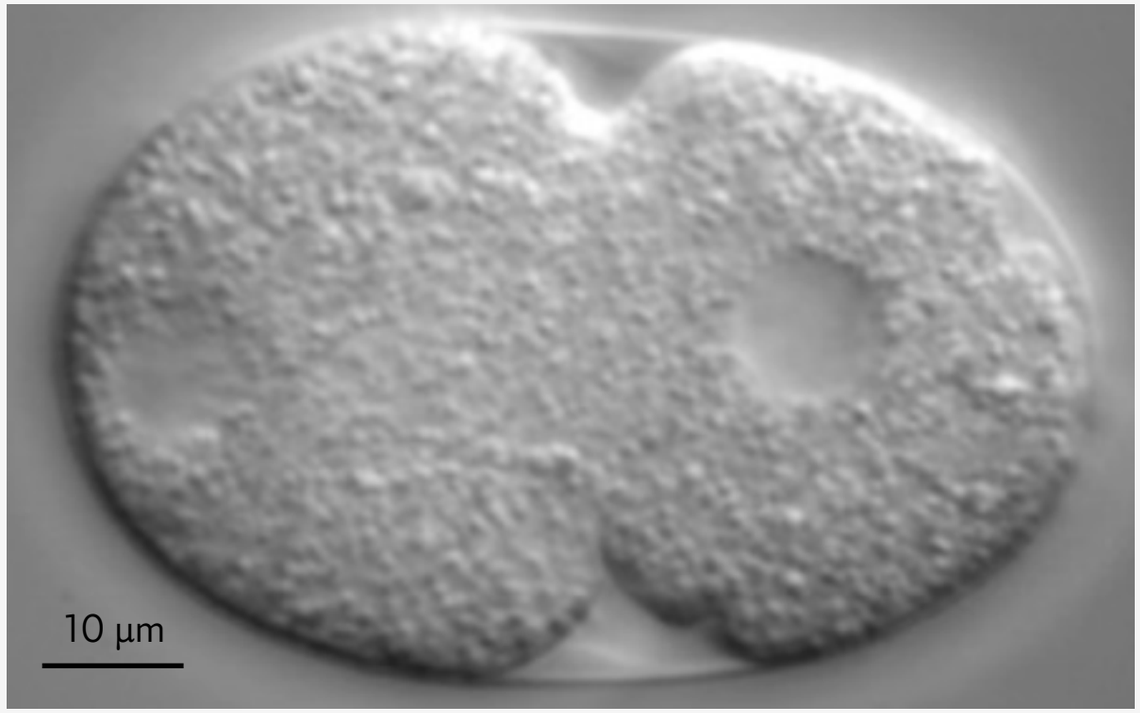
Images: left, Advanced Fertility Center, Chicago; right, Getty Images

Caenorhabditis elegans is a key model organism for developmental biology



Movie from Bob Goldstein's lab, UNC

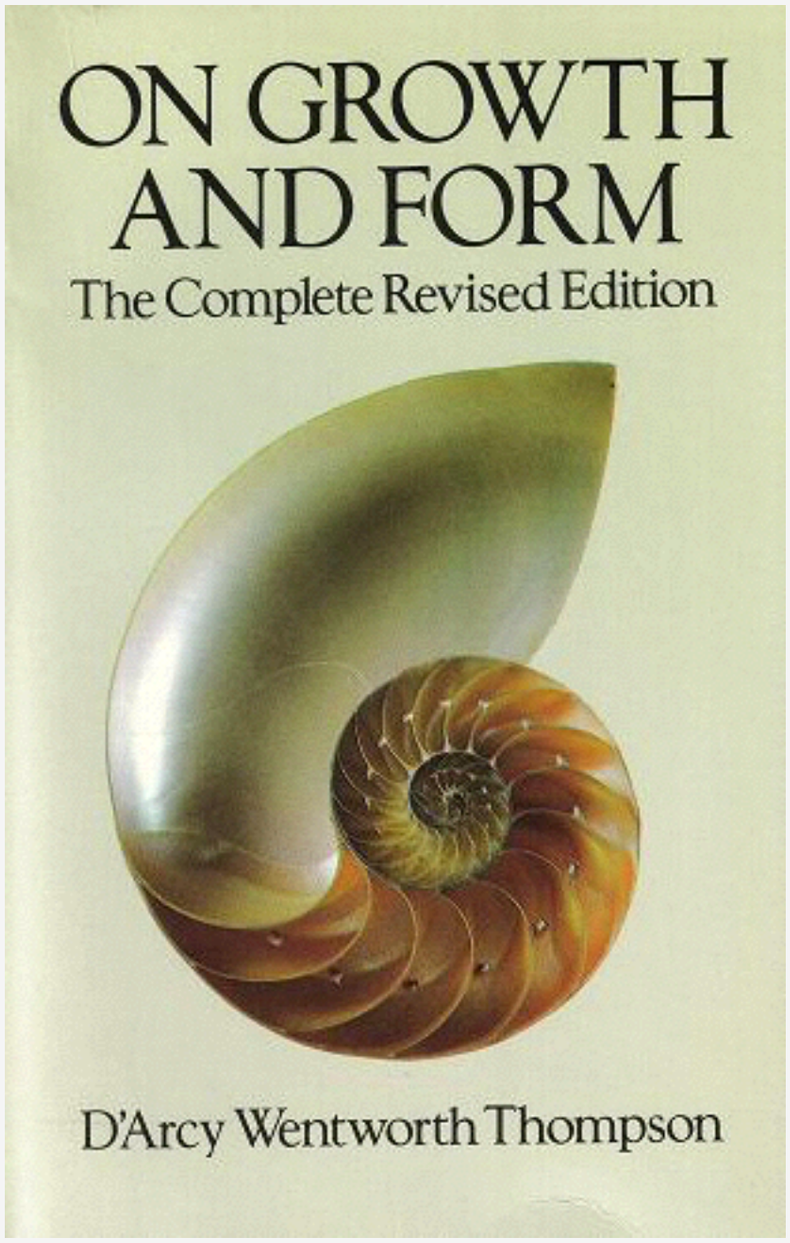
Development from egg to worm is a tightly-regulated program



Images: left, Goldstein lab, UNC; right, wormatlas.org

Video: Bob Goldstein's lab, UNC

On Growth and From brought mathematics to development



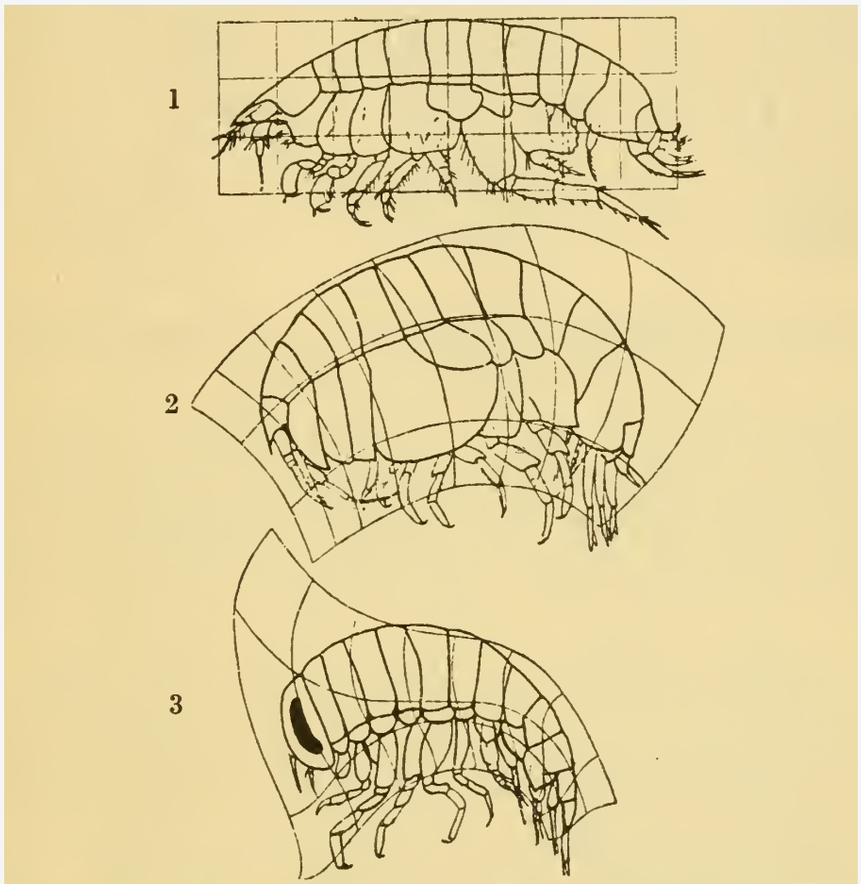


Fig. 514. 1, *Harpinia plumosa* Kr.; 2, *Stegocephalus inflatus* Kr.; 3, *Hyperia galba*.

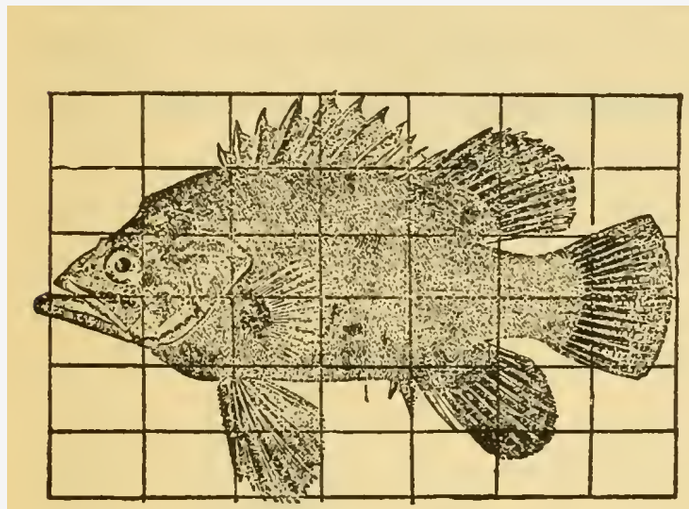


Fig. 521. *Polyprion*.

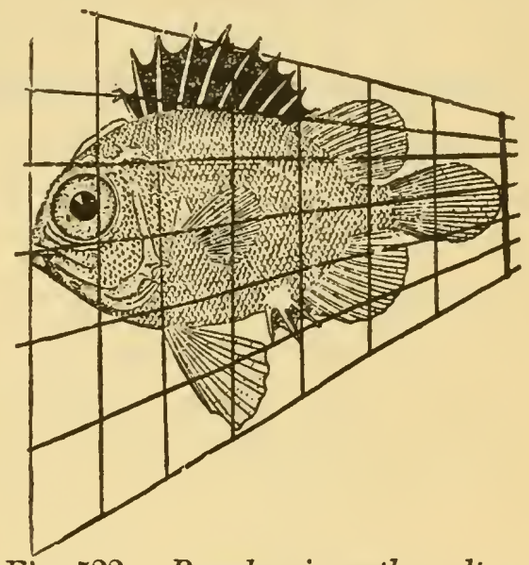
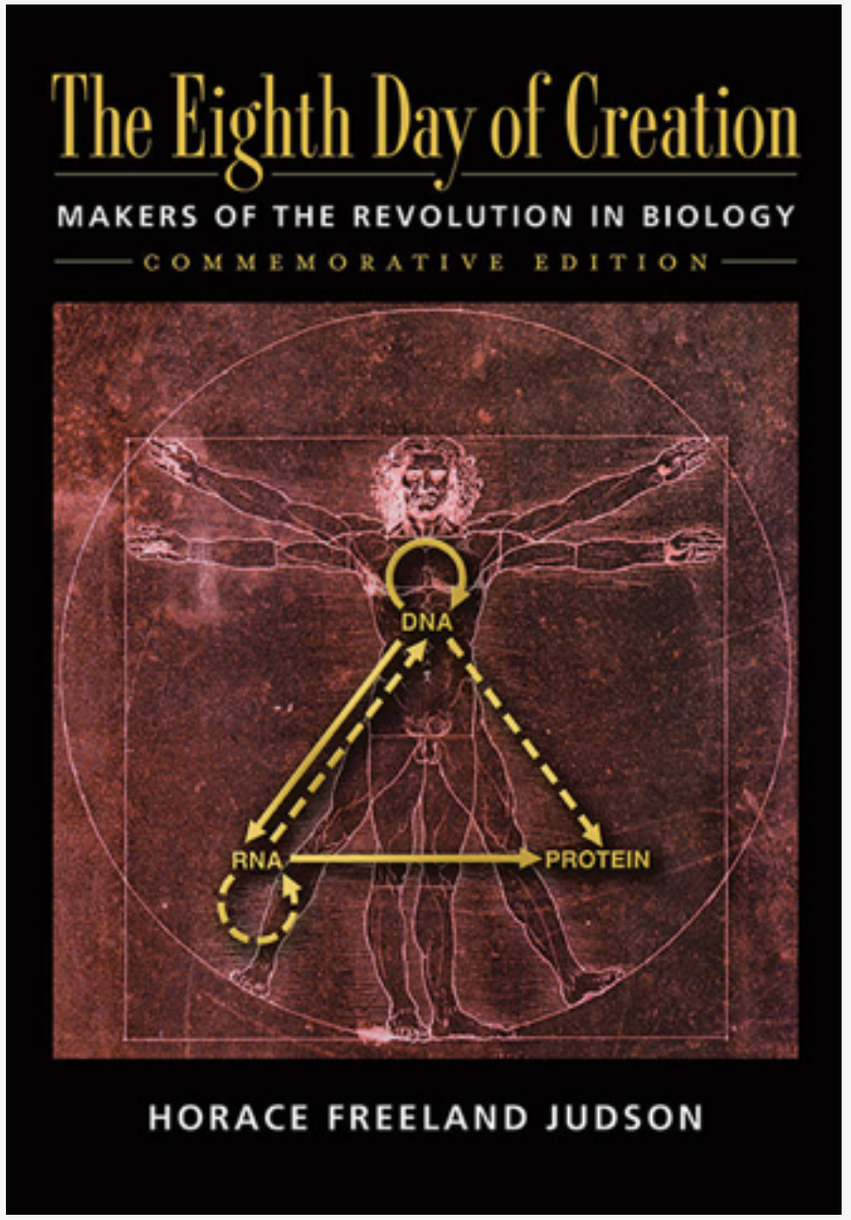


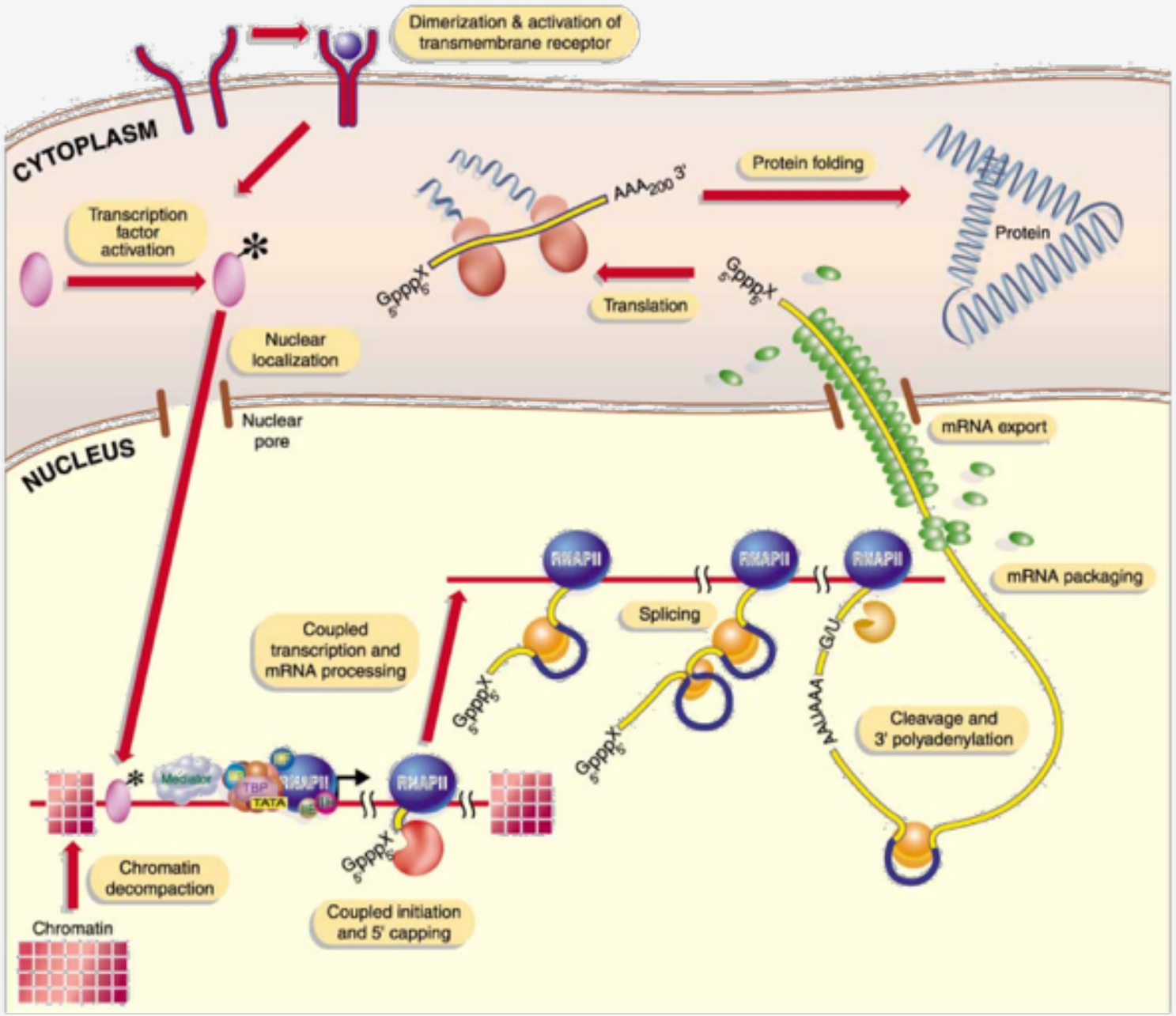
Fig. 522. *Pseudopriacanthus altus*.

Thompson, *On Growth and Form*, 1917

Developmental biology is included in the Molecular Revolution

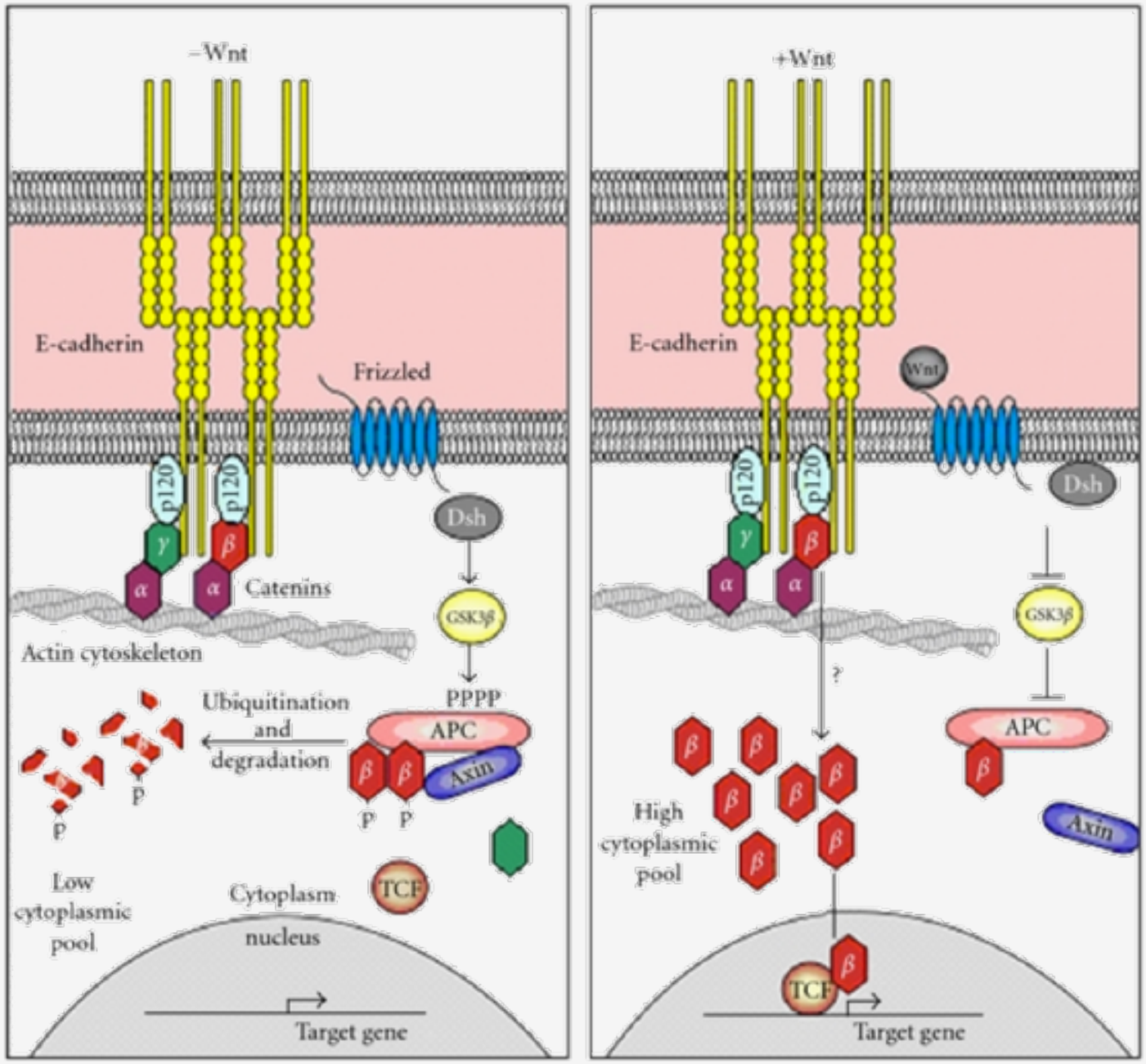


Differential gene expression is the result of molecular action



Orphanides and Reinberg, *Cell*, 2002

β-catenin has a double life: transcription factor and mechanical regulator



Tian, et al., *J. Biomed. Biotech.*, 2011

D'Arcy Thompson's philosophy

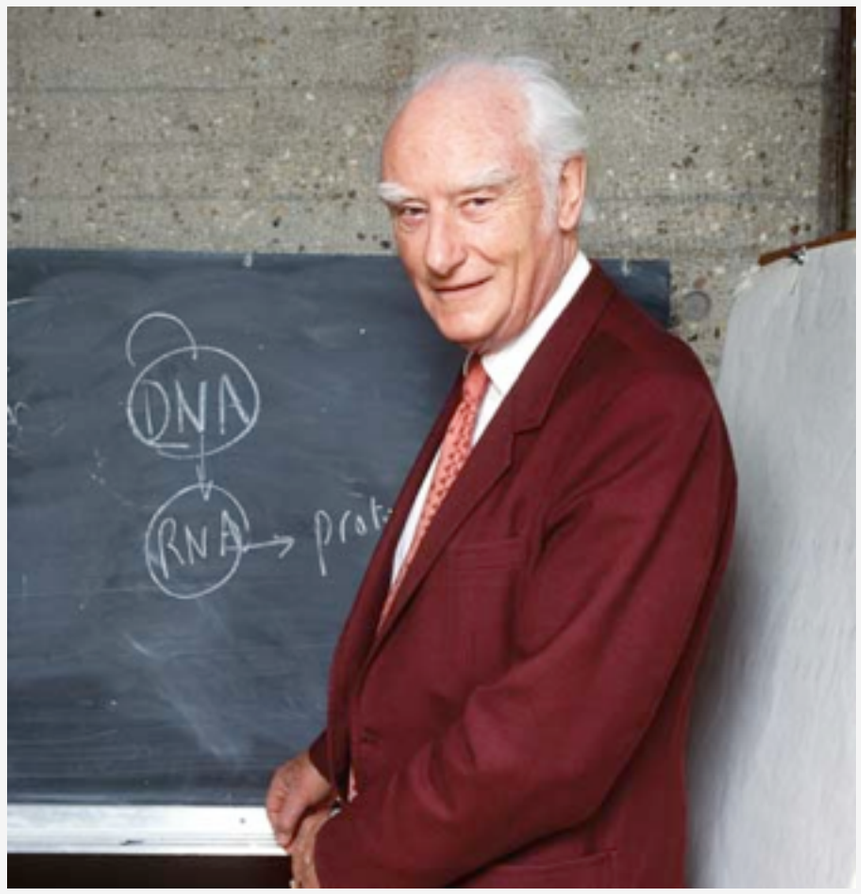
The philosophy that pervades *On Growth and Form*, and indeed D'Arcy Thompson's publications in general, is the explanation of natural phenomena in terms of physical, and especially mathematical, laws. His mathematical approach was unusual among biologists then; and it is still a minority approach in the present day: compare, for example, the relative frequency of papers that deal with the molecular details of developmental gene interactions and those that deal with their quantitative dynamics.

Our ignorance of developmental biology has the following curious feature. We understand how an organism can build molecules (even very large molecules) in great variety and with great precision, although the largest of them is far too minute for us to see, even with a high-powered microscope; yet we do not understand how it builds a flower or a hand or an eye, all of which are plainly visible to us. We understand much of what goes on inside a small cell, such as a

F. H. C. Crick, F.R.S.

Kieckhefer Distinguished Research Professor, The Salk Institute, San Diego, California, U.S.A.

Awarded the Nobel Prize for Medicine (jointly) in 1962, the Royal Medal of the Royal Society in 1972 and the Copley Medal in 1975. Honorary Fellow of Churchill College and Caius College, Cambridge. Fellow of University College, London.



DEVELOPMENTAL BIOLOGY

From: *Encyclopedia of Ignorance*, R. Duncan and M. Weston-Smith. Eds., Pergamon Press, 1977, 299-303.

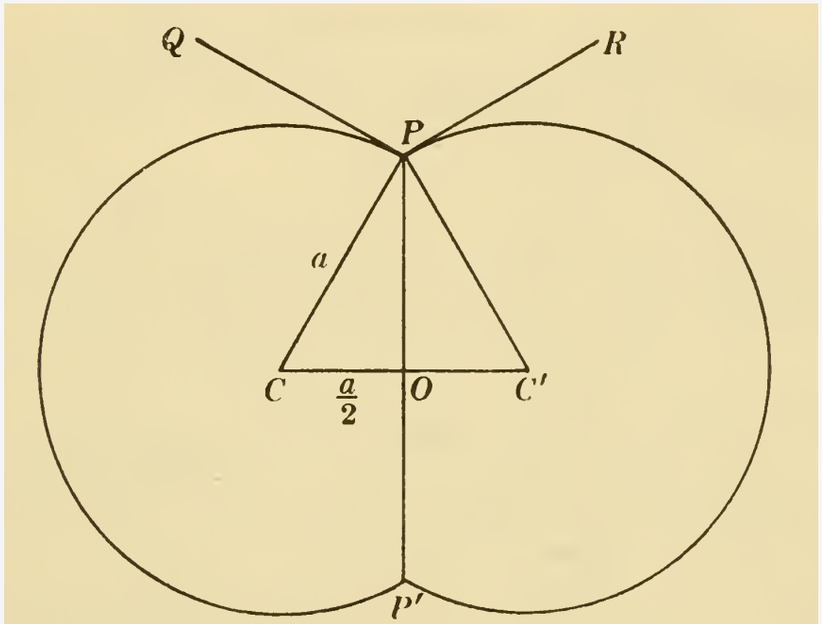
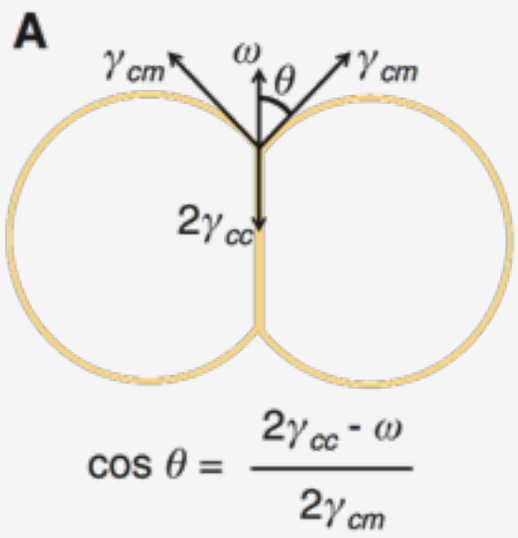
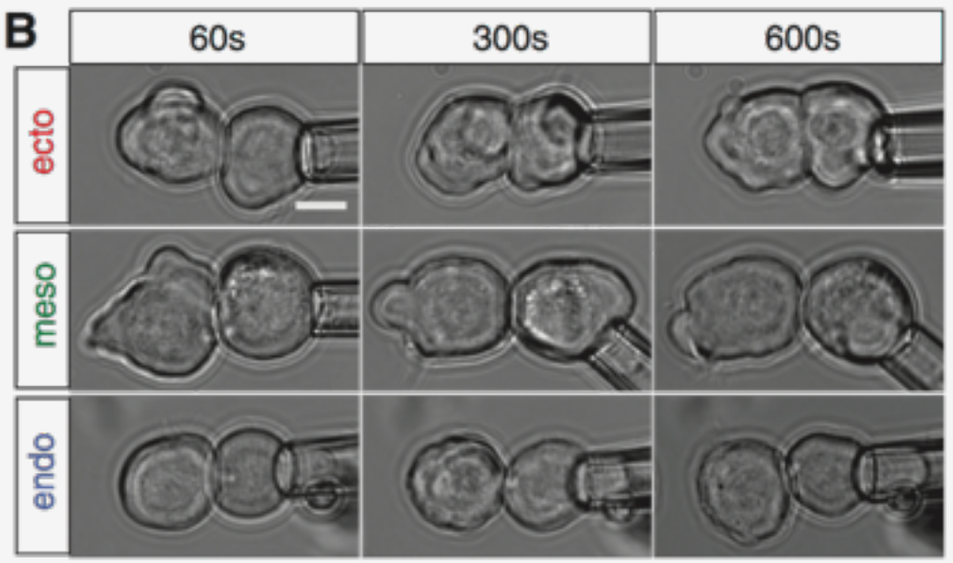


Fig. 158.

Thompson, *On Growth and Form,* 1917

We will marry mechanics and signaling, the past and the present.





Maître, et al., *Science*, 2012

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