onomists are currently debating. His radical proposals, like any revolutionary ideas, will no doubt be met with strong resistance. However, given the urgent need to finish describing Earth's biodiversity, some question whether taxonomists really should be engaged in this debate at all. E. O. Wilson recently compared making radical changes in our current codes of nomenclature with "rewriting the operating manual for the Titanic" (*9*), and Paul Erhlich has regarded it as a silly enterprise (*10*). I too worry that now is not the time to be getting mired in a nomenclatural debate.

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BOOKS: DEVELOPMENT

Model Representations

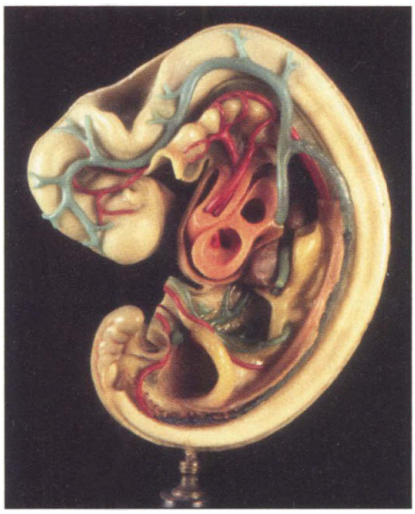
Jenny Uglow

When Franz Keibel, rapidly becoming the world's leading vertebrate embryologist, left Freiburg in 1914 for a chair in Strasbourg, the centerpiece at the departure party was a human embryo modeled in marzipan. This bizarre incident, with male scientists happily nibbling a sweet simulacrum of the unborn, typifies a disturbing undertone that runs through *Embryos in Wax*, Nick Hopwood's scholarly account of the creations and careers of modelers Adolf and Friedrich Ziegler. Techniques of representation are never neutral, however much they claim "objective" status.

Embryos in Wax Models from the Ziegler Studio
by Nick Hopwood

Whipple Museum of the History of Science, University of Cambridge, and the Institute of the History of Medicine, University of Bern, Switzerland, 2002. 216 pp. Paper, $19.50, £13.50. ISBN 0-906271-18-5.

The book is meticulously documented and superbly illustrated. As well as including colored plates of the models, Hopwood takes care to show the workshops where they were made and the classrooms in which they were used. The visual context, which mirrors the author's unearthing of scores of dusty teaching aids from cupboards and storerooms, reinforces his effort to recover the work that went into them: the collecting of specimens, the anatomical and microscopic inquiries, the careful arranging in developmental order. In the process, Hopwood unravels the intricate links between the evolution of wax-modeling and the development of embryology itself in Germany from 1850 to 1920, with all the fierce arguments and jostling for position. Morphology was part of physiology. Without adequate representations, it was impossible to study development: specimens were rare, messy, and bloody; drawings or engravings failed to convey three-dimensional transformations. The models—magnified, solid objects—were essential tools, sold to institutions around the world.



Model dissection. Friedrich Ziegler's models formed an "inseparable" part of Wilhelm His's monumental anatomy of human embryos.

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The Zieglers neatly represent the seesaw of art, science, and commerce involved. Qualified in pharmacy and medicine, Adolf worked as assistant to Purkyně in Prague and Ecker at Jena before founding his studio. His son Friedrich trained as an artist but studied to boost his medical credentials. They were touchily conscious of their "scientific" status. Their first step was to salvage wax-modeling from the taint of sensationalism attached to both the ravishing, unsettling anatomical models of "La Specula" in Florence and the gory heads of Madame Tussaud's exhibitions. Concentrating on the specimens, they gave no sense of the anatomical context. As Hopwood suggests, something was lost. The embryos stood alone, as if developing without need of the body in which they should nestle. Specimens and models were even named by the initials of the doctors who supplied them rather than of the women they came from.

Adolf Ziegler styled himself as a "plastic publisher," and as such he became indispensable. After 1860 (when he and the anatomist Wilhelm His invented the technique of reconstructing sectioned chick embryos), the standard mode of research was for professors to make waxes from their own specimens, publish descriptive articles, and then send the model to the Zieglers for copying and "publication." In the complete reprint of Friedrich Ziegler's last catalog (from around 1912)—an invaluable feature of the book—each series is tagged with the professor's name.

Like book and journal publishers, the Zieglers were nervous about the validity of the work they distributed, and they sometimes found themselves entangled in theoretical quarrels. Adolf worked for Ernst Haeckel and his Darwinist followers, who were convinced that the development of complex from simple states repeated the evolutionary development of the species. Adolf's models of embryonic diversity included trout, amphioxus, starfish, and Haeckel's own controversial (and alarmingly slow-selling) "gastraea," supposedly a living representative of the hypothetical ancestors of all multicellular animals. Yet he simultaneously undertook work for His, who rejected the evolutionary model in favor of a mechanical approach and openly accused Haeckel of fraud. Both men used Ziegler's models as evidence.

The arguments, like the waxes, are history. We cannot recapture the awe of spectators at the 1893 World's Columbian Exposition in Chicago, where the Zieglers' vast cabinet of wonders won first prize. Yet some models, such as the delicate skull on which Friedrich worked for months with Florence Sabin, retain an aesthetic appeal that outstrips mere curiosity. It is ironic, of course, that a book about the preeminence of three-dimensions has to rely on flat illustrations. This extends to the marble statue of Wilhelm His, a virtual emblem of male appropriation, holding an embryo curled fossil-like between finger and thumb—a tiny organism metamorphosed for us from flesh to wax to stone to film to print. A virtue of Hopwood's study, quite apart from its fine resurrection of the media of 19th-century science, is that it makes one wary of all forms of visualization, whether they take on the somber, static solidity of the Zieglers' wax or the bright, dynamic life of today's 3D computer animations.

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