Understanding Embryos: Changing Assumptions

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Understanding Embryos involves changing underlying metaphysical and epistemological assumptions. And understanding the changing understandings over time is important not only in its own right, as adding to our knowledge about biology. Embryos have long been defined as the earliest stages of development, before the individual organism is fully formed, yet just what that means, how we know, and what follows from the interpretation has been deeply contested. In addition, as embryos have entered public discussion and have become the objects of legal and bioethical interpretations and actions, it is important that careful historical and philosophical study inform that discussion. History and philosophy of embryology can help make for better policy as well as better science.

This presentation will take an historical approach, looking at the episodes of interpreting embryos that we have identified in the context of the NSF-funded Embryo Project (see http://embryo.asu.edu). These each reflect dominant assumptions of the day, and the focus remains on the scientific interpretation of embryos. That scientific study is informed by social forces, of course, but the emphasis remains on the science itself rather than the surrounding social factors. The episodes overlap and are rough groupings, which include:
The Hypothetical Embryo: study remained theoretical, drawing on interpretations about the nature of individual organisms and their development. Aristotelian interpretations of the process of becoming and the timing of actualization (or the religious idea of ensoulment) dominated this period.

The Observed Embryo: featuring 18th and early 19th century empirical studies of embryos of diverse organic types. Here metaphysical debates about materials and vitalism collided with epistemological debates about how can empiricism can take us. The period became lively with the interjection of evolutionary ideas, which drew on embryos as evidence and also used evolution as evidence about development.

The Biological Embryo: biologists (as they had begun to call themselves) wanted more than they could see by observing natural organisms, and began to see experimental manipulation as necessary for understanding embryos and development. Competing approaches to experimentations joined with competing interpretations of the meanings of results. Debates focused especially on the relative contributions of cytoplasm and nucleus and the importance of determining the interactions (a topic Manfred Laubichler picks up with his look at Boveri) as well as the importance of genes in shaping development (a theme picked up by Michael Dietrich with Goldschmidt).

The Inherited Embryo: where enthusiasm for DNA and heredity made possible an impression that embryos are simply inherited and unfold deterministically during development. Embryology becomes a matter of developmental genetics on this view. Unintentionally, such views were taken as reinforcing the Catholic view (introduced formally by Pope Pius IX during Vatican I in 1869) that life begins at "conception" – now defined as fertilization, or the point at which the genetic material of egg and sperm combine to make a new individual.
The Visible Human Embryo: where in vitro fertilization technology makes it possible to observe early human development, and indeed to see live human embryos for the first time. This period brings new biology, alongside recombinant DNA technologies, Roe v. Wade, legislation to protect human subjects – and the question whether to include human embryos. The social and scientific become very muddled.

The Constructed Embryo: a period overlapping the previous three and extending further. Mouse studies showed the ability to take apart the cells in early stages and put them together in different combinations, raising questions about what is an individual if we can change it at will. Cloning, stem cell research, regenerative medicine: all raise new questions.

If we can construct, deconstruct, and reconstruct, what is an embryo? And how does the embryo relate to the resulting individual organism at each stage of development? These are fundamental questions for developmental biology. Understanding embryos informs interpretations of development, individuality, and relations of form and function. Biological understandings of those phenomena have been taken as informing social policy and legal decisions about human subjects. In conclusion, I will introduce a couple of examples for which the historical and philosophical understanding has directly influenced such social decisions. The main point throughout, however, will remain on the interplay of historical and philosophical study of embryos and the reasons and implications.