The Interpretation of Development and Heredity (1930), by Edward Stuart Russell [1]

By: Ulett, Mark A. Keywords: Heredity [2]

First published in 1930 and reprinted in 1972, Edward Stuart Russell’s *The Interpretation of Development and Heredity* [3] is a work of philosophical and theoretical biology. In this book Russell outlines a methodological and philosophical program aimed at reorienting the biological understanding of development and heredity. He argues that the mechanistic perspective on development and heredity ignores aspects of biological phenomena that can only be analyzed if biologists view organisms as whole entities, rather than breaking down developmental and hereditary processes into small causal units. This book is representative of Russell’s broad philosophical approach to biology, called “organicism”.

Broadly speaking, *Interpretation* has a tripartite structure. Russell begins with an historical analysis of previous theories of development and heredity. Two philosophical chapters arguing for Russell’s theory of organicism [5] follow this history. The final third of this book addresses the potential applicability of organicism [5] to the life sciences. As such, this work provides historians with a mid-twentieth-century critical commentary on the fields of heredity and development.

As with several of Russell’s other books, *Interpretation* begins with an historical treatment of the subject at hand. Beginning with Aristotle’s refutation of Heraclitus and Democritus’s theories of generation in *Generation of Animals*, Russell outlines the ancient theory of epigenesis [6], or differentiating development from a single source of growth. It was theorized early on that development progresses from the general to the specific, a theory adopted and articulated nearly two millennia later by Karl Ernst von Baer [7]. Throughout *Interpretation*, the epigenetic perspective is explicitly contrasted with preformationism, or the theory that development proceeds from a pre-formed embryo. The historical chapters detail August Weismann’s germ-plasm theory, gene theories, and the nineteenth and twentieth centuries’ epigenetic theories. Russell also addresses Wilhelm Roux’s mechanistic theories of experimental embryology [8] and the Mnemetic theories—development as a type of memory passed down from an organism’s ancestors—advocated by Ewald Hering and Samuel Butler.

Russell argues that there are only a few ways to understand development, and that they recur in slightly different forms through history. To illustrate this, at the beginning of the philosophical chapter of *Interpretation*, Russell organizes the important historical figures of the previous eight chapters into groups. The primary division of these groups occurs between “unity theories” and “particulate theories” of development. The former focus on the development of the organism as a whole, whereas the latter address the components of development independently. Furthermore, Russell subdivides these two groups into investigators whose philosophical focus is placed squarely on the organism as opposed to those who focus on the mechanistic or physico-chemical approach. They are outlined as follows:

<table>
<thead>
<tr>
<th>Unity Theories</th>
<th>Particulate Theories</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Organismal</td>
<td></td>
</tr>
<tr>
<td>Aristotle [9]</td>
<td>Hippocrates [10], Democritus</td>
</tr>
<tr>
<td>Caspar F. Wolff</td>
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<tr>
<td>Samuel Butler</td>
<td>Richard Semon</td>
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<tr>
<td>Edwin Grant Conklin [12]</td>
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<tr>
<td>B. Physico-Chemical</td>
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<tr>
<td>Max Verworn</td>
<td>Thomas H. Morgan</td>
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<td>Jacques Loeb [15]</td>
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<tr>
<td>Charles Manning Child [16]</td>
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This organization [17] of the historical material from previous chapters prepares the reader for Russell’s philosophical treatment of these perspectives on development.

Russell’s philosophical analysis of why the organismic interpretation of biology is better than the reductionistic one begins in the
Sources in biology.

Historical context of mid-twentieth-century critical analysis of mechanistic biology and arguments for the organismal perspective culminates in two methodological, analytical, and metaphysically driven principles. First, the activity of the entire organism cannot be fully explained in terms of the interaction or activity of the parts. Second, the function or activity of the parts cannot be understood except in relation to the activities of the whole. The overall conclusion of this work, then, is that the mechanistic approach requires incorporation of the unitary and particulate theories. From a philosophical perspective Interpretation culminates in two methodological, analytical, and metaphysically driven principles. First, the activity of the entire organism cannot be fully explained in terms of the interaction or activity of the parts. Second, the function or activity of the parts cannot be understood except in relation to the activities of the whole. The overall conclusion of this work, then, is that the mechanistic approach to biological problems must be integrated with a holistic program that focuses on the organism as a the unit of biological analysis. It is only from an integrated, organismal perspective, Russell argues, that the problems of development can be solved.

Historically speaking, biologists and philosophers of biology paid little attention to Interpretation despite favorable reviews shortly after publication in both Nature and The American Journal of Sociology. The possible reasons for this neglect are numerous, though historian of biology Nils Roll-Hansen argues that this is likely because mechanistic biology continued to thrive throughout the central decades of the twentieth century despite contests from Russell, Joseph Woodger[23], and others. Recently, Russell’s Interpretation has received attention from philosopher of biology Jason Scott Robert[23] as an element of the philosophical foundation of modern epigenetic and developmental research. Certainly Interpretation is a valuable source for understanding the historical context of mid-twentieth-century critical analysis of mechanistic biology and arguments for the organismal perspective in biology.

**Sources**

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