

A New Perspective on Embryo Creation

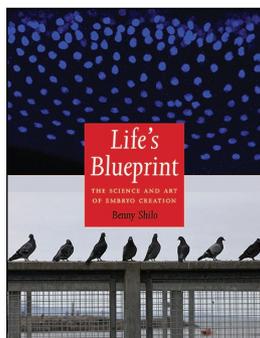
Life's Blueprint: The Science and Art of Embryo Creation. Benny Shilo. Yale University Press, 2014. 174 pp., illus. \$35.00 (ISBN 9780300196634 cloth).

Within the last 30 years, scientific understandings of the formation of embryos have undergone major advances that have had immense implications for human health and future therapies. However, because of the complex nature of the process of embryonic development, a significant communication barrier exists between scientists and nonscientists. As a result, the majority of the public remains unaware of these exciting findings. Benny Shilo, professor of molecular genetics at the Weizmann Institute of Science, endeavors to overcome this barrier in his new book, *Life's Blueprint*. Shilo aims to make the science accessible to a broader audience by writing a jargon-free overview and creating visual pairings of photographs and scientific images to relate scientific paradigms to everyday experiences.

The book begins with one of the most basic questions in developmental biology: How does a cell decide its fate? To answer this, Shilo starts readers with a crash course on molecular biology and genetics, ultimately leading to a discussion of how they affect a cell's fate. One of the strengths of the book comes from Shilo's clear language and simple analogies that engage the reader while remaining faithful to the science they describe. When introducing the concept of embryonic development, for example, Shilo rhetorically asks his readers, "Is embryonic development more like the assembly of an airplane or the operation of an improvisational theater?" (p. 18). He also explains interesting decisions and rationales in scientific research, like why we use roundworm and fly genomes to investigate

human disease, and highlights classical research experiments such as the 1924 Spemann and Mangold experiment, which showed that cell fates in development are not predetermined.

After walking the reader through the initial phases of embryogenesis, Shilo explains what happens as embryogenesis continues and how complex patterns arise from the simple modules. He details how a single substance can generate multiple responses and how patterns evolve through the addition or deletion of regulatory sequences. Shilo follows this discussion by describing the mechanisms that ensure embryo development is on track and the cellular interactions that give rise to tissues. The book concludes with a fascinating chapter on stem cells and their implications for medical innovations, as well as a discussion on the future possibilities regarding tissue and organ generation.



The most interesting element of *Life's Blueprint* is its unique use of photography. A variety of selectively colored black and white photographs are shown alongside more traditional scientific images that display key concepts of embryogenesis. Through these color highlights, Shilo guides the reader's eye to certain parts of the photograph to help emphasize a specific scientific paradigm. This coloring technique mirrors how a scientific diagram or a colored microscopy image would traditionally operate by

isolating a particular aspect of interest from a busy background (e.g., an isolated organ, pathway, or labeled cellular structure).

Shilo's innovative juxtaposition of photography with scientific text and imagery aids readers in approaching certain biological ideas and connecting with the science. Although this concept is interesting, the use of photography could be developed further to create even more effective pairings. Sometimes, the photographic analogies are too obvious or—the other extreme—only tangentially related. For instance, when illustrating the concept of how the shape of a cell is tailored for its function, in the chapter "Shaping the tissues," Shilo chose a photo of a wood plane that is used to describe tools that "execute their specific function most efficiently" (p. 101). Any photograph of an object shaped to execute its function would have sufficed. Other images do not further additional understandings of biological concepts. For instance, in the same chapter, a photograph of a popping soap bubble is paired with a scientific illustration of a developing ommatidium in the fruit fly eye. The popping bubble photograph, although visually striking, does not provide additional insight into the biology.

However, when used effectively, the photographs have the potential to solidify understanding and even help make a concept memorable. One of the more effective photographic pairings was "Transmitting positional information to cells," from the chapter "How can a single substance generate multiple responses?" In the photograph, a group of students sit in a circular formation surrounding a museum guide. The composition and the selective use of the color red to highlight the museum guide helped effectively convey the concept of how distance to a source

can affect how much signal will be sensed. In the case of the photograph, that signal was sound, whereas in the case of a cell, it may be morphogen concentration.

Shilo's photographs are not always extraordinary in their subject matter or composition. Looking through the photographs, there doesn't appear to be a conceptual thread that links them all together in how they create cohesive visual analogies. Rather, the images seem to be selected to conform to the written text. All the images are connected by virtue that they capture a moment of "macro" nonscientific life. Perhaps they would have been more interesting if there were a common thread that ran through all the images, such as if they all morphologically resembled phases of embryonic development. Nevertheless, the straightforwardness of the photographs could also be considered their strength. The uncomplicated nature of the photographs could be what allows the reader to truly relate to scientific concepts, driving points home.

Overall, the book is an approachable overview of the recent findings in developmental biology. It is an interesting read and Shilo does a good job of pointing out important details of scientific experiments and research findings for readers. His unique visual approach has the potential to reveal profound connections and nuances of biological concepts, but ends up falling somewhat short of its aspirations with unspecific images that draw redundant connections. As a novel overview of developmental biology, however, *Life's Blueprint* is a solid effort in turning complex developmental biology research into more accessible, popular science.

JANE LONG

Jane Long (jlong01@risd.edu) is a master of fine arts candidate at the Rhode Island School of Design, in Providence.

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LOVE BUZZ

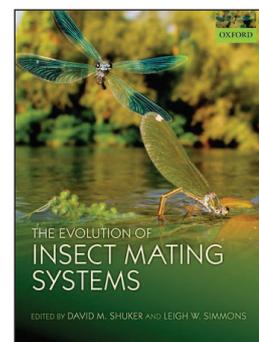
The Evolution of Insect Mating Systems. David M. Shuker and Leigh W. Simmons, eds. Oxford University Press, 2014. 339 pp., illus. \$58.46. (ISBN: 9780199678020 cloth).

“Love Buzz,” a song covered by the US rock band Nirvana, seems to describe particularly well the mating system of bed bugs, the tiny blood-sucking insects that live in old beds and cause skin rashes and allergies: “Would you believe me when I tell you/You're the queen of my heart/ Please don't deceive me when I hurt you/Just ain't the way it seems.”

Female bed bugs are usually unfaithful to their partners, and males have developed one of the most extraordinary means of copulation to assure that their sperm fertilize their lover's eggs. Instead of using the female's genitals, male bed bugs stab their lover's abdomen with a pointy penis to ejaculate as close to the eggs as is possible. Because the wounds inflicted by the males can seriously harm females, causing them infections, dehydration, and an eventual early death, biologist have named this type of mating *traumatic insemination*. To fight back, females have evolved a secondary genital system on their abdomens called the *spermalege*, which contains immunologically active cells that reduce infections and ameliorate the costs of traumatic insemination. The spermalege thus allows females to mate safely with multiple males and profit from the beneficial properties of some compounds found in the male's ejaculate, which help delay senescence and promote reproductive rate.

The bizarre intimacy of bed bugs is just one example of the astonishing diversity of mating systems found in insects, which have puzzled many biologists, agronomists, and nature lovers over the past century. Insects are the most diverse group in the animal kingdom, with nearly 1 million

described species and many more awaiting description (Grimaldi and Engel 2005). They are also important providers of ecosystem services (Losey and Vaughan 2006) and pest agents of several commercial crops (Hill 1987). Although not as sexy as lions, dolphins, or birds of paradise, insects offer excellent model systems with which to study the evolution of mating systems, because they are abundant, can be easily manipulated and kept in laboratory conditions, have copulation habits that are often easy to observe, and have mating behaviors that are readily quantifiable (Wilson 1971, Thornhill and Alcock 1983, Alcock 2013). *The Evolution of Insect Mating Systems*, edited by David M. Shuker and Leigh W. Simmons, synthesizes the major advances in this field since the publication of the classic book of the same title by Randy Thornhill and John Alcock in 1983. The book contains a collection of chapters by leading scientists in the field of insect behavioral ecology, including the editors.



The first three chapters provide the necessary theoretical background to understand the evolution of insect mating systems. Benjamin Normak describes the diversity in the modes of insect reproduction, and Shuker provides an overview of core concepts in sexual selection theory. Hanna Kokko, Hope Klug, and Michael Jennions then introduce the concept and classification of mating systems, offering a historical overview of mating system theory and proposing to unify traditional measures of sexual selection by