Yarden, A. and Brill, G. (1999). The Secrets of Embryonic Development: Study Through Research (a student text, The Amos de-Shalit Israeli Center for Science Teaching, grades 10-12, 2nd edition 2000, 3rd edition 2001).

Short summary of the main features

This publication in developmental biology is aimed at biology majors in senior high school. The scientific background required to cover the very large body of knowledge available on the mechanisms governing embryonic development is much beyond the scope of the senior-high-school biology program. Consequently, here we focus on four key questions in the field of developmental biology. By taking this approach, many topics are left out of the learning materials. However, strong emphasis is placed on the logic behind the scientific thinking that drives this field of research, as well as other fields in experimental biology. We focus on four main processes that take place during embryogenesis: muscle cell differentiation, neural crest cell migration, wing morphogenesis and induction of head formation. Each topic is presented to the students in the form of a scientific paper, which has been adapted especially for the program. Each paper has the internal structure of a scientific paper and presents a key question, the methods employed to address this question, the conclusions, and the new questions which were formulated following the specific research.

The four papers are organized around an introduction, which presents the basic principles of embryonic development and the open questions in the field. The first part of the introduction presents the uniformity of the developmental process in various organisms and focused on the very basic concepts in developmental and molecular biology that are required to understand the research papers. The second part of the introduction focused on five central questions in developmental biology and the research which has been carried out to answer those questions: How does a cell differentiate? How do the differences between cells form during embryonic development? How is the form of the body created? How is the fate of a tissue influenced by its position in the embryo? How does the shape of the embryo change? To be able to provide answers to those questions, a basic knowledge in molecular genetics is required and is included within the text, thus enabling the use of this knowledge when reading the research articles that follow.

There are multiple ways of studying this material, since each paper is an independent unit, as it would appear in a scientific journal, and a few sequences of study can be drawn from the introduction. The program is accompanied by multiple references to Internet sites, as well as by references to additional papers and books related to each topic studied, thus providing the teachers and students with a wealth of selected materials for additional discussion. It is hoped that this approach will stimulate the students' scientific and creative thinking about the experimental approaches developed towards understanding key processes in morphogenesis and embryonic development.

The chapters of the student text are:

A. Basic morphogenetic processes
   Uniformity in the developmental process
   Central questions in developmental biology

B. Collection of research articles
   1. Cell migration during embryogenesis: the migration of neural crest cells
   2. The genetic basis of head formation in Drosophila: the function of the *bicoid* gene
   3. Muscle deficiency in mice with a mutation in the *myogenin* gene
   4. *Hedgehog* mediates the activity of the zone of polarizing activity in the limbs

C. Dictionary

D. Index

E. Credits to copyright owners