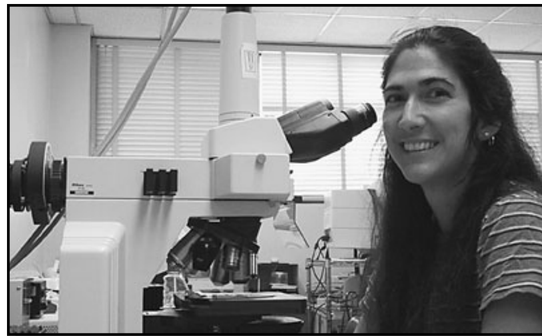
Developmental Biologist Copymaster: Interview with a Developmental Biologist



Carmen Domingo
Assistant Professor, Department of Biology, San Francisco State University

Why did you decide to become a scientist, and how did you choose this field of biology for your specialty?

As an undergraduate student, I first thought about becoming a doctor. But after some volunteer work at the local county hospital, I realized that I preferred working in a laboratory setting where people performed experiments to understand basic biology concepts. In particular, I was fascinated with understanding how life begins. How does a simple egg give rise to a complex adult animal with lots of different cell types? With this in mind, I visited a professor (Dr. Marianne Bronner-Fraser) in the Developmental Biology Center at the university I was attending (University of California, Irvine) and asked to volunteer in her laboratory. This volunteer experience reinforced my desire to pursue a career in research rather than practicing medicine. I gained a lot of support and guidance during this experience. I then went on to pursue a Ph.D. at University of California, Berkeley.

What is the most interesting or unusual thing that has ever happened while you were doing research?

The most interesting aspect of this work is the opportunity to discover something new that no one else has come across. However, to convince yourself and the scientific community at large, you must test your new discovery over and over again to make sure that the new observation is repeatable. For me, this happened while I was a graduate student with Dr. Ray Keller at UC Berkeley. By performing a difficult microsurgical procedure in frog embryos, I observed that cells that normally give rise to skin cells, when transplanted to a new location in the embryo, changed their fate and differentiated into notochord cells. This change in fate had been seen before, but not at the late stages of development that I was observing called gastrulation. These observations led to my first publication in a top journal in my field of expertise called *Development* published by the British Society of Developmental Biologists.

What do you find to be the most fun and/or most challenging aspect of your work?

As a professor at San Francisco State University, I enjoy many aspects of my job. I teach courses to undergraduate and graduate students. I also teach laboratory skills through my research laboratory. Here the students learn to work independently on different research projects. They learn to develop testable hypotheses, design experiments, analyze results, and present research findings in the form of research publications and oral presentations at conferences. As a professor, I have a wonderful opportunity to share my fascination for the field of developmental biology and also mentor students who, like me, may want to pursue a career as a researcher/educator. The most challenging aspect of my work is making sure that the research in my laboratory is published in a timely fashion so that I can continue to obtain federal funds to support the research. It is very expensive to run a research laboratory. I must purchase expensive equipment and supplies and obtain funds for salaries for technicians and students. However, I enjoy the challenges! It makes me a better teacher and scientist.

Optional Developmental Biologist Copymaster: Revised Embryo Puzzle

(Images based on research done by Michael Richardson and his colleagues in 1997 that corrects and updates Haeckel's work. You may wish to provide this as a second puzzle for the developmental biologist team if they complete the first puzzle quickly.

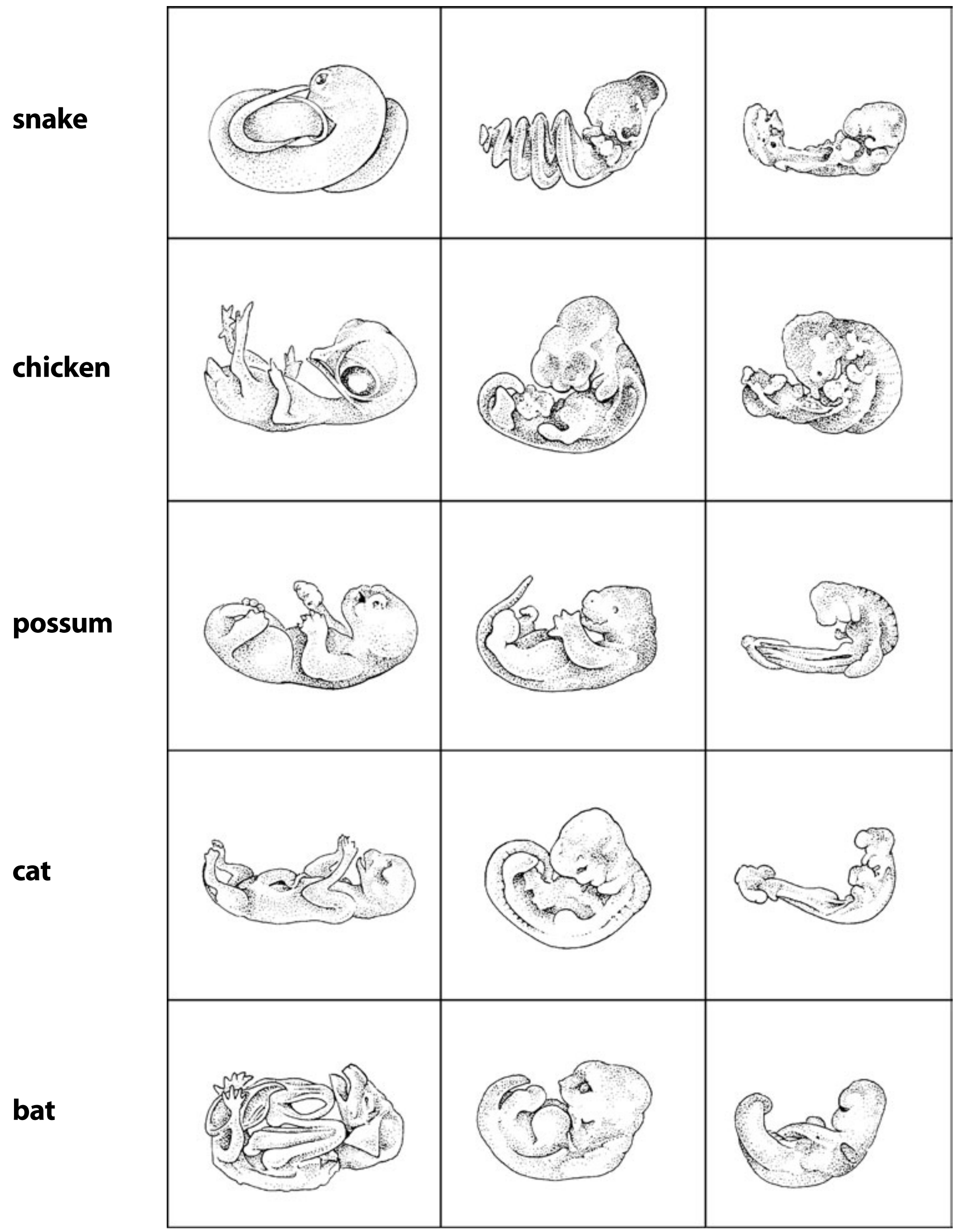


Illustration by Marjorie C. Leggitt based on photo by Dr. Michael K. Richardson.

Developmental Biologist Copymaster: DNA Comparison

Deoxyribonucleic acid (DNA) codes for proteins that your body needs to live. Two of those proteins are the α and β hemoglobin proteins that occur in your blood. These proteins carry oxygen and carbon dioxide as they circulate in your bloodstream. Other animals' blood also contains α and β hemoglobin proteins. However, not all of these proteins are identical. The differences between α and β hemoglobin proteins are caused by differences in the DNA that codes for them.

One reason why developmental biologists are interested in comparing the DNA and proteins of organisms is to learn about relatedness. The more similar two organisms' DNA are, the more likely it is that the organisms are closely related.

Process and Procedures

The following sequences of letters stand for the DNA bases from portions of the genes that code for α and β hemoglobin proteins.

1. Compare the DNA sequences from the α hemoglobin for two different primates. Calculate the percent for how similar the bush baby α hemoglobin DNA sequence is to *Homo sapiens*.

   percent similar = (number of DNA bases the same ÷ total number of DNA bases) × 100

2. Compare the DNA sequences from the β hemoglobin of four different primates. Calculate the percent for how similar each β hemoglobin DNA sequence is to *Homo sapiens*.

Comparisons between portions of the genetic code for α hemoglobin in the thick-tailed bush baby and humans

Note: spaces where the – symbol occurs in place of a letter indicate a gap and should be counted as a mismatch.

thick-tailed bush baby	G G G C C T A A G T C T T C T A T C T T C A C C T G T T C C T G T C T G C T T C C T C T T C C T G G – A C A T C T A T C
human	G C G C C C A T T G C C T A T C C C C T C G G T C T G C C C C G T T T G C C C A C C C T C T C C G G T G T G T C T G T C

thick-tailed bush baby	C A G T C C T G G T A G C C A A C A G T T G G C A G T C A G A G C A G G T C T C C A G C C A G T T A G C T G A T A A G C
human	C A C C C C C G G T A T T A A A A C G A A C G G G G C G G A A A G A A G C C C T C A G T C – G C C G G C C G G G A G G C

thick-tailed bush baby	G A A G A A T A T T A G G G C T C A T A G C T T G C T G A T A C T G A C C A G A G C T G A G G A G A A C – T A T C C A T
human	C A C G G A G A T G C T G C T T G A G A A C G A G C T G T G G G G C A G C C C G G C C G A G G A G G A C G C G T T C G G

Developmental Biologist Copymaster: DNA Comparison (continued)

Comparisons between portions of the genetic code for β hemoglobin in four primates

Note: spaces where the symbol – occurs in place of a letter indicate a gap and should be counted as a mismatch.

chimpanzee	T A T – A A A T G T G T T T C C T G C A T A T A G T C A A A G T T G C C A C T T C T T T T – – T C T T C A T A T C A T C
gorilla	T A T – A A A T G T G T T T C C T G C A T A C A G T C A A A G T T G C C A C T T C T T T T – – T C T T C A T A T C A T C
human	T A T – A A A T G T G T T T C C T G C A T A T A G T C A A A G T T G C C A C T T C T T T T – – T C T T C A T A T C A T C
orangutan	T C T C A A A A A A A A A A A A A A A A A A G A T T C A A A A G A T T C A C T T G T T T A G G C C T T A G C G G G C T T

chimpanzee	T T T A A C T – C T T T G A A A T T T A G A G T C T C C T T G A A A T A C A C A T G G G G G T G A T T T C C T A A A C T
gorilla	T T T A A C T – C T T T G A A A T T T A G A G T A T C C T T G A A A T A C A C A T G G G G G T G A T T T C C T A A A C T
human	T T T A A C T – C T T T G A A A T T T A G A G T C T C C T T G A A A T A C A C A T G G G G G T G A T T T C C T A A A C T
orangutan	C T C A T C C A C C C T T A G A T T G A G A G A A G T C A C T T A T T A T – T A T G T G A G T A A C T G G A A G A T A C

chimpanzee	G G T G G A A G T G T G C C C T G T C T A T T C C T G A A A T T – – – G C T T G T T T G A G A C G C G T G A G A C G – T
gorilla	G G T G C A A G T G C G C C C T G T C T A T T C C T G A A A T T – – – G C T C G T T T G A G A C G C A T G A G A C G – T
human	G G T G G A A G T G T G C C C T G T C T A T T C C T G A A A T T – – – G C T T G T T T G A G A C G C A T G A G A C G – T
orangutan	A G C C G C C T A A C A C T T T G A G C A G A T A T A A G C T T T A C A C A A G A T T A T G A A G G C T G A A A G G A T