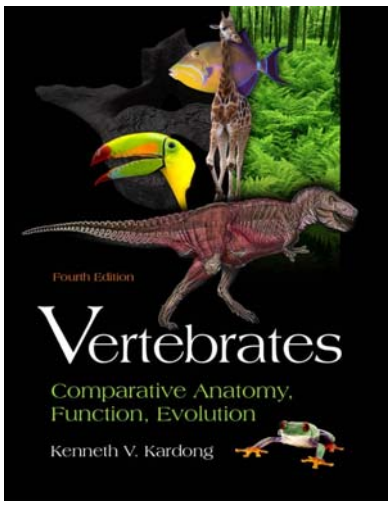

An Introduction

Functional and Evolutionary Laboratories

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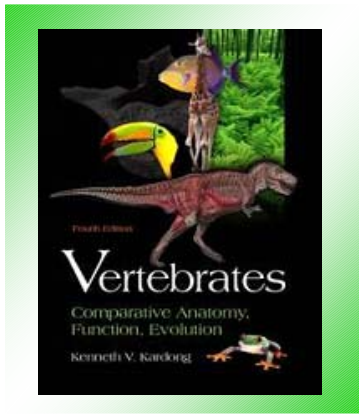
A. Objectives:

These functional and evolutionary exercises provide opportunities for instructors to bring conceptual and critical thinking activities into the laboratory of a comparative vertebrate anatomy.

They are flexible and modifiable to fit the instructional context of an instructor with his or her own course goals.

B. Textbook Reference:

Each exercise is referenced to the Textbook, where the student may read about the subject in greater depth .



C. Introduction:

These functional and evolutionary laboratories will be effective in a variety of pedagogical contexts. They can be adapted to suit the individual style and goals of a particular instructor and course goals. The approach we take to the labs, and the approach used by many others teaching this course, is to use these laboratories to engage students directly in the functional and evolutionary concepts.

1. Seminar Teams

During the laboratory, we divide students into groups of 3-5 individuals which we term "seminar teams, " a kind of collaborative learning. This places undergraduate students into a context used in graduate schools, law schools, medical schools, and in various businesses. The strategy is to place students into a discussion group where they can communicate as equals, and encourage them to discuss a thought question in this dynamic of equals. Although they may not immediately appreciate it, that discussion is the whole point of the seminar team.

This is not a "lab write-up" or a "paper". It is a discussion. This is the same that we do in graduate school where we find a new book or article and discuss it at our level of confusion. For these undergraduates, coming to this subject of comparative vertebrate anatomy for the first time, these questions allow them to discuss the topic at their level of confusion. As an instructor, we facilitate but do not give away the answers.

Following such a group discussion, the students compose a group response to the thought question (Synthesis) and submit this first draft for critique. The group answer is evaluated and returned. The group now has a second chance (usually at the next laboratory session) to discuss and revise their answer for a second time for a final grade. Giving them two chances relieves them of the pressure of getting it right the first time, and may encourage them to read up on the question before coming to it again.

The first purpose then of the seminar team is to get students talking about the thought question. The second purpose is to get them to find their own words to express an answer and therefore take ownership of the information. In order to write clearly, students must first think clearly. These exercises in a seminar team setting provide this opportunity. The third purpose gives the instructor a chance to inspect their critical thinking. The one or two submitted paragraphs not only allows us to see their answer (factual information), but most importantly it allows us to see their reasoning (critical thinking) ! Therefore we can intervene directly in their critical thinking process and offer critique and suggestions to improve their scientific reasoning.

In a nutshell, this is the strategy behind the composition of these exercises. They are not "busy work", but techniques that permit us to directly aid students in their scientific thinking. In turn, these functional laboratories help students to understand the concepts and application of these principles to tangible biological problems.

2. Building Understanding of Concepts

In addition to their service in critical thinking, some exercises also aid critical understanding. They help to build the principle or concept of importance in understanding animal design. For persons interested in this strategy, you might want to begin with:

L.C. McDermott, "Physics education research: The key to student learning and teacher preparation," Physics World, January 2004, pp. 40-41.

Briefly, some exercises (e.g. Bone Architecture) build as they go—step by step. Each step first introduces an experiment illustrating an idea, invites students to predict its result, and then test their hypothesis. That completed, the students then move to the next related step where they add to what they have learned. By the end of the exercise, the larger concept is built up and brought together.

3. Facilitation Tips

a) Within an exercise, make sure students work through in sequence, one step at a time.

b) Encourage students to actually write down their expected outcome (hypothesis) to each small experiment along the way, before proceeding to test it out.

c) Make sure that each group, when writing up its thoughts, follows a general format, such as:

- Title
- Topic sentence
- Arguments and evidence
- Conclusion