Where's Walda?
Investigations in Osteology and Forensic Anthropology

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Introduction

Students often view the skeleton as a static framework that supports and protects the body. In developing curriculum and learning activities that demonstrate all the functions that the skeleton performs, we constructed and field-tested a unit based on skeletal identification techniques common to forensic investigations. In this unit, students learn about the biological functions of the skeleton through an forensic "investigation". They use a collection of human skeletal remains provided by the Department of Anthropology at the University of Wisconsin, Madison (UW-M) to solve the mystery of a missing person whose partial skeleton *may* be among the bones in the sample before them.

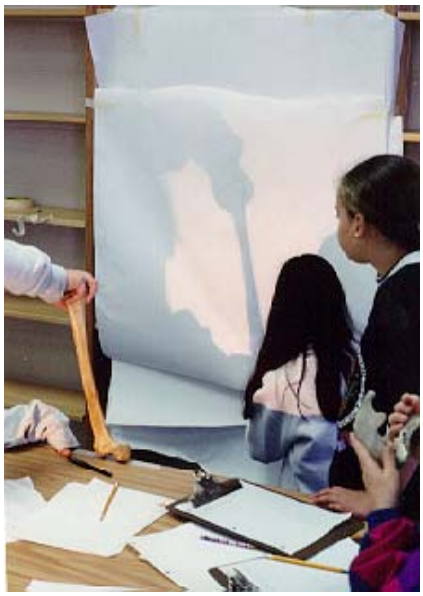
Summer Enrichment Program Students Examine Skeletal remains.

This is an inquiry-based learning activity. All the information about the skeletons is collected, recorded, and interpreted in the context of the mystery to be solved— the identity of members of a hiking party that disappeared in an avalanche a number of years ago. The boundaries of inquiry in this unit are determined by the availability of skeletal remains, however, students are able to structure their activities to test hypotheses about their data and to construct and present an argument for their interpretation of the make-up of the members of the party.

The basic skills needed for sex and stature determination for human skeletal remains can be demonstrated and learned within about an hour. Then these skills are reinforced through the learning activities associated with solving the mystery. When we visit area middle schools on outreach visits, students generally complete the preliminary measurements and the initial determination of the party composition on a limited, selected sample of bones within 90 minutes. In summer workshops with students and with teachers, we generally have these groups "graduate" to larger samples that

include some bones that are harder to "read". These summer workshops can last from 4 hours (middle-school students) to an entire week (teacher workshops).

When the students use a real skeletal collection with bones from a number of individuals, it also provides a setting for learning the basic biological concepts of inter-individual variation, age- and sex-related developmental differences in size, shape and proportion, ethnic variation, and the "personal histories" evident in skeletal malformations, degenerations, and injuries. Finally, of course, in order to carry out the measurements and calculations necessary to solve the mystery, the activity must integrate the skills learned in mathematics classes—basic geometry and linear equations—as they interpret angles, lengths, shapes, and proportions in the skeletal remains that they examine.



Spring Harbor Middle School students explore shape and proportions in skeletons using enlarged images projected on tracing paper.

We also used a tie-in from popular literature. Aaron Elkins's *Icy Clutches* is a murder mystery featuring a physical anthropologist who must interpret the skeletal remains found melting out of a glacier. We suggest that students could construct a mystery story based on their study of these bones, as a follow-up activity.

Where's Walda? provides both teacher professional development—new information and approaches to basic science information— and curriculum development—new lessons, activities, and problems for students to solve in their learning. As such, it exemplifies the mission and approach that underlie Wisconsin Teacher Enhancement in Biology (WisTEB).

<u>Where's Walda?</u>

Walda Fenstermacher was a 28-year-old heiress who loved winter hiking and glacier-climbing. She was last seen departing with a small party of two men and one woman to scale the ominous Mendota Glacier. Bad weather obscured the glacier for a week, and when it cleared, the party was nowhere to be found. Now, after many years, exceptionally warm weather has caused significant melting of the glacier. In its wake, the retreating ice has left masses of debris, including several scattered piles of human bone. The Fenstermacher family wants to know, "Where's Walda?"

After careful observation and data collection at the scene, the bones are carefully wrapped and transported to the laboratory, where a group of trainee forensic anthropologists is set to work on identifying the remains.

Kara Lascola advises students at Spring Harbor

The first task is to identify each bone and decide if it came from the left or right side of the body. That way, we can determine the minimum number of individuals (MNI) whose partial remains are present in the sample. If we have two right femora and three left, then we know that at least three people must be present.

Then, we use the materials we have to identify the sex of the individuals present. Sex differences in the skeleton are most evident in the pelvis, jaw, and skull, but also appear to various degrees in many other bones. Sometimes, the MNI information and the sex-determination information conflict, and in some cases one can be used to resolve questions in the other.

Once we have a reasonable determination of the sex of the individuals in our sample, it is possible to estimate stature using one of several standard mathematical formulae. These all begin by measuring the length of one of the "long" bones of the skeleton. The length measures can then be used to estimate the stature in life for the skeletal remains of a male or female whose bones have been recovered.

Where's Walda? is a phenomenally successful activity for middle- and high-school students. It allows authentic application of basic science and mathematics skills and specific information about the human skeleton to a real-world problem. Indeed, the use of skeletal identification in forensic applications is depicted several times each year in regional, national, and even international news, and the students realize that they have acquired the basic skills practiced by professional "bone detectives" all over world.

Students at Spring Harbor prepare to estimate stature from skeletal remains.

Students and teachers can work with the data they have collected for several classes and can develop other activities that relate to the skeletal variation that they have studied. In our summer programs, we often translate the

skeletal biology in the *Where's Walda?* program into activities that focus on the physical anthropology of the living (anthropometry). Students learn how to translate the measurements of the skeleton into the physical features that characterize the slight variations among individuals. These slight variations, of course, allow us to distinguish one human from an other by simple observation; and they are also the key elements in establishing the identity of skeletal remains that may be recovered from the scenes of crimes, accidents, ancient burials, or old church yards.

Summer Enrichment Program students compare skeletal features to the anatomy of the living.

<u>WisTEB and the Milwaukee School of Engineering</u>

In our *Where's Walda?* workshops, we were fortunate to have permission from the UW-M Department of Anthropology to use human skeletal materials reserved for the undergraduate teaching program. This collection is made up of hundreds of bones and bone fragments from numerous individuals acquired by the department and its faculty over several decades. We recognize that this is a unique and rich resource not available to most schools in most areas of the state. Furthermore, the skeletal materials available from biological supply companies which are priced within the budget of ordinary public-school science programs are generally mass-produced versions of a single skeleton or of a few "standard" skeletons. They lack the variability and idiosyncrasies of the real thing.

Because these idiosyncrasies are essential to successful skeletal identification, WisTEB recently joined in collaboration with the Milwaukee School of Engineering (MSOE) to field-test a pilot program of computer-generated models of the human skeletal remains used in this program. With funding from the National Science Foundation, WisTEB is now cataloguing the basic *Where's Walda?* collection. The bones in this collection will be CAT-scanned and the data files transmitted to MSOE for conversion into

prototypes of teaching materials that will preserve the skeletal characteristics essential to the process of skeletal identification.

Where's Walda? **Collaborating Partners**

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UW-Madison Medical School Summer Enrichment Program
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Madison Metropolitan School District

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