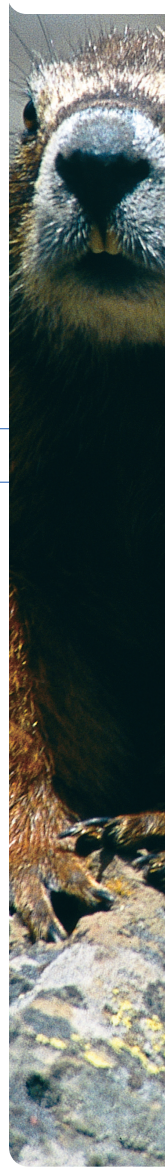

"Hands-Off" Dissection?

What do we seek in alternatives to examining real organisms?

DOUGLAS ALLCHIN, DEPARTMENT EDITOR

Amid the mantra-like rhetoric of the value of "hands-on" learning, the growth of computer "alternatives" to dissection is a striking anomaly. Instead of touching and experiencing real organisms, students now encounter life as virtual images. Hands-on, perhaps, but on a keyboard instead. Or on a computer mouse, not the living kind.

This deep irony might prompt some to hastily redesign such alternatives. Or adopt others. However, one could—far more deeply and profitably, I think—view this as an occasion to reflect on fundamental pedagogical aims.

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In What Sense, Alternatives?

What do computer programs and models teach? By not sacrificing any animal, one ostensibly expresses respect for life. Nothing seems more important—or moral—for a biology student to learn. Yet using this very standard—respect for life—one may find many alternatives deeply flawed.

Most alternatives share a fundamental destructive strategy of taking organisms apart. Each organ is removed and discarded in turn. That might seem to

be the very nature of dissection. Yet the maxim I learned was: "The best dissection is the one that makes the fewest cuts." A proper aim is discovery, not destruction. One should separate and clarify: Trace pathways, find boundaries, encounter connections—quite impossible if things are pre-cut and disappear as preformed units in a single mouse-click.

The "search-and-destroy" strategy, once common, is now justly condemned—notably by NABT itself (NABT, 2003). Such dissections were never well justified. They reflect poor educational goals and fundamentally foster disrespect towards animals. Indeed, dissections may be opportunities to monitor and thus guide student attitudes. "Search-and-destroy" *alternatives* to dissection merely echo antiquated approaches. Better *no dissections at all* than such ill conceived alternatives.

Prepackaged images or take-apart models reduce the body to parts. Like pieces in a mechanical clock (Russell, 1996, p. 2). After all, the body is neatly parceled in discrete units. However, a real body is messy. It is held together with all sorts of connective tissue. Its compartments are lined by layers of membranes. There's fascia and fat. The complexity just doesn't show up in textbooks—or dissection programs that (ostensibly serving education) make things simple. Demonstrating the gap between idealized textbook diagrams and reality is one extraordinary value of looking inside real organisms.

Here are some tasks that might guide a dissection oriented to discovering the body's organization:

- Trace back the path of urine, from a familiar point of excretion to its origin.
- Trace a piece of roughage from its ingestion to its excretion.
- Trace a molecule of glucose from its absorption in the gut to its use in a heart muscle cell.
- Trace a molecule of oxygen from the lung to the brain (or kidney).
- Trace the meeting of male and female gametes from each gonad.

No vague pointing! That's cheating. The tip of the probe must physically trace clearly visible structures. Now, that's "virtually" impossible with a computer program or a model.

Another inherent problem with alternatives to dissection is objectification. The animal isn't real. The dissection is a game, just like other computer games. There is not even any basis for respect. Many critics of animal use focus not on the sacrifice of animals, but on the psyche of the student. Invasive studies "can easily lead to insensitivity, callousness, and emotional hardening" (Russell, 1996, p. 6). Such claims echo renowned philosopher William James and others who alleged that animal experimentation inured the researcher to the suffering of organisms—and so also of humans.

Yet ghostly images on a screen and plastic replicas habituate students to respond to substitutes for living creatures. In *modeling* reality, they allow students to rehearse destructive actions. It is all the worse because there is no emotional engagement. It is, after all, *virtual* reality. What does it mean when students learn to butcher a body with no feeling of alienation? There is no sense of responsibility in interacting with something once living. When the virtual dissection is over, you close the program and erase any implications for the actions in that apparently unreal world. What you keep are the habits. Do alternatives train students—and habituate them—so that they can bomb villages in remote locations, secure behind a distant computer, with no human feeling? I fear that the emotional distance in computer programs and models may foster habits of a quite unintended kind.

Alternatives to dissection are ultimately often perverse alternatives. They tend to preserve the features of *inappropriate* dissections—destructiveness, reductionism, and objectification. Ironically, they do not teach respect for life.

Teaching Anatomy?

What *do* alternatives to dissection teach? Indeed, what *should* they teach? Many consider the goal of dissection as learning internal anatomy. Thus one recent study on dissection alternatives published in *ABT* measured effectiveness solely in terms of anatomical identification (Cross & Cross, 2004).

—And why frog anatomy? Aren't we aiming to help students conceive *themselves* biologically? So, if one is using virtual dissections, why use virtual frogs? Why not virtual humans? The frog (or rat or fetal pig) was generally meant as a surrogate for the human anyway, wasn't it?

Encountering the inside of real humans, not just sterile diagrams in a textbook, might seem overwhelming. But it is fascinating and engaging, nonetheless. In the European Renaissance, as social taboos about cadavers dissipated, human dissections spread publicly. Interest was hardly limited to anatomists. Vesalius held public demonstrations, as celebrated on the title page of his great treatise (Figure 1). Permanent anatomy theaters opened. Dissection became spectacle.

Nor has fascination with the human body waned. Witness the current response to BodyWorlds, an exhibit of real human bodies preserved with polymer technology. Its creator, Gunther von Hagens, shares his vision of skateboarders, basketball players, and other

Figure 1.
Courtesy of the Wangensteen Historical Library, University of Minnesota.

bodies with their muscles fully exposed (Figure 2). Of course, it's dreadfully sensationalistic. Still, a good teacher doesn't discount emotion as a prime opportunity to motivate learning. Perhaps that's what we need in the classroom, instead of the skeleton in the closet?

Of course, one can begin to evoke the early anatomists' appreciation using their magnificent drawings. Images from many of their great works are now available online (www.nlm.nih.gov/exhibition/historicalanatomies/home.html). In addition, through historical comparisons, one can visibly trace the scientific significance of investigative human dissection: an opportunity for teaching history and nature of science. Educators need not rely on (nor suffer the expense of) proprietary software to find quality images for observing anatomy.

Renaissance authors on anatomy created their own version of vicarious dissection. Reveling in the innovation of printing, they adopted a format now reserved mostly for children's books: fold-outs! Images of the nude body included flaps. When lifted, they revealed the organs underneath! And then the organs underneath them. Alternatives to dissection apparently began quite early—for those *eager* for the knowledge.

If teaching simple anatomy is the goal, one may well question dissection as an appropriate strategy. One needn't carve up an animal to learn where the organs are. (One doesn't need an *imitation carving-up,* either.) Old fashioned diagrams work just fine. And sometimes, perhaps, just old diagrams.

Beyond Anatomy

But perhaps anatomy is not the aim? Consider how images of humans may disturb students (even without killing animals). Why? They respond surely because we are humans. We are seeing ourselves in an unfamiliar—and possibly uncomfortable—way. The anatomical knowledge here is irrelevant. What matters is the relationship between the student and the object being viewed. Maybe that's why dissection so often stirs emotions?

Most students, I fear, view animals—and themselves—as black boxes. Encounters with the internal are rare. Surgery is sequestered in operating rooms. Meat originates in remote slaughterhouses and butchery occurs backstage at the grocery. Graphic images of war or terrorism or car accidents are (respectfully) omitted from broadcast news. Images that betray the tidy organismal black box can powerfully disrupt our psyche. Many shudder to view bodies (implicitly their bodies) as assemblages of organs. Glimpses of violence on television and in film sometimes titillate – but largely because they broach a customarily profane domain. In such a context, how do teachers address the fundamental lesson about our very *biological* being?

Perhaps teachers need to also *personalize* the anatomy? For example, they could point to sites on their own bodies, and invite students to probe what's under their own skin. Do we fully value the tactile? Or does palpating one's spleen flirt with what may be another morally marginal territory: sensuality? (Note the potential irony that science might underscore the role of sense data, while fearing in the classroom to entertain the sense of touch—on one's body, at least.) I can report that even advanced students enjoy learning the skeleton through play: "Simon Says, touch your clavicle. Simon Says, touch your metatarsals. Touch your occipital lobe! Ooh, Simon didn't Say!" Here, at least, would be real "hands-on" learning.

Figure 2.
© Gunther von Hagens, Institute for Plastination, Heidelberg, Germany (www.bodyworlds.com).

But even such games or exercises fail to fully confront one's biological self. That level of understanding is deeply *emotional*. Opinions on dissection vary. Yet everyone acknowledges, I trust, that what marks the experience for most students is *affective*. The *feelings* tend to be primary. Quite so. Here is how Leonardo da Vinci expressed some such feelings about dissected bodies in his anatomical notebooks:

> *And if you should have a love for such things you might be prevented by loathing, and if that did not prevent you, you might be deterred by the fear of living in the night hours in the company of those corpses, quartered and flayed and horrible to see.*

Dissection, I contend, is not properly about teaching anatomy. It is about learning to address these profound emotions and, ultimately, understand oneself.

Several emotion-laden elements of one's biological self are encountered in dissection. Opening the body's black box is the first. Students often invest considerable attention to the exterior of their bodies (their grooming, their muscles, their soft tissue), but when do they consider their physiological interior? Yes, the texture of the muscles is like meat: That's because that's what meat is. Hm, the texture of the brain is like a firm custard. (There are educational benefits from using freshly dead specimens.) The emotions are directly linked to self-understanding.

Second is awareness of the body's "messiness," as noted above. An idealized textbook diagram may be a tool for learning anatomy, perhaps, but not for appreciating the complexity and particularity of real bodies. This, too, has a deeply emotional component.

Finally, the whole experience is perfused with the shadow of mortality. A full understanding of life is incomplete without a complementary understanding of death and dying. A challenge is addressing the emotional overtones of that topic gently and respectfully,

but also with honest realism. William Harvey, in studying the heart and blood flow, performed many vivisection experiments. That may seem callous and impersonal. Yet Harvey also attended the autopsy of his own father. And when his wife's pet parrot, regarded with much affection, died, he dissected it, too. Harvey, we might understand by these emotional contexts, had learned a profound respect for life, even among the dead. The emotional overtones of dissection are not necessarily ideally suppressed or disregarded. Rather, they may be integral to deepening an appreciation for life—including notably one's own life.

The history of anatomy offers another potential lesson, here. In Medieval Europe, human anatomy was taught in part using annual dissections. But they were largely demonstrations, following the ancient texts of Galen. Anatomical discoveries were few. The Renaissance hands-on attitude changed that. Dissection shifted more to active investigation. New structural and functional knowledge emerged (French, 1999). By comparison, then, modern students might benefit from immersive experience—and not necessarily to learn anatomy.

So add to the list of dissection activities:

- Explore. Find something not on the list and discuss why you found it meaningful.

Many current alternatives to dissection, I claim, fail to address the most important lessons. The very awkwardness of dissection may be its touchstone. Models, whether plastic or pixeled, are not real. Indeed, they distance the viewer from the real body. The emotional interaction — which virtually defines the whole learning experience — is absent. In that sense, they are not alternatives at all.

Rethinking Dissection

Several values and principles intersect in the ongoing dialogue on dissection. Some highlight the ethics of animal use. Some underscore the learning goals and their values. But let us imagine that a principle central to everyone's perspective is "respect for life." Sacrificing animals easily falls under that principle. It may also seem to trump any further debate. But the very concept of sacrifice also honors the same principle, by acknowledging that a loss may, in the appropriate context, have deeper value.

For biology teachers, the deeper meanings may be critical. *Expressing* respect for life may parallel a goal of *teaching* respect for life. Educators might discuss more the challenges involved. For example, the goal seems to touch upon the realm of emotions, and presumably of individual values—far from the norms of scientific evidence. At the same time, how can respect be complete, or real, if emotions are deemed irrelevant? Will students learn only virtual respect, as much an imitation as virtual dissections? Recognizing the role of emotions, of course, introduces further challenges: How do teachers assume roles as leaders and guides, not merely as instructors? More deeply, how do we characterize and justify biology education as embracing more than just information or lab skills? (Goodness, how would one compose a state curriculum standard?! How would one test for it on a multiple-choice exam—even if one can easily justify respect for life as a public value?) Creative and resourceful teachers typically find meaningful, perhaps local, solutions.

In a culture where anyone who ate meat helped butcher it and anyone who wore leather helped skin it, dissection in a school classroom might be redundant. These experiences might be considered the real alternatives. Dissection may thus also be about learning the scope of one's actions regarding animals and thus understanding the corresponding responsibilities.

Dissection may be paradoxical in its role in teaching respect for life by coupling informative images and emotional encounter. A successful dissection may be one that each student would never need experience again, but without which a vital lesson might never be learned.

Web Excursions

Historical Anatomies, National Institutes of Health. www.nlm.nih.gov/exhibition/historicalanatomies/home.html.

BodyWorlds. www.bodyworlds.com.

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