Making an argument about the significance of your research

Writing in Biology: BioTAP question 2

Your thesis should contain a substantive literature review that places your research within its appropriate scientific context. This literature review should not only describe what is known about your topic, but should also identify the specific ***gaps*** in knowledge that your project intends to address. Beyond simply summarizing the salient literature, you should describe how your research addresses the gaps in the literature, and you should **make an argument** for the broader significance of your research.

A strong thesis will review the literature, demonstrates how your research fills a gap, and presents an explicit and compelling argument for the broader significance or scientific value of your research.

Practice exercise

The following are three examples of student writing taken from biology honors theses written within the past few years. Use the following guiding questions to assess whether or not each passage makes an explicit and compelling argument for the broader significance or scientific value of the student's research. Then, rank the three examples on a scale of 1 (i.e., the strongest) to 3 (i.e., the weakest) with regard to how well the writer structures his/her argument.

Guiding questions

1. Does the student review the literature?

2. Does the student identify a gap in the literature?

3. Does the student make connections (explicit or implied) between the published literature and the student's own research project?

4. Does the student describe how his/her research fills a gap in the literature?

5. Does the student make an argument for the significance of his/her research? Has the student explained what additional insight his/her research provides?

6. How would you rank this example?

Example 2a:

Behaviorally, the Glaser et al (1982) study delineated the changes in reaction times due to the degradation of the Stroop inference effect based separating out the two features of word color and word meaning in time. Electrophysiologically, the Liotti et al (2000) study isolated two components (one early negativity and one later positively) in the incongruent conditions and not the congruent conditions of simultaneously presented word and color combinations of the Stroop task, effectively isolating waveforms that are indicative of the Stroop interference in ERPs. Here, we intended to put these two different investigations of the Stroop interference effect together to discern the effect of temporally separated features on these indicative Stroop interference electrophysiological components in order to elucidate the nature of the conflict processing that is occurring during the Stroop task.

Example 2b:

Sea urchins have been used as a model organism in developmental biology since the late 1870's because of the relative ease with which embryos can be spawned, cultured, and observed in the laboratory setting as well as the ease with which their gene expression can be altered. Moreover, even though sea urchins are not chordates they, like humans, are deuterostomes, meaning that many cellular and developmental processes are likely to be more highly conserved between humans and sea urchins than between humans and non-deuterostomal model organisms. Thus, by understanding sea urchin development, we can hope to gain a better overall understanding of processes relevant to human development as well as development in general.

Cell cycle regulation and cell division have frequently been shown to play important roles in cell specification and differentiation (e.g. Leatherman and Jongens, 2003; Ettensohn and Malinda, 1993), but most recent studies in sea urchin developmental biology have focused specifically on the molecular components acting in cell specification (e.g. Sherwood and McClay, 1997; Sherwood and McClay, 1999, Sherwood and McClay, 2001; Sweet et al., 1999; Sweet et al., 2002; Davidson et al., 1998). Understanding secondary mesenchyme specification has been a topic of particular interest (Sherwood and McClay, 1997; Sherwood and McClay, 1999; Sweet et al., 1999; Sweet et al. 2002), but to date little has been reported concerning potential roles of the cell cycle in such processes. Although investigators have been able to identify early molecular signals responsible for specification of the secondary mesenchyme, much remains to be learned about differentiation of secondary mesenchyme cell (SMC) subtypes. My research examines potential roles of cell cycle regulation in differentiation of the SMCs.

Examples 2c:

The ability of stem cells to self-renew rather than differentiate at a particular division is necessary for the maintenance of a stem cell compartment. Understanding the mechanisms of this decision has the potential to improve the in vitro expansion of hematopoietic stem cells (HSC) for transplant. Since the acquisition of stem-cell-like self renewal has been linked to cancer, it may also lead to a better understanding of mechanisms underlying cancer. Overexpression of the Wnt signaling pathway has been shown to increase HSC self-renewal and inhibiting the Wnt signaling pathway leads to decreased HSC growth and reconstitution potential. These findings suggest that Wnt signaling is a critical regulator of HSC self-renewal, but its role in vivo remains unclear.