

1) Example Summary of Primary Research Paper

Adult beetles (*Phyllodecta laticollis*), found in Norway, are exposed to sub-zero temperatures in the field throughout the year. In general, organisms that tolerate freezing conditions either produce extracellular nucleating agents that trigger ice formation outside the cells rather than within them or they produce biological antifreezes, such as glycerol, that lower the freezing point of the blood and tissues to below that of the environment, thereby preventing ice formation. This study (Van der Laak, 1982) documents the tolerance of *P. laticollis* to below-freezing temperatures and determines how seasonal shifts in the temperature tolerance of these beetles are mediated. Beetles were collected throughout the year and frozen to temperatures as low as -50°C ; post-thaw survivorship was then determined. Determinations were also made of the concentrations of solutes in the blood (that is, blood osmotic concentration), total water content, amino acid and glycerol concentrations in the blood, presence of nucleating agents in the blood, and the temperature to which blood could be super-cooled before it would freeze. The temperature tolerance of *P. laticollis* varied from about -9°C in summer to about -42°C in winter; this shift in freezing tolerance was paralleled by a dramatic winter increase in glycerol concentration and in total blood osmotic concentration. Amino acid concentration also increased in winter, but the contribution to blood osmolarity was small compared to that of glycerol. Nucleating agents were present in the blood year-round, ensuring that ice formation will occur extracellularly rather than intracellularly, even in summer.

For beetles collected in midwinter and early spring, blood glycerol concentrations could be artificially reduced by warming beetles to 23°C (room temperature) for about 24-150h. When glycerol concentrations of spring and winter beetles were reduced to identical levels by warming, the spring beetles tolerated freezing better than the winter beetles; these differences in tolerance could not be explained by differences in amino acid concentrations. This result indicates that some other factors, as yet unknown, are also involved in determining the freezing tolerance of these beetles.

Notice that this summary condenses a seven-page paper and translates it into a cogent and clear synopsis. Note the **absence** of technical jargon, direct quotations and dense sentences. The student has distilled this paper down into clear statements of the main purpose of the study, experimental method, main findings and interpretation of the results. If you can summarize the main points of your paper clearly and ***in your own words***, it demonstrates actual understanding of the content of the study. (Be aware that it is very obvious to the reader when you have little to no understanding of the main points of the paper you chose to critique!) If you cannot write a clear summary, you absolutely cannot begin to critique the paper.

2) Example summary and critique of primary research paper

The fertilized eggs of marine snails are often enclosed in complex, leathery egg capsules with 30 or more embryos being confined within each capsule. The embryos develop for 1 or more weeks before leaving the capsules. The egg capsules of intertidal species potentially expose the developing embryos to thermal stress, osmotic stress, and desiccation stress. This paper (Kinehcep, 1982) describes the ability of such egg capsules to protect developing embryos from low-salinity stress, such as might be experienced at low tide during a rainstorm.

Two snail species were studied: *Nucella lamellosa* and *N. lima*. Embryos were exposed at 10-12°C either to full-strength seawater (control conditions) or to 10-12% seawater solutions (seawater diluted with distilled water). The ability of egg capsules to protect the enclosed embryos from low-salinity stress was assessed by placing intact egg capsules into the test solutions for up to 9h, returning the capsules to full-strength seawater, and comparing subsequent embryonic mortality with that shown by embryos removed from capsules and exposed to the low-salinity stress directly.

Encapsulated embryos exposed to the low salinities suffered less than 2% mortality, even after low-salinity exposures of 9h duration. In contrast, embryos exposed directly to the same test conditions for as little as 5h suffered 100% mortality. All embryos survived exposure to control conditions for the full 9h, showing that removal from the capsules was not the stress killing the embryos in the other treatments. Sampling capsular fluid at various times after capsules were transferred to the diluted seawater. Kinehcep found that the concentration of solutes within capsules fell to near that of the surrounding water within about 1h after transfer.

This study clearly demonstrates the protective value of the egg capsules of 2 snail species faced with low-salinity stress. **However, Kinehcep was unable to explain how** egg capsules of these 2 species protect the

enclosed embryos since the capsules did not prevent decreases in the solute concentration of the capsular fluid. **Although Kinehcep plotted the rate** at which the solute concentration falls within the capsules (his Fig 1.), he sampled only at 0, 60, and 90 min after the capsules were transferred to water of reduced salinity. I think **he should have sampled at** frequent intervals during the first 60 min to discover how rapidly the solute concentration of the capsule fluid falls. **As Kinehcep himself suggests, perhaps the embryos are** less stressed if the concentration inside the capsule falls slowly. These experiments were all performed at a single temperature even though encapsulated embryos are likely to experience fluctuation in both temperature and salinity as the tide rises and falls during the day; **the study should be repeated** using a range of temperatures likely to be experienced in the field. **In addition, I suggest repeating** these experiments using deep-water species whose egg capsules are never exposed to salinity fluctuations of the magnitude used in this study.

A short and clear summary precedes the critique in this example. One point to consider is that when the critique portion begins in the last paragraph of the text, the student is careful to separate her analyses/critique from that of the author's approach and interpretation. Look carefully at the kinds of points the student considers in her critique-what part of the finding or experimental approach does she bring into question, and why? Note the phrases I have highlighted and underlined in the text of the critique paragraph, what is their relevance to a critical reading of the author's interpretation of the results?

Keep in mind that this critique is on the short side. You are expected to more thoroughly critique the paper in your short assignment for 245W.

Additional critique tips:

Subtitle the sections of the paper into 1) summary and 2) critique if this helps you in the organization of your paper while revising it.

If you find writing the summary portion of the paper to be difficult, go back to square one and reread the paper several times, taking notes as you do so. Master the summary before you attempt to critique the paper.

Other thought-provoking questions to consider using in your critique:

1) Are the results only applicable to the particular system/population studied? Can the interpretations of the author(s) be more widely applied? Why or why not?

2) Are the results reproducible?