



TUCSON HIGH MAGNET SCHOOL

BIOLOGY & RESEARCH METHODS

Teacher: Margaret Wilch

Fellow: Rebecca Stockbridge



OUR GOALS

By combining our biological and mathematical expertise, we encourage students to:

- think critically about procedures and data analysis,
- recognize the benefits of viewing science through a mathematical lens,
- and communicate scientific ideas through a variety of media.

HONORS RESEARCH METHODS

Research Methods students spend the year developing and carrying out independent research projects. They must read and summarize eight published articles, write a project proposal, a literature review, and a final paper, as well as present regularly to their peers along the way.

Rebecca works one-on-one with students to help them progress on their research projects and develop their scientific writing and presenting skills.

REVIEW
Title of article:
Cancer Stem Cells: At the Headquarters of Tumor Development
Author(s):
Ryan J. Ward, and Peter B. Dirks
Journal:
The Annual Review of Pathology: Mechanisms of Disease
Date, Volume & pages
September 20, 2006 2:175-189

60/60
Well done!
Interpret

1. Summarize relevant background information provided in the introduction. Explain in your own word the previous research and relevance of the research. (10 pts)

- Stem cell hypothesis: only a portion of the cells within a tumor have the capacity to sustain tumor growth, the subpopulations of cells that are capable are called cancer stem cells.
- The stem cells are the only cells with in the tumor capable of self renew, differentiation, and regeneration of cancer phenotype
- Human cancers are made of a heterogeneous population of cells, and only a minority of the tumor cells population have the capacity to regenerate and sustain tumor growth (cancer stem cells)
- In the 1950s and 1960s cancer patients were injected with their own explanted cancer cells. Out of the million cancer cells implanted only 50% of the injections developed tangible bumps under the skin (palpable nodule)



Students work on preparing the protocol for their experiments.

A background summary on a peer-reviewed article.

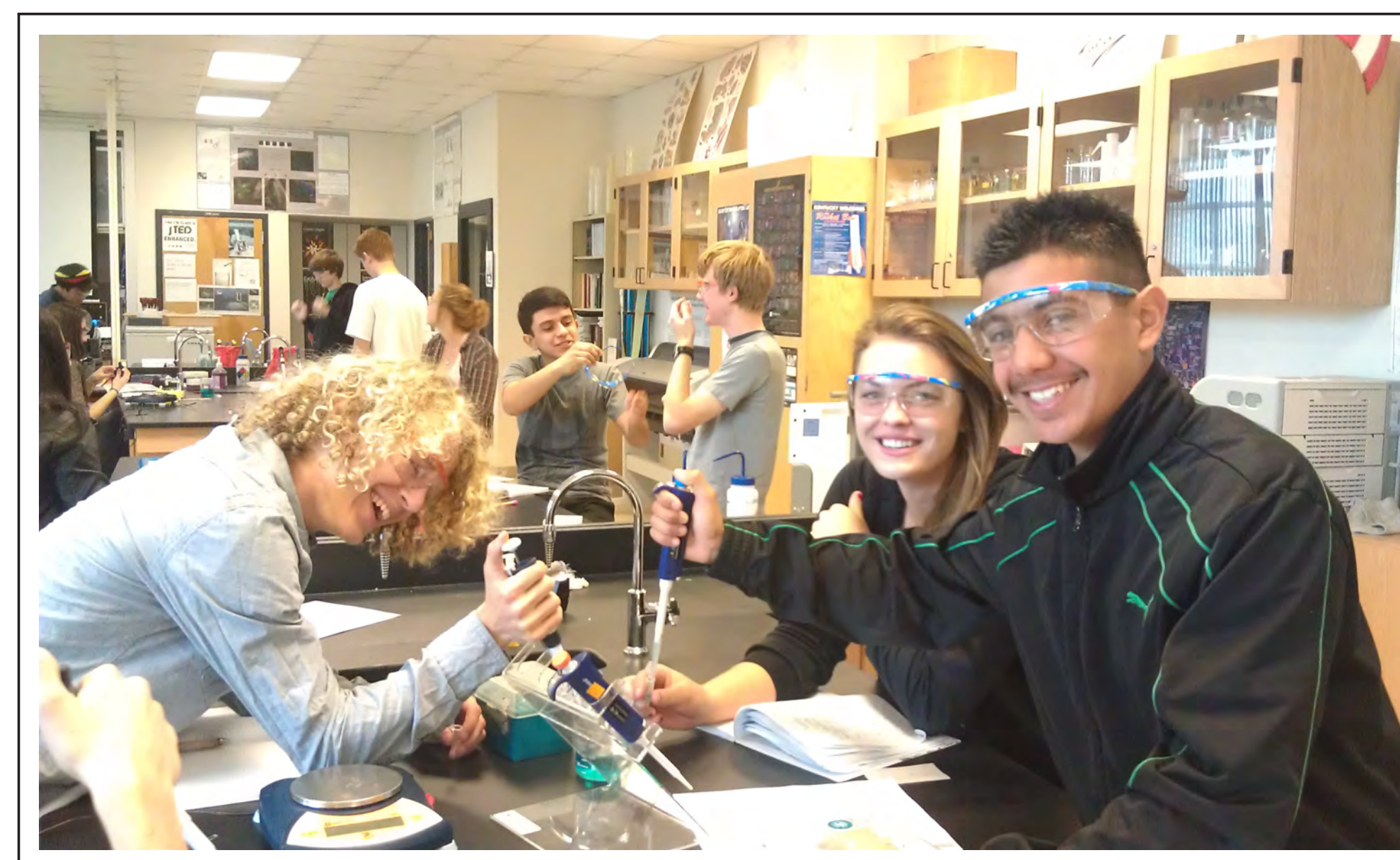
STUDENT QUOTES

“Rebecca has improved my ideas about and understanding of the statistical analyses necessary to do to quality research.”

“Rebecca has helped me with understanding how to identify the central question in journal articles.”

HONORS BIOLOGY

In-class labs provide a great opportunity for students to use mathematical thinking. Rebecca often asks questions to probe students’ understanding of experimental procedures, and encourages students to analyze both the methodology and their results.



Students developed and analyzed their pipetting skills during a lab.

Data Table 3: Standard Deviation for Volume measurements using serological

2 mL Volumes $\bar{X} = 2.03$

Value: X_i	$X_i - \bar{X}$	$(X_i - \bar{X})^2$
1.89	$1.89 - 2.03 = -.14$	$(-.14)^2$
1.98	$1.98 - 2.03 = -.05$	$(-.05)^2$
2.20	$2.20 - 2.03 = .17$	$(.17)^2$
2.23	$2.23 - 2.03 = .20$	$(.20)^2$
		$\sum (x_i - \bar{x})^2$

Varianc = $S = \frac{\sum (x_i - \bar{x})^2}{n-1}$

Standard deviation = $\sqrt{S}$

Add up this column

To determine how accurately they use the pipets, students calculated the standard deviation of their measurements.

Evaluating Science in the Media

Each week, students read and analyze a science article from the popular press, focusing on the presentation and clarity of the content.

In the fall, students studied how a brief mention of a connection between processed meat and cancer in a report from the World Cancer Research Fund became sensationalized and misreported in the international media.

Is anything safe to eat?

- The Daily Mail

WCRF UK Recommendations for Cancer Prevention

- 1 Be as lean as possible without becoming underweight
 - 2 Be physically active for at least 30 minutes every day
 - 3 Avoid sugary drinks. Limit consumption of energy-dense foods (particularly processed foods high in added sugar, or low in fibre, or high in fat)
 - 4 Eat more of a variety of vegetables, fruits, wholegrains, and pulses such as beans
 - 5 Limit consumption of red meats (such as beef, pork and lamb) and avoid processed meats
 - 6 If consumed at all, limit alcoholic drinks to 2 for men and 1 for women a day
 - 7 Limit consumption of salty foods and foods processed with salt (sodium)
 - 8 Don't use supplements to protect against cancer
- Special Population Recommendations**
- 9 It is best for mothers to breastfeed exclusively for up to 6 months and then add other liquids and foods
 - 10 After treatment, cancer survivors should follow the Recommendations for Cancer Prevention

And, always remember – do not smoke or chew tobacco