The Nucleus

Quarterly Newsletter of the Texas Association of Biology Teachers

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From the Editor

Dear Friends and Colleagues:

It is with some trepidation that I have agreed to become editor of this publication. This is not because of the work, but rather because of the enormous footsteps of those who have done it before me.

As a reader of *The Nucleus*, I have enjoyed many articles and classroom activities shared by others, without ever really taking the time to consider the effort someone else made to provide them. I have a new appreciation for those generous souls as I stare at blank pages waiting to be filled.

My guilty conscience sneaks in when I remember all the calls for articles and ideas made by previous editors which I ignored. How could 'little ole me' possibly have anything useful to share? What a cop out (as my kids would say) ...

The honest answer is that I *do* have things I could (and should) have shared. Granted, not many of them are original. (I will 'steal' every good technique you use in your classroom to make mine better!) But as long as the source is credited, I'm not heading to the confessional.

So, Karen Hewitt - thanks for your version of the Penny Flip babies... Linda Culp - my students love the "Texas Latin"... Debbie Richards - the 'foam' enzymes make it so much easier for my students... the "Woodies" DNA song is a hit every year.... The full list would never fit here so I thank you all, wherever you are, for your generosity. However, my units are works in progress. Some students are still unfulfilled. ***I want more!***

In the next issue, look for an assortment of activities to add to our 'tool box' for next year, updated information on elections and CAST, and we'll also include the scoring rubrics for the 2001 AP free response questions. It just wouldn't all fit into this issue.

As you take time this summer to rest, recuperate and reorganize, be on the lookout for that special gem in your curriculum. If it has value in your classroom, share it. If you went to a great workshop, let us know about it. Send it to me via any of the contact numbers or addresses below.

And since you're going to write anyway, you might as well let us know how your summer went. *The Nucleus* is ***our*** forum. Let's use it!

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A message from your president

Betty Ann Wonderly

Whatever happened to those hazy, lazy days of summer? It seems that my summer has sped by like a supersonic jet. While the summer gets shorter, the list of things I planned to do during the summer seems to get longer.

One of the things that was not on my "to do list" was testifying before the State Board of Education. That sounds downright scary. However, by the time you read this, I will have testified and survived. I do believe that our students deserve the best and, a 12-year-old biology book just doesn't seem reasonable. Therefore, I am asking that biology be added to the upcoming adoption. I hope to make the board aware of the effect of the sequencing of the Human Genome on biology, the incompatibility of many of our texts with TEKS, and the inability of our texts to help prepare students for the upcoming TAAS-II. Now, if I can just keep all those acronyms straight, I hope I can convince the Board that we cannot wait until 2011 for a new book for biology.

With fall rapidly approaching, I hope you are thinking about CAST in Austin. You will be able to register online after August 1st. There has been some trouble with online program proposals so if you submitted a proposal and you have not heard anything, please contact Vanessa Westbrook at *vwestbrook@mail.utexas.edu*. If you are planning to attend, be sure to sign up for our luncheon. We always have a great speaker and many door prizes. This is a great time to visit with friends and exchange ideas. If you would like to help with the luncheon or the booth, please email me. The more people that are involved, the more fun it will be for all of us.

Speaking of more people, how about a membership drive? Alton tells me that our membership represents less than 10% of the biology teachers in the state. He has agreed to chair the committee and has some fantastic ideas to encourage all of us to campaign for more members. You know Alton, always full of surprises. If you would like to help with this, please email him at *altonb@ix.netcom.com*.

Our new webmasters, Mark Storey and David Allard, worked on an official TABT web page which is up and running. Special thanks to our volunteers for making this possible. Check it out at the following web address: *http://is.tc.cc.tx.us/~mstorey/TABT/index.html.*

We will be electing officers in the fall and will be sending the ballot by email to most of you. This represents a great financial savings, so if you have an email address and are not getting updates from Alton, please be sure to send him your address.

Here are some interesting websites I have found. You can assess your learning style or have your students assess theirs at *http://www2.ncsu.edu/unity/lockers/users/f/felder/public/ILSdir/ilsweb.html*. You can get free publications from *http://www.nigms.nih.gov/news/science_ed/.*

Also, Access Excellence has a new mystery online. These can be fun as introductory exercises the first few days of class while students are being switched. If you haven't visited *www.accessexcellence.org* you don't know what you're missing. They have lots of other things besides mysteries.

One final thought. In this issue, you will find the first installment in our report on the AP Biology exam for this year. Please note that the question on evolution, a concept all students need to understand, had the lowest mean. If you have not done so, you might want to make sure you have signed up to receive the teacher materials from the PBS evolution series at *learnevolution@wgbh.org.*

2001 AP Biology Exam Results

Teachers converged at Clemson University June 3-9 to read and score the free response questions for the 2001 AP Biology exam. We extend our thanks to Carolyn Schofield along with Frank Bell, Israel Solon, Amy TeBeest and Betty Ann Wonderly for sharing the comments on what they saw as readers during the essay scoring.

QUESTION 1:

In biological systems, structure and function are related. Choose three of the following components of organ systems

alveolus	villus	sarcomere
capillary	nephron	neuron

a) For each component **describe** the structure of the component and **explain** how that structure is responsible for the function of that component.

b) For the three components that you chose in part a, **explain** how the structure of the component contributes to the functioning of the organ system to which it belongs.

Results for question 1:

Mean = 3.74

-, 0 = 23%

1, 2 = 20%

3,4,5 = 26%

6,7,8 = 21%

9,10 = 10%

Readers comments for question 1:

"Many, many students did a very good job of discussing function for this question but neglected structure so they received no points. Teachers need to think about this when they prepare students to write the essay questions. Tell them to read the question and then reread the question. It became obvious that students did NOT understand the hierarchy of bodily structures: they often went from cells to organs, then tissues and systems."

"The most popular choices for answers were capillaries, villi, and alveoli. Many students told all about transport by capillaries, but not anything about the actual purpose of bringing the blood through the capillaries to nourish cells and remove waste. Some got arteries and veins backwards. Villi were often identified as lining many different (and incorrect) parts of the body - lungs, stomach, liver, large intestine. The terms alveoli and villi were often interchanged. Neurons and nephrons were regularly confused - kids usually described both as parts of the nervous system. Interesting, though, sarcomere is arguably one of the hardest concepts for students, those that chose it did well as long as they remembered to give structure as well as function."

QUESTION 2:

Charles Darwin proposed that evolution by natural selection was the basis for the differences that he saw in similar organisms as he traveled and collected specimens in South America and on the Galapagos Islands.

Part A) Explain the theory of evolution by natural selection as presented by Darwin.

Question 2 continued:

Part B) Each of the following relates to an aspect of evolution by natural selection. Explain three of the following.

(i) Convergent evolution and similarities among species (ecological equivalents) in a particular biome (e.g., tundra, taiga, etc).

(ii) Natural selection and the formation of insecticide-resistant insects or antiobiotic-resistant bacteria.

(iii) Speciation and isolation.

(iv) Natural selection and behavior such as kinesis, fixed-action-pattern, dominance hierarchy.

(v) Natural selection and heterozygote advantage.

Results for question 2:

Mean = 3.43
-, 0 = 15%
1, 2 = 24%
3,4,5 = 39%
6,7,8 = 19%
9,10 = 3%

Readers comments for question 2:

"How many times can students say 'things change with time' and 'survival of the fittest' without giving any evidence or explanation?! We graded thousands of papers with just buzz words and phrases and little substance. This was the longest grading question because the students wrote so much (in fact, many graders were hired to stay late to finish all the papers!). ***So many*** students implied that things change because they 'need to'. Many related that when faced with an environmental challenge, the organisms 'adapt and become different' - Lamarck seems to be alive and well! Few students were able to state and explain the major pints of Darwin's theory though most were able to give examples in the second part."

"It seems students do not understand 'resistance' – many called it 'immunity' AND talked about antibodies or the immune system 'fighting off' the antibiotic! (note: we did accept immunity if it was used in the generic way for 'not being affected by'). Convergent evolution was another much-muddled concept: answers were often about co-evolution (bees and flowers) or even adaptive radiation (seems they thought convergent and divergent meant the same thing). The fact that all creatures in the Arctic tend to develop white hair was the most often cited convergent example. We were very disappointed that this question had the lowest mean, and everyone agreed that we ***all*** need to rethink and refocus our teaching concerning evolution and its process. Be careful how you phrase explanations, and be clear that adaptations occur because organisms born with genetic differences may have an advantage in survival and therefore production of offspring who also inherit those favorable differences!"

QUESTION 3:

A biologist measured dissolved oxygen in the top 30 centimeters of a moderately eutrophic (mesotrophic) lake in the tempertue zone. The day was bright and sunny, and the wind was calm. The results of the observation are presented below:

Hour	**O_2**
6:00 a.m.	0.9 mg/L
8:00 a.m.	1.7 mg/L
10:00 a.m.	3.1 mg/L
12:00 noon	4.9 mg/L
2:00 p.m.	6.8 mg/L
4:00 p.m.	8.1 mg/L
6:00 p.m.	7.9 mg/L
8:00 p.m.	6.2 mg/L
10:00 p.m.	4.0 mg/L
12:00 midnight	2.4 mg/L

Question 3 continued:

a) Using the graph paper provided, **plot** the results that were obtained. Then, using the same set of axes, draw and label and additional line/curve representing the results that you would predict had the day been heavily overcast.

b) **Explain** the biological processes that are operating in the lake to produce the observed data. **Explain** also how these processes would account for your prediction of results for a heavily overcast day.

c) **Describe** how the introduction of high levels of nutrients such as nitrates and phosphates into the lake would affect subsequent observations. **Explain** your prediction.

Results for question 3:

Mean = 5.47
-, 0 = 2%
1, 2 = 7%
3,4,5 = 39%
6,7,8 = 45%
9,10 = 7%

Readers comments for question 3:

"We found the graphing skills of most students to be adequate. Unfortunately, there are still a few who do not know which is the dependent and which is the independent variable, forgot to label each axis and use units, and did not use the space provided well (made graph very small or too large to fit the paper). Some tried to extrapolate and added a zero-zero point rather than just graph the data given."

"Most students were able to relate the graphs to photosynthesis and the differences in light. However, many of the students didn't seem to have a very clear understanding of why the light increased during the day nor why that affected photosynthesis. Most students understood that the rate would go down on a cloudy day, but again, seemed to be unsure of why. Very few students mentioned respiration and the relationship of both photosynthesis and respiration to the differences in dissolved oxygen concentration. Many graders felt that it might help to teach the topic of productivity with photosynthesis. "

There are still students who think the light reactions occur during the day and the 'dark' reactions occur at night. Many also think that plants carry on only photosynthesis and do not respire OR that respiration occurs only at night. And large numbers indicated that O2 was coming from the breakdown of CO2. Very few students had a clear idea of what adding nutrients to the water would do. N and P were usually described as "food" for the plant rather than elements for biosynthesis. Few students seemed to relate the question to ecology, eutrophication, productivity, etc. – they viewed it only as a question dealing with photosynthesis.'

"The mean on this question was high because so many students got the 4 points possible on the graph and were able to identify photosynthesis as the process that was involved. But, as a rule, the answers did not show the depth of understanding we had hoped for."

QUESTION 4:

Proteins - large complex molecules - are major building blocks of all living organisms. Discuss the following in relation to proteins.
a) The chemical composition and levels of structure of proteins.
b) The roles of DNA and RNA is protein synthesis.
c) The roles of proteins in membrane structure and transport of molecules across the membrane.

Question 4 continued:

Results for question 4:

Mean = 3.56
-, 0 = 20%
1, 2 = 25%
3,4,5 = 27%
6,7,8 = 20%
9,10 = 8%

Score Distributions

	2001	2000
5	**18.0%**	**18.4%**
4	**18.7%**	**20.7%**
3	**22.1%**	**25.4%**
2	**24.4%**	**22.1%**
1	**16.8%**	**13.4%**

Readers comments for question 4:

"Again, kids were not answering the questions asked! What is the ROLE of protein? What does it do? Many testers wrote all about process without explaining what it accomplished and so received few points. Transcription was often badly muddled with tRNA (transcription RNA?) being used. And mRNA was too often described as being an 'exact copy' of the DNA message rather than a complimentary copy of the bases. One HUGE misconception which jumped out at graders was that DNA was always replicated before transcription/translation could occur: this statement occurred so often, the readers said they began to believe it was correct. tRNA and rRNA kept magically appearing or would come from mRNA in the cytoplasm: few kids truly understood that ALL of the different forms of RNA are transcribed from DNA. Maybe we should try teaching DNA replication separate from transcription and translation?!?

"It also became clear that students believe 'quartenary structure' must have 4 parts (like hemoglobin and antibodies) rather than just be composed of more than one polypeptide subunit. A suggestion was made to use other examples (such as insulin with only 2 parts) to dispel the misunderstanding.

Source:
listserv posting by
Dr. Robert E. Cannon of the University of North Carolina at Greensboro

Attention TABT Members ...

Are you receiving the URL of the Week and other announcements via e-mail?

If not ... please send your e-mail address to Alton Biggs at altonb@ix.netcom.com

We are moving into electronic distribution of *The Nucleus* and don't want you to be left out!

And watch for your officer ballot via e-mail, too!

ISEF 2001: "A Science Odyssey" Showcases Talent

Students from across the globe met in San Jose, California the week of May 7th to compete in the International Science and Engineering Fair. Each state sent their best projects from regional and state competition.

International students traveled from all over the world including China, South Africa, Puerto Rico, Germany and the United Kingdom.

Corporate sponsors reflected the fair location in the heart of the Silicon Valley. Firms providing support for the fair included Intel, Agilent Technologies, Applied Materials, Seagate, and Siebel. The foyer of the convention center contained several display cases which described the scientists and processes involved in the evolution of the microchip.

Over 1,000 projects were entered in the fair, and the quality was staggering. The work of students and their mentors represented cutting edge technology (the marriage of an electrode glove with a computer to translate sign language into text) and new applications of old technology (the use of ultrasound frequencies to control mosquito larvae).

But the fair wasn't all work and no play. Students enjoyed a mixer in the San Jose Technology Museum with a live performance by Sugar Ray, IMAX movies, an abundance of good food, and the company of their peers.

Distribution of prizes required three separate awards ceremonies. Scholarships worth thousands of dollars were awarded by local universities, and officers in the Armed Services also handed out prize money.

The Texas delegation was well-represented and many students earned scholarships and prizes. Everyone, including the sponsors, returned with great memories and the motivation to do it again next year.

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2001 Election Ballot

Vote for one for President Elect

_____ ***Robert Dennison***
_____ ***Dan Wivagg***

Vote for one for Secretary/Treasurer

_____ ***Debbie Richards***
_____ ***Write-in Candidate*** _____

Please e-mail your vote to: ***altonb@ix.netcom.com*** **or**
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