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IN VIVO

The Publication of the Metropolitan Association of College and University Biologists

Spring 2006 Volume 27, Issue 3

KINGSBOROUGH COMMUNITY COLLEGE TO HOST MACUB CONFERENCE SATURDAY, OCTOBER 28, 2006

KENNETH WESSON

TO PRESENT KEYNOTE ADDRESSES AT 39TH ANNUAL MACUB CONFERENCE

Kenneth Wesson

Kingsborough Community College will host the 39th Annual Fall MACUB Conference on Saturday, October 28, 2006. The conference will feature a keynote address by Kenneth Wesson. Kenneth Wesson delivers keynote addresses on the neuroscience of learning for educational organizations and institutions throughout the United States and overseas. His audiences range from pre-school and early childhood specialists to college and university-level faculty members and administrators. His recent international audiences have included educators and chief administrative officers from North America, South America, Asia, Eastern Europe, the Middle East, Northern Africa and sub-Saharan Africa. He has spoken to educators and administrators from six of the world's seven continents.

Kenneth Wesson regularly addresses educational organizations, counseling associations, school districts and civic groups, as well as parenting organizations on establishing "brain-considerate" learning environments. In addition to his speeches on the neuroscience of learning, he also speaks on the subjects of early brain development, emotional intelligence, the neuropsychology of prejudice, contextual learning, diversity in learning, design and engineering, and curriculum development.

His recent work has included delivering addresses to the American Society for Microbiology; the IBM Corporation; the Summer Institute for the National Academy of Sciences; the Johnson and Johnson Corporation; the National Science Teachers Association (NSTA); the Hawaiian Association for Counselors and Educators in Government; the Annual Biomedical Research Conference for Minority Students (sponsored by the National Institute of General Medical Sciences); the National Alliance of Business; Head Start; the "Aging To Perfection" Conference; the Great Teachers' Seminars; the National Science Foundation's Systemic Initiatives for Math and Science; the Distinguished Scientist Lecture Series in Santa Monica, CA; the IDATER Conference (International Design and Technology Educational Research and Curriculum Development) in England, and numerous American colleges and universities.

He has been a keynote speaker for several of the leading international educational organizations for American and International schools, including the Association of International Schools in Africa (AISA), the Association of American Schools in South America (AASSA), the Central and Eastern European Schools Association (CEESA), the National Association of Independent Schools (NAIS), East Asia Regional Council of Overseas Schools (EARCOS), the Near East South Asia Schools (NESA), along with numerous American educational organizations, school districts, and colleges.

His recent articles on the brain include: "Neuropsychology and Prejudice;" "Early Brain Development and Learning;" "Got Art?: The Connection Between Drawing Skills and Brain Function;" "Where is God in the Brain?;" "What Recent Brain Research Tells Us About Learning;" and "Memory and the Brain." Several of his articles have appeared in the Independent School Journal, which was recently honored by the Association of Education Publishers (AEP) as the 2005 "Periodical of the Year."

He has been profiled in "Who's Who in Science and Engineering," "Who's Who in American Education," and "Who's Who in America" from 1998-99 to 2006-07.

Instructions for Authors

IN VIVO is published three times yearly during the Fall, Winter, and Spring. Original research articles in the field of biology in addition to original articles of general interest to faculty and students may be submitted to the editor to be considered for publication. Manuscripts can be in the form of a) full length manuscripts, b) mini-reviews or c) short communications of particularly significant and timely information. Manuscripts will be evaluated by two reviewers.

Articles can be submitted electronically to *invivo@mec.cuny.edu* or mailed as a printed copy (preferably with a diskette that contains the file) to the Editorial Board at Medgar Evers College. All submissions should be formatted double spaced with 1 inch margins. The title of the article, the full names of each author, their academic affiliations and addresses, and the name of the person to whom correspondence should be sent must be given. As a rule, full length articles should include a brief abstract and be divided into the following sections: introduction, materials and methods, results, discussion, acknowledgments and references. Reviews and short communications can be arranged differently. References should be identified in the text by using numerical superscripts in consecutive order. In the reference section, references should be arranged in the order that they appeared in the text using the following format: last name, initials., year of publication. title of article, journal volume number: page numbers. (eg. - [1]Hassan, M. and V. Herbert, 2000. Colon Cancer. *In Vivo* **32:** 3 - 8). For books the order should be last name, initial, year of publication, title of book in italics, publisher and city, and page number referred to. (eg. - Prosser, C.L., 1973. *Comparative Animal Physiology*, Saunders Co., Philadelphia, p 59.). Abbreviations and technical jargon should be avoided. Tables and figures should be submitted on separate pages with the desired locations in the text indicated in the margins.

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Publish your manuscripts in *In Vivo*

Follow the Instructions to Authors on page 2 and submit your manuscripts to the Editorial Board.

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The Benjamin Cummings/MACUB Student Research Grants are Awarded to Four Students

The Benjamin Cummings/MACUB Student Research Grants was established to provide research support for undergraduate students working under the supervision of faculty who are current members of MACUB. We are proud to announce the following four awardees for 2006:

Ms. Mel Pilar Espaillat
Biology Department
State University of New York at Farmingdale
Farmingdale, NY 11735
Faculty Advisor: Dr. Carla A. Martin
Research Project: Modulation of Dendritic Cell (DC) Heat Shock Response and Immunogenic DC Activity by IL-10

Ms. Emy Rothenberger
Biology Department
Monmouth University
West Long Branch, NJ 07764
Faculty Advisor: Dr. Dottie Hutter
Research Project: Effect of MAP Kinase Signaling Pathways on Contact Inhibition

Ms. Thekriat M. Afaneh
Biology Department
St. Francis College
Brooklyn, New York 11201
Faculty Advisor: Dr. Steve M. Lipson
Research Project: Investigation Into the Effects of Cranberry Juice and Proanthyocyanidins on the Inhibition of Reovirus and Reovirus-induced Gastroenteritis in Mice

Ms. Michelle Cerami
Department of Biological Sciences
St. John's University
Jamaica, NY 11439
Faculty Advisor: Dr. Richard Stalter
Research Project: Forty Years of Community Development at a Gamma Irradiated Forest, Brookhaven National Laboratory

Each student research awardee received $500 toward their research plus complementary registration for the Annual Fall MACUB Conference and membership in MACUB

Congratulations are in order for the awardees and thank you to all those who applied.

In This Issue:

Visit the M.A.C.U.B. web site at www.macub.org

The MACUB web site is now up and running. We now call for members to use the web site for registration information. Register for the 38th Annual Fall Conference on-line. Submit your poster presentation abstract on-line. Submit your member paper presentation on-line. If you are a MACUB member in good standing and have a Web site that you would like linked to our web site, submit the URL address to: gsarinsky@kbcc.cuny.edu.

Save the Date

Saturday, October 28, 2006
MACUB Fall Conference at Kingsborough Community College

What is the *Bally–Hoo* About Avian Flu? Is There Anything New?

by

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In the early fall of 2005 I was asked to write an article pertaining to avian flu for a target audience of aviculturists concerned about their birds or themselves acquiring this illness. During the latter part of that year scientific journals and the news media focused a great deal of time and attention on avian flu. Reports appertaining to this flu's origin, transmission communicability, and pandemic causing probability and potential were written. During my research for that publication[1] I came across what appeared either "sensationalized" (in newspaper and television reports) or "on (scientific) target" (in science journals). My colleagues and acquaintances knowledge-base correlated with their position along the dichotomous spectrum I observed. Some were fearful; others impassive. It appeared the "panic" aura which existed then, both in acquaintances and the media had dissipated somewhat in just shy of half a year. The question and clarification frequency I meet now has lessened significantly.

However, at the time of this writing, media attention to avian influenza and a possible looming pandemic has again intensified. Since the beginning of 2006 many articles[2,3,4] appeared in the newspapers pertaining to confirmed diagnoses and surveillance tracking of avian flu (H_5N_1) in Turkey. These are the first cases known outside of East Asia. Dr. Guenael Rodier, an official from the World Health Organization believes a new mutation in the A (H_5N_1) does not appear to account for the spread of the virus among humans in Turkey[5]. Further, Dr. Rodier states the recent patients who caught the virus appear to have caught it form direct contact with infected poultry. There are also cases where children who tested positive for H_5N_1 did not show symptoms. Doctors speculate whether they are witnessing human bird flu in early stages and/or discovering that Influenza Type A (H_5N_1) infection does not always lead to illness[6].

My interest and attention again was drawn to avian influenza. Had additional significant events occurred since the article I had written? Did the predicted events for a pandemic commence? The original article I wrote appears below in italics, interspersed with updated references and thoughts.

Can I get bird flu from eating chicken? Looking at a chicken? How can I get it or prevent it? Where can I get it? Can my parrot get it from me? What are the believed risks of contracting avian flu, for you, for Polly?

At the outset, I will present its summation. Based on our knowledge and the past, an avian influenza pandemic would require that all the following events occur:

- *an avian flu strain would (genetically) combine with a human flu strain to create a novel strain.*

Fig. 3 Question 10 (How much of a challenge did the program require of you?)

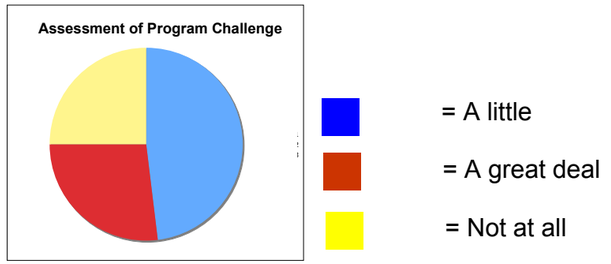


Fig. 4 Question 11 (Do you think that other students would benefit from this Program?)

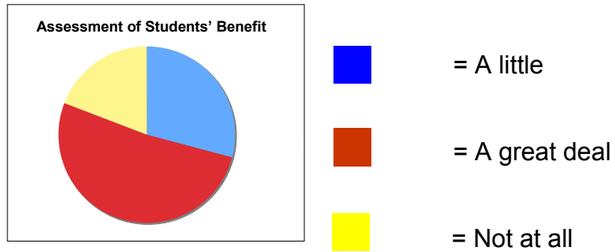


Fig. 5 Question 12 (Do you think you would benefit from reviewing the program several times?)

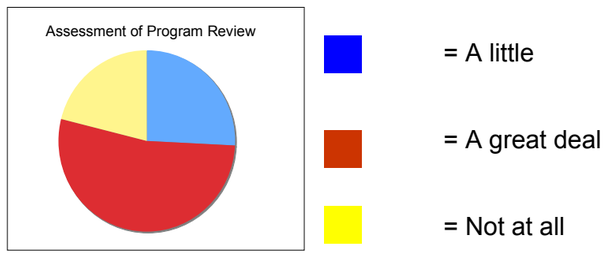


Figure 1. MACROMEDIA VS. WITHOUT MACROMEDIA

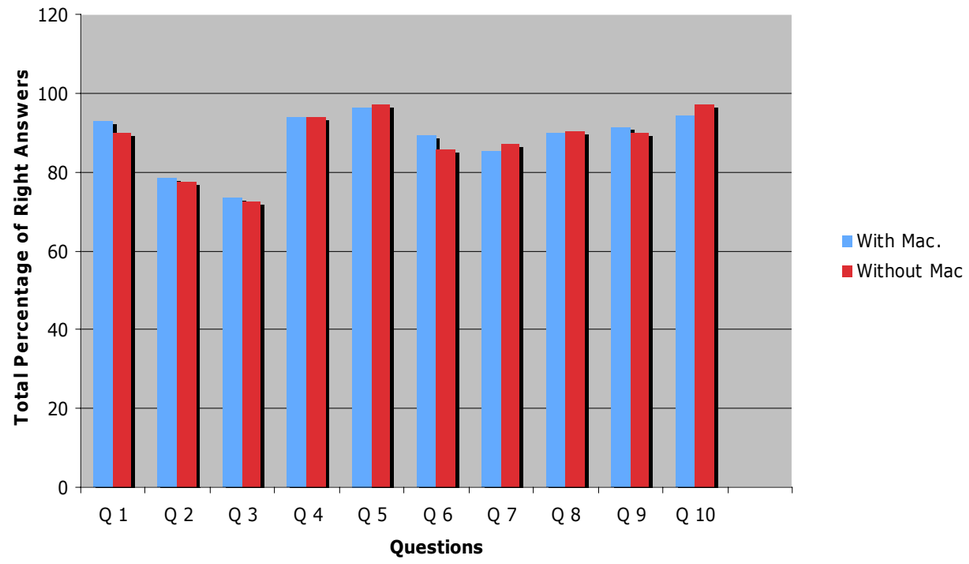
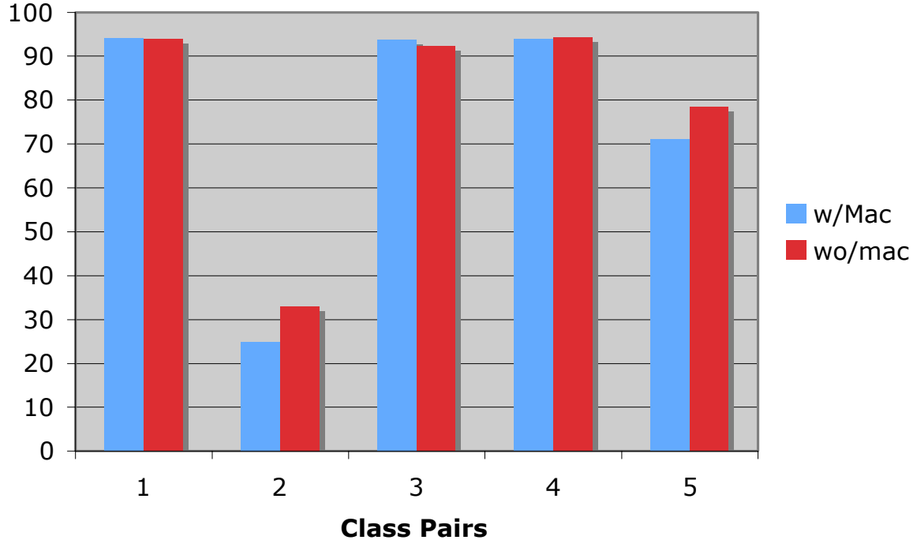


Figure 2. Comparison of Class Averages



- *this new virus would be a highly pathogenic strain.*
- *the recombined flu virus would have the ability to readily and easily infect humans and be rapidly transmitted human to human in several continents. Global control measures would be inadequate to contain said outbreak.*

Does this sound far-fetched, improbable? Not really. It can happen, it has happened before. If the global pandemic cycle holds true, occurring every 68 years, our next pandemic could occur in the year 2025[7]. Read on if you would like to learn a few facts, as we know and understand this pathogen, its communicability and pathogenicity.

In this article, I will share information concerning this feared pandemic, viral pathogens, transmission, acquired immunity and defense. Let's not panic; wasn't it President Franklin Delano Roosevelt who said we had nothing to fear but fear itself? One author, Dr. Marc Siegel identifies what he sees as three major catalysts of our "culture of fear": government, the media and "big pharma"[8]. He terms anthrax, SARS and Mad Cow disease "Bugs du Jour", believing that statistically, fear relating to these diseases are only a concern for a narrow segment of the population. Further, Dr. Siegel contends there is heightened anxiety correlated with scientific misinformation. Something to ponder?

What is flu? Flu, or influenza is defined as an acute viral infection of the respiratory tract, occurring is isolated cases, epidemics or pandemics. Influenza is caused by three strains of influenza virus, classified into types A, B and C, based on the antigens of their protein coats[9]. Well, that's a mouthful! Let's break it down into understandable English.

Several hundred viruses are known to infect humans. These include the common cold, measles, chickenpox, smallpox, Epstein-Barr, HIV, herpes, rabies, polio and hepatitis. Viruses are considered non-living by scientists, since they lack independent metabolism and reproduction. Without a host cell, a virus cannot reproduce. They are composed of protein and genetic material (either DNA or RNA). Proteins which occur on the surface of these viruses, called antigens, are hemagglutinin (H) and neuraminidase (N); these are what distinguish various subtypes of influenza viruses. Numerous combinations of the H and N proteins are possible (e.g.: H_1N_1, H_2N_1, H_3N_2, etc.). Changes in these proteins are characteristic of the influenza viruses, and occur frequently. These changes are referred to as antigenic shifts, or antigenic variation. Influenza viruses have high a mutation rate which changes their specific antigenic combination. Change in antigen components (antigenic drift) occurs annually with the influenza viruses, and is the reason for developing different flu vaccines each year. Small changes in the virus that persist over time can produce novel virus strains that our immune system may not be able to be recognized by antibodies we produced to earlier influenza strains. Avian influenza A which is infecting birds in Asia is a highly pathogenic strain (H_5N_1) that occurs in both humans and poultry. Viral subtypes are distinguished based on genetic features and the severity of illness they cause in poultry[10]. When highly pathogenic viruses (H_5 or H_7) cause outbreaks, more than ninety percent of poultry die from infection[11]. The recently reported finding of a duck infected with an avian flu was a strain that is not considered virulent[12]. Erring on the side of caution and "an extremely hypersensitive

environment", the United States banned imports of some Canadian poultry.

The source of a virus is called the reservoir. Influenza viruses have animal reservoirs. Many regions of the world have animal reservoirs for influenza viruses. Wild birds are the natural hosts for influenza A. In rural China and Vietnam, chickens, pigs and humans live in close and crowded conditions. Chickens can transfer the virus to pigs who can transfer it to humans, then back to pigs, etc. Recombination of the genetic material often occurs. The location where a virus was first identified, or thought to originate, is how it gets named. The 1957 Asian flu, 1968 Hong Kong flu and 1977 Russian flu are examples. The worst worldwide epidemic (pandemic) known as the Spanish flu occurred in 1918 and killed more than 20 million people. Cases where avian influenza infection transferred to humans are thought to have resulted from direct contact with contaminated poultry[13]. Since 1997 these types of infection have not resulted in sustained human to human transmission.

According to a top Chinese scientist the avian flu is currently stable, and not mutating to a human to human readily transmissible form[14]. All cases reported in Turkey [were traceable to contact with infected birds [5]. A milder strain of bird flu virus (H_5N_2) infected farm workers in Japan which represented the first human infection by this strain[5]. Their symptom was a sore throat. After the chairman of the poultry farm came under intense criticism for covering up the outbreak, the chairman and his wife hanged themselves.

The 1918 viral strain was recreated by Taubenberger *et al.* last year[15,16]. RNA was isolated from a lung tissue sample from a 1918 Alaskan flu victim found in permafrost. It was transcribed, amplified and sequenced then studied in mice and compared to a contemporary (human) strain called Texas Virus. The 1918 virus released fifty times the viral particles from human lung cells. Thirty nine times more viral particles were formed in mouse tissue four days after infection than were found with the Texas strain. All mice died within six days of infection versus none with Texas strain. Scientists of molecular pathology at the Armed Forces Institute of Technology sampled tissues from preserved birds collected around 1918[17] and found that several birds had a flu virus, exactly like that in today's bird flu virus with respect to the polymerase genes they encode. The reconstructed 1918 viral sequence was also compared to today's human influenza viruses[18]. Dr. Taubenberger's data concerning the virus's genetic origin suggests that the 1918 virus was an avian-like virus that adapted to humans *in toto*. Ten amino acid changes consistently differentiated the 1918 and subsequent human influenza virus sequences from avian virus sequences. It was postulated these changes may play a role in assisting the virus to human adaptation.

The Orthomyxoviridae (influenza A virus) genome has eight negative sense RNA molecules[18]. They are between 890-2341 nucleotides in length and encode eleven proteins. Scientists have considered whether these (few) changes turned the bird virus into a pathogenic strain transmissible from human to human. Ghedin *et al.*[18] analyzed human influenza isolates across several seasons within a constrained geographical area and identified a number of mutations that may affect receptor-binding affinity and potentially increase the efficiency of viral replication. Their studies were expanded to include avian influenza, as mixing and

Table 2 - Program Assessment

Part A: Answer questions 1 through 10 by choosing from the following:
a. No help b. A little help c. Moderate help d. Much help e. Very much help

1. Did the overall approach used to present the material help you to understand the concept of osmosis?
2. Did the graphics help your understanding of osmosis?
3. Did the self-test help your understanding of the concepts?
4. Did the photos of the RBCs help you to clarify your understanding of the concept of osmosis?
5. Were the osmometer and graphs helpful to your understanding of the concept of osmosis?
6. How much did the animations help you to understand the concepts in the program?
7. How much did the program help you in understanding the relationship between the concepts (example: diffusion vs. osmosis)?
8. How much did the program help you in reading and understanding the same concepts in the textbook?
9. How much did the program help you in gaining insight into your laboratory exercises?

Part B: Answer questions 10 through 12 by choosing from the following:
a. a little b. a great deal c. not at all

10. How much of a challenge did the program require of you?
11. Do you think that other students would benefit from this program?
12. Do you think you would benefit from reviewing the program several times?

Table 3 - PROGRAM ASSESSMENT

Part A					
QUESTIONS	**A**	**B**	**C**	**D**	**E**
Q 1	6	12	38	35	12
Q 2	7	8	41	26	22
Q 3	6	18	31	29	22
Q 4	6	16	31	30	20
Q 5	6	23	32	30	16
Q 6	7	11	26	35	23
Q 7	9	7	30	26	22
Q 8	11	12	30	29	21
Q 9	8	18	29	26	23
	A = No help	**B = A little help**	**C = Moderate help**	**D = Much help**	**E = Very much help**
Part B					
Q 10	48	27	25		
Q 11	26	46	17		
Q 12	22	45	18		
	A = A little	**B = A great deal**	**C = Not at all**		

Table I - Quiz - Osmosis Questions

1. What would happen to RBCs when placed in a hypotonic solution?
   a. they would undergo crenation
   b. they would undergo hemolysis
   c. nothing would happen

2. If I place a glass test tube containing RBCs in a 0.9% salt solution in front of a printed sheet, will I be able to read the print?
   a. No, the solution is turbid; the cells have undergone crenation.
   b. Yes, because the solution is clear; the cells have disintegrated
   c. No, because the solution is turbid; the cells are intact.

3. What solution would be appropriate for a patient who needs hydration?
   a. 0.9 % saline b. 10% saline c. distilled water

4. If I place a cucumber slice into a hypertonic salt solution, how will the cucumber appear after a few minutes?
   a. Soft and limp because of water loss
   b. Hard and turgid because it gained water
   c. Its appearance would be unchanged

5. When you have a sore throat, you are often told to gargle with a warm salt solution. Can you tell me the rationale for this suggested therapy?
   a. The hypertonic solution would relieve the swelling by drawing water out of the inflamed tissues.
   b. The warmth would sooth the inflamed tissues. The cells of the throat would break down, thus relieving the swelling.

6. What would be the fate of a patient whose veins are injected with distilled water?
   a. Patient would die because his blood cells would burst (hemolysis)
   b. Patient would die because his cells would undergo crenation.
   c. Patient would be fine

7. What would happen if a *Paramecium*, which normally lives in fresh water, were put in a strong salt solution?
   a. It would undergo crenation
   b. It would undergo cytolysis
   c. It would happily swim

8. What would happen if a sprig of *Elodea*, which normally lives in fresh water, were put into a strong salt solution?
   a. Cells would undergo plasmolysis
   b. Cells would become turgid
   c. Cells would appear normal

9. If we compare a 35% sugar solution with a 50% sugar solution, which solution is hypertonic?
   a. The 35% sugar solution
   b. The 50% sugar solution
   c. They are both isotonic

10. The diffusion of water through a semi-permeable membrane is known as
   a. dialysis b. filtration c. osmosis

re-assortment of human and avian strains via co-infection are a concern with respect to pandemics.

A pandemic is an increase in the occurrence of a disease within a large and geographically widespread population [often refers to a worldwide epidemic][9]. Usually pandemics spread among continents, as was seen in previous influenza outbreaks and AIDS, also associated with a virus, HIV. The 1957 and 1968 pandemics were attributed to human flu viruses that had picked up some avian flu components, thereby making it a mix of avian and human flu genes. The 1918 pandemic is believed to have been an avian strain that jumped directly to humans. With this in mind, there is concern and surveillance whether a person simultaneously infected with bird flu and human flu might result in an exchange of genetic material between the two viruses which could create a transmissible virulent and pathogenic pandemic strain. Professor Olivia Judson (Imperial College, London) stated

"Anyone who supposes that evolution doesn't happen, or doesn't matter, should space a thought for H_5N_1, …if we're unlucky, this virus will give us a nasty demonstration of evolution in action…. Viruses and other pathogens evolve in ways that we can understand and, to some extent, predict. Whether it's preventing a flu pandemic or tackling malaria, we can use our knowledge of evolutionary processes in powerful and practical ways, potentially saving the lives of tens of millions of people."[19]

Humans can become infected with a strain of avian flu which could either mutate or combine with human flu strains and evolve into a pathogenic form such as those previously identified in other pandemics. Microbial exposure, transmission and propagation are facilitated by crowding and unsanitary conditions. For example, in Indonesia and other nearby countries, chickens are raised in backyards and kept as pets in cages. The flu is usually spread through bird feces, saliva and nasal secretions or indirectly through contact with infected materials. Humans cannot be infected with the flu by eating a disease bird if it is thoroughly cooked. The H_5N_1 bird flu outbreak of 1997 (Hong Kong) which killed six of eighteen infected people[20] *is known to circulate in herons and falcons. It has continued to evolve (an antigenic shift), and is now known to kill wild waterfowl. Its natural source has extended to include an expanded range of hosts, which include tigers and domestic cats. Only if the virus acquires human to human transmission can a pandemic occur. Control measures, including improved sanitation, banning ducks, geese and quail from live-poultry marketing sources have been performed in Hong Kong*[20]*, but need to be implemented elsewhere in Asian countries, such as Indonesia and Vietnam, which are reservoir sources for avian influenza. China has said that it would inject all the nations' 5.2 billion chickens, geese and ducks with a vaccine against bird flu*[21]*. A concern that vaccination teams can carry the virus from farm to farm was raised. Concern over migratory bird transmission has been noted by several authors*[21,22,23]*. Migratory waterfowl are believed likely to spread flu to poultry in the United States. Outbreaks along their migration routes in Croatia, Romania and Turkey have already occurred. Surveillance by ornithologists is ongoing, as well as sampling bodies of water for the influenza virus (shed in*

birds' feces). Our world is such, that we cannot separate or isolate ourselves from others. Nobel Laureate Joshua Lederberg stated, "The microbe that felled one child in a distant continent yesterday can reach your child today and seed a global pandemic tomorrow".

Surveillance is not universal, nor uniform. The Indonesian government ordered a military research unit which worked closely with the country's authorities for improving monitoring and avian flu diagnostic abilities to stop all research by December 31, 2005[24]. Howard Markel of the University of Michigan feels the best way to reduce the danger of avian flu transmission in humans is to "keep watching the (migratory) birds"[25]. Taking precautions, maintaining surveillance and continuing to issue warnings to children not to treat chickens as pets is stressed by the World Health Organization and UNICEF. It is believed that the 142 confirmed cases of H_5N_1 infection reported in Asia since 2003 were mainly in Vietnam, followed by Thailand, Indonesia and other Asian countries resulted from contact with birds, not people[25]. Countries and Nations neighboring Turkey across the European Union have enhanced their surveillance efforts[26].

Influenza is acquired by inhalation or ingestion of virus-contaminated respiratory secretions[9]. It has an incubation period of one to two days, with recovery occurring within 3-7 days. Cold-like symptoms appear concomitant with decreasing fever. Occasionally severe secondary bacterial infections occur in individuals; fatalities resulting from this pneumonia have been recorded. Since the 1940's, vaccines for prevention of influenza, consisting of inactivated viruses or viral components, were given to the chronically ill, persons over 65 and health care workers to reduce their risk of acquiring this illness. Researchers are studying reconstructed versions of the 1918 flu virus to identify which components make it so deadly, and assist in developing vaccines against them[27]. Flu symptoms are usually treated, as there are not drugs available to destroy the virus. Rather, antiviral drugs [e.g.: amatadine (Symmetrel), rimatadine (Flumadine), zanamivir (Relenza), oseltamivir (Tamiflu)] reduce the duration and symptoms if administered within two days of appearance of influenza illness. The World Health Organization (WHO) has recommended nations stockpile antiviral drugs such as Tamiflu[28]. Vaccination is the basis utilized for prevention. Masks, such as those used by certain personnel in dealing with SARS (severe acute respiratory syndrome), were not completely reliable. They were effective as part of a series of infection control measures, but if contaminated with droplets that are transferred to hands, their effectiveness in protection would be compromised. Immunization's goal is to prevent or eradicate disease. Influenza vaccines were developed in the 1930's, and are relatively free of serious side effects. The vaccine induces protection against both mild and severe flu. Antibody production is directed against the hemagglutinin (H) protein. Administration of the viral constituent results in the production of antibodies against it. Our bodies respond to the introduction of the viral component by producing antibodies that may interact with the virus before cellular penetration occurs and/or by preventing a replicating virus from spreading. There is generalized agreement amongst scientists that vaccination can be a helpful defense against this pathogen.

comprehension. Fig. 4 illustrates that students who used the macromedia program felt that other students would benefit from the program. As seen in Fig. 5, students also stated that they themselves would benefit from reviewing the program several times; in other words, they would like to use the program as a tutorial tool.

In conclusion, although we learned that the students liked the macromedia program and found it beneficial, there was not much difference in the performance of students who were exposed to the macromedia program as compared with those who were not. Therefore, we believe that we should engage in a long-term study where students can use the program as a tutorial rather than just as a one time exposure during the lecture. In this manner we may be able to determine whether the macromedia program really is helpful to students.

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motivational cue for each correct answer, while further instructions are given when they choose the incorrect answer. This technique is referred to as the *diagnostic prescriptive approach*[14] because students choosing incorrect answers to questions receive an explanation of why that choice is wrong. They also have a chance to return to a previous screen. Scores for the self-test are given to each student at the end of the test.

In order to evaluate the effectiveness of the program on students' performance, five pairs of general biology classes (each pair with the same instructor) were given a ten- question quiz on osmosis (Table 1). The macromedia program was included in the lecture material in one class from each pair. The total percentage of correct answers to each question was compared for each pair (Fig. 1). In addition, class average grades were compared for each pair (Fig. 2).

Once the students have completed the program, they may assess it for its ability to help them to learn and to understand the material. Students may go back at any time during the program to repeat all or part of it. Results of the assessment are sent to the authors via email. Table 2 illustrates the evaluation questions.

Results

In general, students expressed enthusiasm for the program at the time it was presented in the classroom. However, when students were given a classroom quiz (Table 1) on the concepts explained in the program, the results (Fig. 1) showed that there appeared to be little difference between the percentage of correct answers on the quiz taken by students exposed to the macromedia program during the lecture as compared with other students who had received only the traditional lecture. In Fig. 2, the graph showed no significant difference between the class average grades of the paired class groups (with macromedia vs. without macromedia).

The purpose of this study was to measure the impact of our osmosis macromedia program on students' learning. Despite the fact that the results indicated no differences between macromedia-exposed students vs. non-macromedia-exposed student groups, we still believe in the efficacy of macromedia programs. Perhaps the benefits of using this macromedia program would be more obvious if students were induced to access the program on the internet and use it repeatedly as a tutorial to learn at their own pace. In this study we only used the macromedia as an adjunct teaching tool to the lecture.

Our investigation allows for a great deal of latitude to further research whether the utilization of this program as a tutorial could positively increase students' ability to learn. Since students told us that they felt that our program was helpful to their understanding of osmosis, we then asked students to formally assess our program.

Table 2 illustrates the twelve assessment questions asked of the students about the macromedia program's instruction. As shown in Table 3 the majority of students answered question 1 to 10 (part A) in a positive fashion. For example, on assessment question 1, 82% of students replied that the program gave them moderate to much help.

In addition, when students were asked if they felt that the program was a challenge to them, most students stated "only a little" (Fig. 3), which indicated to us that the osmosis macromedia program was developed at their level of

Is an Avian flu vaccine available? Several drug companies are engaged in vaccine development and production that would help ready us for a pandemic strain. Dr. Anthony Fauci, the Director of the US National Institute of Allergy and Infectious Diseases believes the capacity to produce sufficient and effective vaccines should be addressed, and is a potential concern[15]. The use of adjuvants (e.g.: aluminum salt compounds), which enhance the efficiency of vaccines, could allow vaccination to cover strains that may be drifting[29]. A pandemic strain that has crossed to humans from birds will require a (new) vaccine that is specifically effective against it. The immune response created by our current vaccines would probably be insufficient for protection[30]. Researchers at St. Jude's Children's Research Hospital (Memphis, TN) say that once they obtain a sample of the virus it would take four weeks for development.

Influenza drugs do not prevent viral infection, but rather lessen the severity and duration of its symptoms. Federal health officials at the C.D.C. are urging doctors to prescribe newer antiviral drugs (*e.g.:* oseltamivir = Tamiflu) versus the ones used, since this season's influenza strain had quickly become resistant to those being used[31]. A ninety one percent increase of resistance was seen in the United States this season. Potential resistance should also be considered when prescribing one specific drug for any disease. The recommendation and use of Tamiflu for avian influenza cases should be watched over. A recent report in the New England Journal of Medicine reported Tamiflu resistance in certain patients who died from avian flu[32].

Concerns of a possible worldwide avian flu epidemic had added exigency to research and vaccine production. Several pharmaceutical companies have secured contracts to increase vaccine production[33]. One biomedical company, Chiron, will use cell-based technology for vaccine production rather than eggs which are conventionally used. This reduces the amount of time it would take to develop a new vaccine against a specific strain, but according to one representative from Sanofi Pasteur, the world's largest vaccine maker, it would be "10 years before it will be at a meaningful scale". Just after the September 11th attacks, the United States stockpiled millions of doses of smallpox vaccine [which were perishable]. Hardly anyone took them and they were thrown away. This cost millions of dollars[8]. Fear of side effects and lack of need were cited as reasons for the non-use. As the author stated, "we would worry less if we understood the difference between potential and actual risk". According to most of the reports I read, the current US supply of vaccine we have for our poultry is large enough to create a "buffer zone" around an infected farm, thereby reducing the ability of the virus to multiply and slow its spread.

In addition to vaccination, Universal Precautions are recommended by the Centers for Disease Control (CDC, Atlanta, GA). The recommendations for health professional include barriers for handling blood or body fluids such as gowns, gloves and eyewear. Emphasis on preventing skin and mucous membrane exposure include decontamination of work surfaces and hand-washing. Remember that influenza is an airborne pathogen; it is suspended in the air and can be contained in small particles called droplet nuclei or dust. Droplet nuclei can remain in the air for several days, and can travel long distances. An uncovered sneeze aerosolizes vast numbers of moisture

droplets and initially moves more than 200 miles per hour where it can adhere to dust particles. Particles may contain mucus laden with microorganisms which can be infectious to a susceptible host, and even a mask doesn't prevent the spread of every particle[9]. Currently, changes in quarantine procedures specified by the C.D.C. have been proposed that would expand the definition of illnesses to include respiratory ailments such as influenza, as well as retain airline and ship manifests electronically when people arrive ill on international and domestic flights[34]. These proposals support a plan to improve the response to communicable illnesses. Persons who travel to countries where H_5N_1 flu outbreaks have occurred (Cambodia, China, Indonesia, Kazakhstan, Malaysia, Russia, Thailand, Vietnam, Turkey, Romania) are advised to get a flu shot which would minimize genetic mixing with avian flu strains, stay away from markets with live chickens and ducks, washing their hands frequently and not eating undercooked poultry[35]. In early November, President Bush outlined a strategy to prepare for a pandemic influenza outbreak. This $7.1 billion plan would fund research and stockpile enough vaccine for 20 million people (75 million doses = one quarter of the population) by 2009, which could minimally be partially effective if the virus mutates from the vaccine type, and anti-viral drugs[36,37]. There is generalized agreement that the best weapon would be a vaccine. Unlike the way China handled the SARS epidemic two years ago, there is greater openness in their government in confirming reports of human cases there. Chinese scientists have already isolated H_5N_1 from pigs, which are capable of replicating both human and avian influenza viruses[38]. This research and preparedness contrasts to China's recent SARS fighting experience.

So, what is a person to do? What is a person to believe?

The facts as we know them today are outlined above. What is the likelihood of contracting a pandemic variant of avian flu at this time? Negligible or non-existent if you do not have contact with anyone possibly carrying a novel (genetic) recombinant avian-human virus hybrid. Viruses, in general, demonstrate host specificity, a bacterial virus infects bacteria, plant virus infects plants, etc. An avian virus can potentially infect other birds. In the case of this avian virus, we know that mutated versions can infect different species of birds, as well as pigs and humans. We can not, and should not exist in a "germ-free vacuum". Our body's ability to respond to and fight potential pathogens is assisted by past exposure and actively acquired immunologic components[39]. Numerous studies, dating as far back as the early 1900s demonstrate immunologic deficiencies in animals, including humans, with an "unpracticed" immune system.

Based on current knowledge and history, it is this author's opinion that our concern about avian flu should be treated the same way as for any other communicable disease or illness. Wash your hands, keep surfaces clean, and practice safe food handling. Being informed will help us be more prepared and careful. Hysteria and panic will not help us avert, nor contain an outbreak. Maintaining vigilance and caution which includes practicing sanitary and health precautions as described above may potentially help. After all, we quarantine new members of our flock, protect ourselves and them from harm and outside challenges.

this software was that biology concepts are often process-based. The program was implemented in three stages: design, development and delivery. The students could replay steps in the animations at will. The authors warned that the development process is labor intensive.

The concept of osmosis is a difficult concept for students to comprehend. John N. Fox, et al. (1993)[11] developed an interactive computer aid to help students gather data on this concept in a 40-minute high school laboratory period. The authors concluded that these computer-interfacing experiments are extremely helpful to students because they afford "the same excitement of discovery that research scientists find every day in laboratories".

Students have traditionally had difficulty with the concept of osmosis[12, 13]. The movement of water through a semi-permeable membrane is an abstract concept that students find hard to visualize. They continue to perpetuate misconceptions about osmosis throughout their academic careers. For these reasons we chose osmosis for our macromedia-based instructional program. Our teacher-made software program was developed by using Flash, for graphic instructions and animations. We had considerable training at New York University School of Medicine, Department of Academic Computing, through a grant issued by NETs.Work.

NETs.Work is a series of projects of the ISOF (Institute for Schools of the Future), which is funded by the U.S. Department of Education's Preparing Tomorrow's Teachers for Technology (PT3) program. Professionals from the Advanced Educational Systems at the New York University School of Medicine, under the leadership of Dr. Martin Nachbar, provided technical training, support, state-of-the-art facilities, and powerful models of learning and technology use.

The project was labor intensive, involving many hours of training. We were supported in the development of our osmosis project with workshops, small-group training, telephone consultations, one-on-one mentoring, and collaborative peer support. In addition we met with staff for project development and also engaged in peer feedback from colleagues concerning our osmosis macromedia project.

Hopefully, students availing themselves of our program will acquire an understanding of basic concepts such as kinetic molecular movements, diffusion and tonicity. Throughout our macromedia program there are stopping points where students have the opportunity to generate hypotheses based on the knowledge that they are acquiring. The concepts of solutions, solute and solvent, are illustrated in our program, followed by a visual representation of solutions of different tonicities; hypertonic, hypotonic and isotonic. Animated illustrations of red blood cells in solutions of different tonicity are presented, giving the students the opportunity to visualize hemolysis and crenation. These presentations are followed by an osmometer demonstration using two different tonicity solutions. In addition, a graph depicting the rise and fall of the solutions within the osmometer enables students to predict in which direction the solutions will flow. Following the osmometer demonstration, photos of red blood cells in solutions of different tonicities are also shown in order to reinforce these concepts.

After these illustrations, students are given a self-test to review the material they have just learned. When answering the questions, students hear an auditory

simulations. One of the main advantages for students using macromedia programs is the opportunity to receive immediate feedback that enables them to work at their own pace and perform self-evaluations.

Educational research has recently focused on concept of learning styles; including visual, auditory and tactile or kinesthetic[2]. Students use different methods of studying and learning. Macromedia-based instructional programs have been demonstrated to be both visual and auditory. These programs readily accommodate to the majority of students' needs. Kinesthetic and tactile learners can also take advantage of the opportunity for repeating instruction until they feel that they have satisfactorily mastered the material.

Macromedia projects have become popular in recent years. They are being used in many different disciplines; mathematics, physics, chemistry, biology as well as in training programs[3,4]. Macromedia animations and interactivities may now be incorporated into school or teacher web pages to be accessed easily by students; web courses may also be taught. These alternative modes of instructions have been in development for many years. For example, a conference in West Australia[3,4] focused on visualizing chemical reactions using a multimedia approach in a training program for primary school children, ages 10 – 11. Fankhauser and Helmut (1996)[5], also utilized a multimedia approach in a training program. Some of the advantages of this multimedia program included immediate feedback, visual presentations, improved management of the learning process, privacy and increased instructional availability. These authors also developed methods for evaluating computer assisted learning packages using pre- and posts-tests. In addition, computer assisted learning has the advantage of allowing learners the ability to use the program whenever they desire. It offers greater opportunities for practice on the part of the student. Another advantage of these programs is that they are self-paced with an electronic "expert" on the subject always at hand.

Paul Fritze (1996)[6], incorporated animations into web pages for the purpose of teaching students how to use the library. He developed a production cycle for working with macromedia which included analysis, development, prototype and evaluation stages. Janet E. Hurn (1997)[7] developed a macromedia program for physics students. She was able to tailor the material to her students' needs. Because students had family obligations, worked part-time and commuted to school, they had restricted study time. The macromedia program she developed allowed these students to learn the material on their own time. John Foshay (1999)[8] describes the process of developing teacher-made software. His program included multiple-choice questions for students with mental retardation. He found that these students benefited from the macromedia presentation. Mark Darty and James Brophy (1999)[9] developed an internet-based class in physiological psychology. The program encouraged students to use computers and to get on line. Again, with this program, students could review the materials as many times as they needed to in order to master the concepts.

Macromedia has also been used in the biological sciences. For example, Chong Ho Yu, et al. (2000)[10] developed an undergraduate plant biology course utilizing macromedia software such as Flash, Director, Shockwave and Quick Time. The authors' rationale for the use of

So, with this plethora of available information, one could ask why I wrote this article. Many questions remain after reviewing these latest reports. The confirmed cases of H_5N_1 flu reported since 2003 were mainly in Asian countries. This strain has not yet been found in North America. As stated earlier, an avian influenza pandemic would require certain events occurring. Or, alternatively an avian influenza strain could adapt to humans, becoming pathogenic and cause disease. Our increased awareness and surveillance will only help minimize or alleviate (?) our exposure to this disease. However, as the very word pandemic means, it is a *worldwide* epidemic. Therefore our awareness and information relation other countries should be considered. Could Dr. Siegel's contention that our information sources and the media bear a significant responsibility on public awareness and perception bear consideration?

According to Dr. Issac Weisfuse, a medical detective in charge of preparing New York City for a potentially deadly flu outbreak "…since there were flu pandemics in the 18th, 19th and 20th centuries, the idea that a pandemic will somehow skip the 21st century doesn't make any sense"[40]. It is my understanding that bedbugs are the next "emerging" concern.

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Active and Applied Learning: the Potential for Finite and Long-Term Learning with Macromedia

by

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Abstract

During 2003/2004 we participated in a program funded by a grant awarded by the U.S Department of Education to New York University School of Medicine, Department of Academic Computers. The purpose of the grant was to provide training and support to college faculty to acquire the skills to integrate technology with their course work. By using Macromedia software, we created a program that would help students to enhance their understanding of the concept of osmosis. Half of the students were shown the program during the lecture in paired sections of Principles of biology. Subsequently, they were tested on the subject of osmosis. Their performance was compared. Students were also asked their opinion on the benefits of the program and their responses are described in this article.

According to the National Science Education Standards (1996)[1], students must work as active learners, and teachers should design and implement new methods of instruction that facilitate students becoming active learners. This is especially true for community college students, who have had little exposure to science prior to their college careers. Macromedia programs are tailor-made to provide the proper active instruction.

The purpose of this study was to develop, test and assess the effectiveness of a newly designed macromedia program to aid students in comprehending a difficult biological concept. The concept that we chose for development of a macromedia program was osmosis. Students find osmosis a challenging topic because the understanding of it depends upon their knowledge of the interaction between complex relationships including Brownian motion, diffusion, concentration gradients, and tonicity, etc. Macromedia programs are designed to allow students to be actively involved in the learning process. Furthermore, macromedia-based instructional programs create high quality opportunities for students to achieve theoretical and practical understanding of multifaceted concepts such as osmosis. The understanding of osmosis might otherwise be too abstract and difficult for students using traditional methods of instruction, such as lecture and laboratory.

In the past, macromedia has been utilized for many purposes, such as special education programs, enrichment programs for intellectually gifted children, tutorials and laboratory exercise