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MACUB Election Results

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DNA Damage of Plants Due to Depletion of Stratospheric Ozone and Acid Rain: the Mechanism of Photorepairing for the Damage

by

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ABSTRACT

Plants are sensitive to environmental stress, which varied from nations to nations. Nevertheless, plants have capacities for repairing and tolerating detrimental effects by various DNA damaging factors such as ozone layer depletion, and acid rain. The latter decreases both pH value and light availability, and increases moisture, further affects plant DNA alteration due to the former. This paper was prepared to cover these serious and complicated issues as complete as

INTRODUCTION

The diminishing quantity of the stratospheric ozone layer in the last several decades has had a detrimental effect on plant life on earth. The major cause of the degradation of the ozone layer is usually attributed to the use of chlorofluorocarbon and bromofluorocarbon compounds. The ultimate effect of ozone layer depletion is its effect on electromagnetic radiation.

Light, a form of electromagnetic radiation, can be categorized by its wavelength, which is inversely proportional to its energy. For our purpose ultraviolet-B (UV-B) includes wavelengths from 280nm-315nm, ultraviolet-A (UV-A) includes wavelengths from 315nm-380nm, and photosynthetically active radiation (PAR) includes wavelengths from 400-700nm, which also includes the visible light spectrum.

An effect of the depletion of atmospheric ozone layer is that increasing amounts of UV-B is reaching the surface of earth. This is alarming since UV-B is directly responsible for the cross-linking of adjacent DNA thymidine nucleotides, which ultimately leads to genetic mutations when the organism attempts to repair the damage^{1,2,3,4,6,7,8,9,10}. DNA damage of plants leads to susceptibility to anthracnose, one of several diseases of plants caused by certain fungi and characterized by dead spots on the leaves, twigs, or fruits. These diseases are extremely detrimental to plants and thus are of major concern. In fact, plants have capacities for repairing and tolerating detrimental effects by various DNA damaging factors. A tolerance pathway that has been forecasted to exist in higher plants is translation synthesis (TLS), which is catalyzed by polymerases. For instance, in *Arabidopsis thaliana*, however, the merely genes known to be involved in TLS is the *Arabidopsis* homology of REV3, and AtREV3, which are putative catalytic subsets of *Arabidopsis* DNA polymerase zeta. A disturbed mutant of certain genes has been noted to be highly susceptible to ultraviolet-B (UV-B) and a variety of DNA damaging agents. Conversely, REV1 and REV7 are considered components of translation synthesis in plants. Some results of studies suggest that TLS mechanism exists in a higher plant and show that through such mechanism to accomplish the important roles in tolerating exposure to DNA-damaging agents¹¹. Overall, there are several factors, which are directly or indirectly responsible for DNA damage in plants. These are UV-B, acid rain, and gamma ray bursts (GRB). We will proceed to explore these

subjects in detail as well as consider the interactive as well as cumulative effects of these factors.

PART I: UV-B INDUCED DNA DAMAGE IN PLANTS

The indirect defensive mechanism of high PAR against increased UV-B

In field studies, relative intensities of PAR, UV-A and UV-B have shown to be a major factor in evaluating plant sensitivity to DNA damage. As expected, the degree of DNA damage can be cumulative as one or more forces combine to act on the plant. However, it is also well known that varying the intensity of PAR can alter the sensitivity of plants^{1,7,12}. Both high ratios of PAR to UV-B and UV-A to UV-B have been found to be essential in repairing UV-B damage in both terrestrial and aquatic plants. Conversely, studies carried out under greenhouse condition show that low PAR, low UV-A worsened UV-B induced DNA damage¹. With decreasing PAR and increasing UV-B, there is a reduction in total biomass and plant height. This defensive mechanism of high PAR against increased UV-B may be indirect. In plants, by increasing leaf thickness, the amount of flavonoids and other phenolic compounds present inside plant cells are increased, which absorb radiation of various wavelengths. In essence, a reduced amount of UV-B ultimately reaches the nuclei where DNA is located. In fact, blue light, together with UV-A radiation, play an essential role in the photorepairing of DNA lesions of plants¹².

The importance in differentiating between DNA and RNA photorepairing

With regard to photorepairing of plants, it is crucial to distinguish from that of RNA system. For instance, ultraviolet (254 nm) irradiation of liquid-cultured tobacco cells inhibited the production of nitrate reductase; subsequent illumination with white light allowed a partial restoration of the synthesis of the enzyme (photoreactivation). Ultraviolet irradiation of these same cells also inhibited their ability to incorporate labeled uridine and labeled amino acids. Subsequent illumination with white light gave a partial restoration of the ability of the cells to incorporate uridine while a similar post-ultraviolet-irradiation treatment failed to restore the amino acid incorporation. The system in tobacco known to repair ultraviolet-damaged viral RNA thus does not seem to

repair ultraviolet damage to the protein-synthesizing system of the cell. The photoreactivation of nitrate reductase production is best explained by the action of a DNA photorepairing system²³.

The 'sunscreen' function of Anthocyanins

In plants anthocyanins are present together with other natural pigments like the closely chemically related flavonoids, carotenoids, anthoxanthins, phenolic compounds and betacyanins. Anthocyanins occur in all higher plants, mostly in flowers and fruits but as well in leaves, stems and roots. In these parts they are found predominantly in outer cell layers such as the epidermis and peripheral mesophyll cells. The quantities are relatively large: one kilogram of blackberry, for example, contains approximately 1.15 gram.

Anthocyanins are water soluble vacuolar flavonoid pigments that mirror the red to blue range of the visible spectrum, depending on the pH of the surrounding solution. They are noted extensively in the kingdom of plant, and have been observed to occur in all tissues of higher plants, supplying color in everything from fruits to autumn leaves. In photosynthetic tissues, such as leaves, anthocyanins have been noted to act as a "sunscreen," protecting cells from photo-damage by inspiring UV and blue-green light during periods of high light stress and strain as occurs when plants are exposed to high light in association with drought or cold temperatures. This "sunscreen" function is considered to be the reason why many deciduous plants turn red in the fall; since chlorophylls break down as leaves begin to senesce, anthocyanins protect the remaining leaf tissues while the plant translocates nitrogen and organic molecules back into the stems. Anthocyanins as well act as effective antioxidants helping to shield the plant from radicals formed by UV light and during metabolic processes. More recent literature (early 2006), places the number at more than 550 different kinds of anthocyanins. The distinguishness in chemical organization that takes place in reaction to alterations in pH is the rationale why anthocyanins are frequently employed as a pH indicator, because they change their color from red in acids to blue in bases. Plants with extraordinarily high quantities of anthocyanin are popular as ornamental plants, such as a purple-leaf cultivar, and the dark purple pigmentation of pansies.

Other plants rich in anthocyanins are chokeberry, cherry, eggplant, blue grape, Vaccinium and red cabbage and also the Usambara-violet. Most frequent in nature are the glycosides of cyanidin, delphinidin, malvidin, pelargonidin, peonidin and petunidin. Roughly 2% of all hydrocarbons fixated in photosynthesis are converted into flavonoids and their derivatives such as the anthocyanins.

In still comparatively young plants or new growth, where chlorophyll and wax product have not yet begun and which would be unshielded from UV light, anthocyanin production intensifies. Parts or even the entire plant are colored by these "juvenile anthocyanins," and hence protected from damage. Immediately after chlorophyll production begins, the production of the anthocyanin pigment is decreased. The establishment of anthocyanin

in plants is specific to the respective plant type, as it depends on the soil conditions, light, warmth and plant type and/or sort. Plants that have only a single anthocyanin as pigment are very rare, but it does occur nevertheless. The absence or extremely high prevalence for a certain anthocyanin in a plant is because of genetic circumstances.

The change in the abundance of flavonoids upon the pigment complex

Anthocyanins, flavonoids and phenolics are compounds present in a plant cell. For example, in black chokeberries, *Aronia melanocarpa* treated with catabolites of polyamine biosynthesis, the total amount of anthocyanines and phenolics are decreased only slightly, but the amount of flavonoids is significantly increased. This is an important change for the entire pigment complex of the cell as absorption spectra is greatly affected¹³. Bear in mind that plants contain a mixture (complex) of photosynthetic pigments (chlorophyll, xanthophylls, phenolic compounds, free polyamines, etc.) that enable the plant to capture sunlight and convert it to energy; it can use as well to make sugars, etc.

One of the mechanisms to increase the transformation to phenolic pigment

Ornithine decarboxylase (ODC) is the first and the rate-controlling enzyme in polyamine biosynthesis. It decarboxylates L-ornithine to form diamine putrescine. ODC activity in cells is strictly regulated and one of the central elements of ODC regulation is an inhibitory protein called antizyme. Antizyme binds to ODC, inhibits its activity and targets ODC for the proteasomal degradation. Essentiality of polyamines for the normal cell growth and proliferation is well known. Recently their roles in the regulation of several classes of cation channels have been discovered.

Conversely, ornithine decarboxylase inhibition has a markedly different effect as it significantly increases the total content of anthocyanins and total phenolics, inhibites the total content of free polyamines, and stimulates the processes of saccharides transformation to phenolic pigments¹³. [Vide: infra- the section of the 'sunscreen' fuction of Anthocyanins.]

With the aforementioned on pigment complex in the mind, let us next assess the defense mechanism of UV-absorbing pigments, especially that of lichens, as well as water content, which appears to be another significant factor in susceptibility of plants to UV-B radiation.

The effects and measurements of UVB radiation upon lichens

Lichens are symbiotic organisms comprised of a mutuality relationship between filamentous fungi and photosynthetic algae. The fungus part provides the alga with water and mineral while the alga provides nutrients via photosynthesis. This relationship developed in early history of terrestrial life and might be a precursor to modern plants³.

It is supposed that ancestral lichens probably experienced higher ultraviolet (UV) radiation fluxes than at present due to the undeveloped atmosphere. An enzyme-linked immunosorbent assay (ELISA) is a technique, which detects the presence of an antigen in samples. The antigen is a target of a specific primary antibody. A second antibody, which is linked to an enzyme, has some activity in converting a chromogenic (color-forming) or fluorogenic (inducible-light forming) substrate that can then be measured in order to quantify the amount of antigen present in a sample. Under this circumstance, effects of UV-B radiation on lichen DNA can be studied by measuring the amount cyclobutane pyrimidine dimers (CPDs) via an ELISA^{3,5}. In this fashion, ELISA can also be used for evaluating the ability of lichens to repair DNA damage¹² by measuring the decrease in CPD content. Note that, first, ELISA is an immunological method. If the target DNA is an antigen, then anti-double strand antibodies can be used to trap the DNA. This antibody may be conjugated with streptavidin/biotin or vice versa. A streptavidin/biotin-labeled enzyme and substrate may be added. Please remember that one molecule of avidin can bind one molecule of biotin, whilst one molecule of streptavidin can bind four molecules of biotin.

Additionally, UV-absorbing pigment content and changes in the absorption of light within the tissue can be studied using two other methods. First, an acetone-ethanolic extracts of lichen can isolate pigments in a sample, allowing spectrophotometric measurements of light absorption characteristics. Second, reflectance measurements can be carried out to evaluate the relationship between pigment parietin (= physcion) content per unit area and reflectance at 500 nm. Note that reflectance is the ratio of total amount of radiation, as of light, reflected by a surface to the total amount of radiation incident on the surface. As well, note that physcion is a secondary metabolite trivial name. Its molecular formula is C₁₆H₁₂O₅. The species with physcion are *A. fumigatus*, *E. amstelodami*, *E. chevalieri* and *E. herbariorum*.

On reflectance measurements, for instance, *Xanthoria parietina* is a widespread lichen colored by the orange cortical pigment parietin (= physcion). Yngvar Gauslaa and Elin Margrete Ustvedt studied the pigment content in 60 thalli of *X. parietina* sampled in four habitats along a sun–shade gradient from evergreen boreal forests through open deciduous stands to sea cliffs. A high PAR susceptibility of parietin-deficient *X. parietina* in the absence of UV-B has been noted. The blue light screening of parietin is noted to be functionally more important than the UV-B screening. A strong positive relationship between parietin (=physcion) content per unit area and reflectance at 500 nm allows the parietin (= physcion) content in *X. parietina* thallium to be assessed non-destructively by reflectance measurements⁴.

The response of *Cladonia arbuscula ssp. mitis*, the air-dry thallium to UV-B

Decreased synthesis or deterioration of photosynthetic pigment, and/or loss of water can lead to a decrease in the photochemical efficiency of plant photosynthetic system (PS)³³. Hence, water content of the

plant appears to be another significant factor in susceptibility to UV-B radiation. For instance, *Cladonia* is a genus of moss-like lichens. In the species *Cladonia arbuscula ssp. mitis*, air-dry thallium is more susceptible than hydrated thallium to DNA damage and less capable of repairing CPDs⁶. In addition, hydrated thallium kept at low temperatures is unable to repair the accumulated DNA damage¹² suggesting that there is an optimal operating temperature for DNA repair machinery inside the cell. Finally, new growth of the lichen thallus is most susceptible to damage caused by UV-B radiation. This thallium exhibited the highest amounts of DNA damage, the least repair ability and the lowest content of phenolic pigments^{6,13}.

Defense mechanisms against UV radiation in air-dry lichens, and the importance of phenolic pigment

It is well established that certain pigments absorb certain wavelengths of light. The importance of phenolic pigments is that they absorb radiation in the UV range. An obvious defense mechanism against UV radiation in air-dry lichens would be the accumulation of UV-absorbing pigments, which consequently decreased the effect of UV-B reaching the DNA of cells within the thallus and causing damage by cross-linking the DNA⁶. [Vide: infra- Pigment Complex].

PART II: ACID RAIN INDUCED DNA DAMAGE

The contaminated acid clouds can gust from nations to nations. For instance, the polluted acid clouds from Great Britain fall in Sweden and Germany. Records revealed that before 1984, half of the forest in Germany was vanishing due to acid rain. Acid rain damages buildings. It destroys the building, and affects the metal, cement, stone, and brick. Buildings once damaged by acid rain begin to disintegrate, in addition, figurines of statues begin to lose their countenances. For example, the Statue of Liberty in New York City required millions of U S dollars to mend for the reason that acid rain damaged it. Once acid rain destroys trees, their color first becomes yellow in the fall earlier than usual; additionally they miss the entire leaves. Conversely, pine trees turn yellow spots on their needles due to acid rain. (Table 1) (Infra: the section of Pigment Complex).

Plants are sensitive to environmental stress^{12,16}, which varied from nation to nation. For instance, in China, acid rain is resulted from by the oxidation response of SO₂ with H₂O₂ and O₃ in water drop¹⁵. Acid rain is very much traumatic to DNA of plants. Therefore, it is most important to have proper evaluation of leaves, their sizes, weights, with close calculation of initial light-induced Delayed Light Emission (DLE) intensity concurrently.

Capacity for photosynthesis and the intensity of DLE

Delayed light emission (DLE) is an observable fact of photon release by a living organism subsequent to its inspiration by observable emission¹⁷. On behalf of plants, DLE is principally brought about from the inverse photochemistry responses in the photoreactivity system of

Table 1. The relationship between the pH values of acid rain, the intensity of DLE and effect on leaves

pH Values of Acid Rain	Intensity of DLE	Effect on the Leaf Surface
5.7- 3.7	reduced	No noticeable injury brought about by the acid rain
< 3.7	greatly reduced	Minute yellow blemishes began to become visible
< 2.7	complete absence of DLE	Majority of leaves missing their original green color

plants^{12, 18}. In fact, toxic gas frequently invades a plant by means of coming to its stomata. Whilst plants are injured, and their DNAs are damaged, there are subsequent alterations both physiologically and biochemically. The changes of foliage reflect not only the presence of pollution but also the content and extent of the toxic substances. Each plant has a different sensitivity to different pollutants and a plant can thus unfortunately behave as an admonishing organism for an individual pollutant^{12, 17}.

Delayed Light Emission (DLE) is an intrinsic fluorescence label of chemical efficiency in plant PS³². In fact, DLE of leaves reduced with pH values of 5.7–3.7 in acid rain. (Table 1). There initially was no noticeable injury brought about by the acid on the leaf superficially. As soon as the pH value was below the value of 3.7, minute yellow blemishes began to become visible on the surface of leaves, additionally the DLE intensity diminished. As long as the value of pH was as low as 2.7, the majority of leaves missing their original green color¹⁶. Simultaneously, the DLE approximately left¹⁵. Hence, there was definite damage to DNA of plant. After the leaves were exposed to SO₂, both rates of DLE and photosynthesis diminished to almost half of their initial values respectively. Noticeably, the leaves demonstrated dark green flecks at the beginning, subsequently by loss of color. The production of SO₂ went through the lamina via the stomata, and diffused through the cell walls, and then created HSO₃⁻, SO₃ and H⁺. Hence, these ions injured the cell, ensued in decreased DLE, essentially because of the subsequent three probable means²².

First, the disproportion of pH values may as well revise enzyme conformation and carboxylation responses, and along with it, raise mitochondrial respiration²⁷, all of which would result to a lower net photosynthesis^{28, 29}. Secondly, the pH value of the cell was decreased by H⁺, which caused the stomata of the plant to shut down, and a fractional alteration of chlorophyll into Ph (phaeophytin). Finally, this exaggerated the amalgamation of both CO₂ and energy of light and hence repressed both the capacity for photosynthesis and the intensity of

DLE^{30,31,32}. Although for the time being, the chlorophyll fluorescence kinetic technique is broadly applied for monitoring environmental stress and pollution^{33, 34}, due to the difficulty encountered while using it³⁵, DLE has become a helpful supplementary technique to it.

Acid rain, DNA damage of plants, and anthracnose

The DNA damages of plants due to acid rain plus SO₂ seems very similar with that resulting from ozone layer depletion, in term of the discoloration of leaves and trees as one can easily observe. Note that both causes affect the cross linking of DNA. Conversely, Flowering dogwood (*Cornus florida L.*), one of the most common tree species in eastern North America, currently is at risk of becoming endangered all through its native range by a fungus that causes dogwood anthracnose. This aggressive disease rapidly kills dogwood trees with its mortality has exceeded 90% in some forest types. The public health and ecological unimpaired state of forest ecosystems all through the eastern United States are threatened by the rapid decline of dogwood populations. The severity and rate of infection are reported to vary with several environmental factors. Within individual stands, the mortality and severity of this disease increase with DNA damages due to aggravation with acid rain. As acid rain decreased light availability and increased moisture, both affect the alteration of DNA of plants. Management techniques to control anthracnose have received little attention; however, recent findings suggest that prescribed burning may offer an effective management tool for controlling anthracnose²⁰.

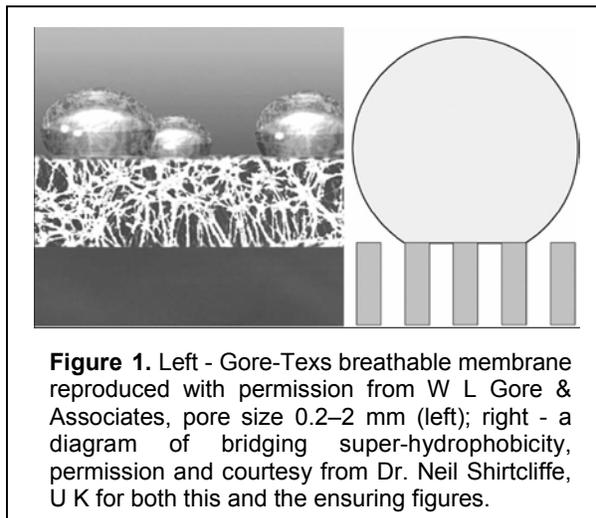
The battle of photosynthesis against acid rain

Another species of lichen, *Lecanora conizaeoides*, has the property of being super-hydrophobic. It uses an amalgamation of hydrophobic compounds and multi-stratum unevenness to shed water very effectively. This is united with gas conduit to create a biological counterpart of a waterproof, breathable item of clothing⁶.

This particular lichen grows more often than not throughout damp seasons and is extraordinarily resistant to acid rain^{6,10,21}. The water-resistant, breathable surface permits this lichen to photosynthesis at times when other species are enclosed with a layer of water. Additionally, rainwater sprints off the exterior of the organism, decreasing its ingestion of water from above and almost certainly is causative to its battle against acid rain (Figs. 1-2).

The similar damage to DNA of spinach and soybean with acid rain: an interactive effect of enhanced UV-B radiation and acid rain

Another typical example of the similar damage to the DNA of plants is as well illustrated by the inhibited growth of spinach, and soybean, respectively by the interactive effect of enhanced UV-B radiation and acid rain on the seed germination and seedling growth,



respectively. Such an interactive effect of enhanced UV-B radiation and acid rains have been investigated in China, and some studies were reported last year^{7,8}. The results showed that the interactive effect of the enhanced UV-B radiation and acid rain resulted in the reduction of height, leaf number, leaf area and dry weight of spinach and soybean respectively. At the same time, the content of chlorophyll and transpiration in leaf were decreased. The decreasing degrees of seed germination and seedling growth under such combined stress were significantly worse than that under a single stress, and the decreasing degrees were further influenced by the dose of UV-B and the pH values of acid rain. The adverse effect of enhanced UV-B radiation was further compounded with acid rain on the seed germination and seedling growth of spinach and soybean respectively^{7,8}.

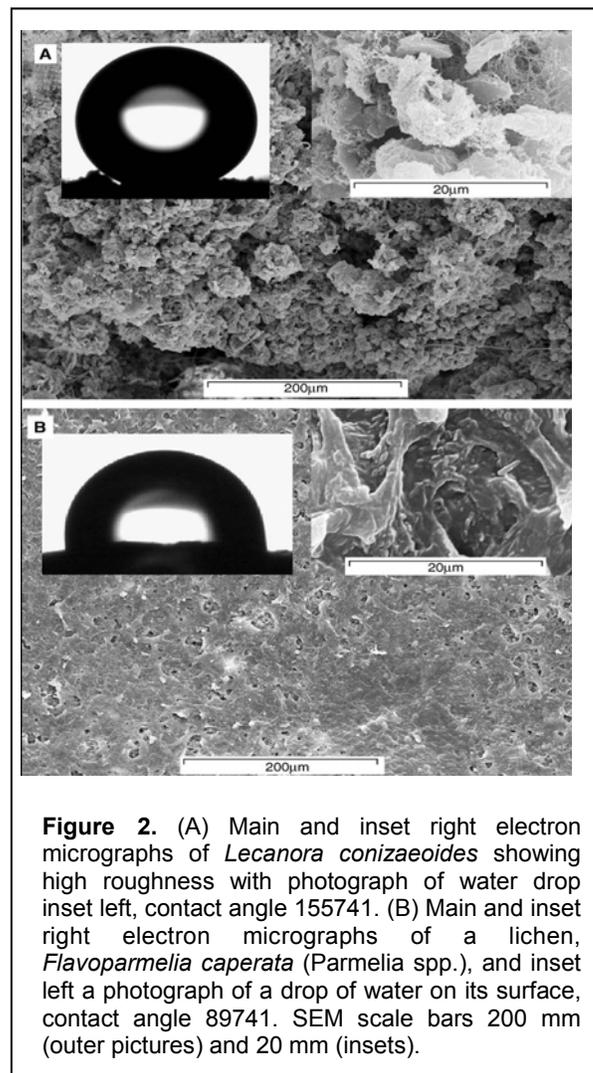
PART III GAMMA-RAY BURST INDUCED DNA DAMAGE

On the other hand, results of modeling the effects on Earth-like planets of long-duration gamma-ray bursts (GRBs) within a few kiloparsecs just as follows:

A basic effect is formation of nitrogen oxide compounds, which as well deplete amount of the stratospheric ozone layer, increasing quantity of UVB are reaching the surface of earth, in addition, adversely worsening DNA damage, especially upon surface plants, along with them, the marine microorganisms such as phytoplankton. In addition, we anticipate increased atmospheric opacity due to accumulation of nitrogen dioxide generated by the burst and worsened precipitation of nitric acid, in turn; it will certainly exacerbate the effect of DNA damage¹³.

Outlooks and Discussion

Obviously, further studies are needed to determine the interactions of UV-A, UV-B and PAR⁹ for better understanding the complete mechanism of repairing DNA damages¹². As this article is being presented, it has never been this author's intention in this study in inappropriately generalizing the condition of DNA damages by UVB to plants other than lichen, black chokeberry, pine, soybean and spinach; nor prematurely taking a broad view



on such findings of DNA damages to various regions of earth. More information is obviously necessary about the complete mechanism and adverse effect of UVB damage to DNA of plants, which has obviously been aggravated by acid rain in countries in Asia, Africa, the Pacific, and other parts of world. An important point that may be noted is the fact that DNA damage of plants is worst, indeed the depletion of stratospheric ozone layer is only much and very bad, but yet not the worst for long periods of time, at the mid- latitudes. This is because of a mixture of the localized stratospheric ozone layer depletion, and the incident sunlight at various angles. Polar regions have periods of absolute darkness, and yet throughout daylight the solar incidence angle is minute. Therefore, whilst the depletion of stratospheric ozone layer in the long-term is greatest at the poles, the DNA damage in these regions is yet restricted because of the decline of incident solar UVB¹⁴. Nevertheless, surface effects such as DNA damage of plants by solar UVB are even more forceful at mid-latitudes, due to the interval and angle of sunlight. Dissimilarities in the levels of depletion of stratospheric ozone layer at various times around the year are due first and foremost to the timing of polar spring, as the existence or lack of sunlight is a crucial variable in the photochemistry overriding the degrees of DNA damage of plants.

CONCLUSION

Therefore, we must understand our worldwide burden and recognize our responsibility in taking care of such problems of DNA damage of plants. This study may as well highlight the importance in evaluating the prevalence of worldwide plant DNA damages by UVB, which is unfortunately compounded by acid rain, other than any solitary study at any certain single locality, in order to further evaluate and compare with those findings and results of various regions in the world.

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Oxygen Uptake and Aggression in *Betta splendens*

by

Donald Dorfman

ABSTRACT

Oxygen uptake in grams per hour (VO_2) was determined for male and female Siamese fighting fish, *Betta splendens*, in respirometers. Some had access to surface waters (controls), while others were denied access. Those denied access were in the presence of no mirrors, or were surrounded by either two or four mirrors. VO_2 is increased in males in the presence of mirrors because of their aggressive tendencies. This increase does not occur in females. VO_2 rises with increasing temperature. Males had higher VO_2 s than females. Smaller fish (weighing 1.75 g or less) tend to have higher VO_2 s than larger fish. Fish denied access to the surface had higher VO_2 s than those that had access. There was no significant difference in VO_2 between fish exposed to two mirrors or to four mirrors.

INTRODUCTION

A number of studies have been made utilizing male Siamese fighting fish and their behavior when in the presence of another male Betta, when it views its mirror image, or when it views a model of a male Betta. These include aggressive display¹, waning and combative aggression^{2,3,4}, conditioning^{5,6}, habituation⁷, reinforcement potency^{8,9,10}, drug influences¹¹, isolation and aggression¹², hyper-aggression¹³, fin length using computer animations¹⁴, and others. Relative to other fishes this is a lethargic fish belonging to the family Anabantidae of the Order Perciformes. The anabantids have a secondary breathing organ, the labyrinth organ that enables them to breathe air directly at the water surface. The males of this species are particularly pugnacious. Their aggressive displays in the presence of other males include opercular flaring, then a subsequent broadside display in which their fins are maximally extended¹⁵. Females Bettas do not illustrate this pugnacity and are usually kept in community tanks. Females do however set up a hierarchy, and until the hierarchy is established, hostile behavior may occur¹⁶. The aggressive responses do have a cost in elevated VO_2 s¹⁷. The purpose of this study was to examine the VO_2 s of male and female Bettas given access to the surface and when exposed to two and four mirrors in four sided respirometers.

MATERIALS AND METHODS

Male and female Bettas were obtained from several commercial sources. All of the fish were maintained in 200 gallon tanks in the laboratory at 21 +/- 0.5°C prior to being tested. Females were kept together in the holding tanks. Males were individually maintained in non-see-through 400 ml cups placed in a water bath at the maintenance temperature. Prior to being tested males and females were acclimated for at least two days in tanks with temperatures of the waters in which they were to be tested. Temperatures of the acclimation waters for the various temperature exposures varied less than 0.5°C. The range of test temperatures was 19 to 36°C. All of the

tests were performed under lighted conditions. A total of 659 fish were tested, including 350 males and 309 females. The data for the 350 males includes data from 173 males from a previous study¹⁷. Approximately 10 fish were tested at one temperature each day. After acclimation to the test temperature, a single fish, either male or female, was placed into a plastic see-through rectangular container. This container was modified and used as a static respirometer (Figure 1). The dimensions of the respirometer are; interior height 98 mm, top width 65 mm, bottom width 57 mm. After filling with water, a close-fitting cover was placed on the respirometer vessel for the duration of the test. The cover has a 3/4 inch capped microfuge tube (5 mm diameter) that is opened when placing the cover on the filled vessel, containing the fish, to allow air to escape, then closed with the flip-top cap to minimize oxygen exchange from the air. There was a minimal (one to two mm) space between the surface of the water in the vessel and the covering cap. For those tests that did not allow fish access to the surface, a screen was placed several mm beneath the surface of the water in the test vessel. For tests that allowed fish to rise to the surface, a screen was not employed.

Fish in vessels that were designed to elicit aggressive responses had either two of the four sides of the rectangular test vessel with mirrors on either two opposite sides, or on four sides. The mirrors were placed on the outside of the vessels and held in place with rubber bands. The interiors of all the test vessels contained a bottom screen. This prevented the fish from being drawn into the drain tube when, at the conclusion of the test, the water in the vessel was drained into a BOD bottle to determine the dissolved oxygen in the test vessel.

Each fish was kept in the respirometer for two hours. The respirometers were maintained in water baths at the test temperature. At the conclusion of the test a flexible drain tube at the side of the test vessel was withdrawn from its rubber band support and placed into the bottom of a BOD bottle to drain the respirometer (Figure 1d). D.O. was determined by the Winkler Method¹⁸. All of the Winklers were performed by the author, and D.O. determinations made within three minutes of the

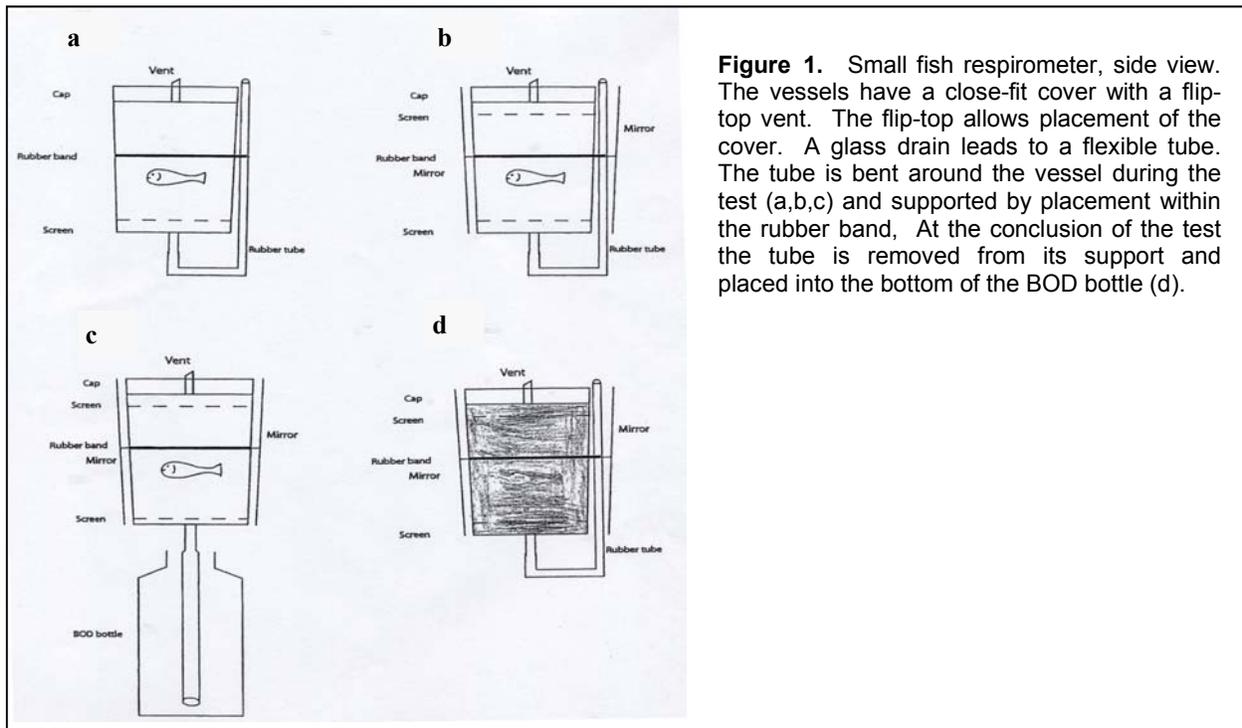


Figure 1. Small fish respirometer, side view. The vessels have a close-fit cover with a flip-top vent. The flip-top allows placement of the cover. A glass drain leads to a flexible tube. The tube is bent around the vessel during the test (a,b,c) and supported by placement within the rubber band. At the conclusion of the test the tube is removed from its support and placed into the bottom of the BOD bottle (d).

termination of each test. Fish were weighed at the conclusion of each test. Several fish were returned to the colony (females to their group tank, males to their individual cups) and used for subsequent tests several days later, not necessarily at the temperature of their initial test.

In addition to the test vessels containing one fish, there were blank vessels (i.e. without fish) to perform D.O. determinations at the start and the conclusion of the tests. The following formula was used to determine the mls of oxygen per gram per hour (VO_2 /gm/hr):

Average D.O. of an initial blank vessel (no fish) and a final (determined after two hours) blank vessel D.O., minus the D.O. of the respirometer containing a fish. This was multiplied by 0.380 (mls of water in the respirometer vessel) minus the weight of the fish, divided by the duration of the test (two hours), then divided by the weight of the fish (grams). This is multiplied by 0.7 to convert to mls of O_2 . Typically, oxygen consumption is reported in mls¹⁹.

Straight-line linear regression (Sigmaplot 2002 for Windows Version 8.02) for VO_2 uptake/gram/hour was performed separately for males and females for control and mirrored (two and four mirrors) fish.

Data was grouped into three temperature ranges for males, and for females. The temperature groups included low, 19 to 25°C, medium, 26 to 30°C, and high, 31 to 36°C. The fish groups were again divided into fish weighing 1.75 grams or less and fish weighing more than 1.75 grams. T-tests²⁰ were performed comparing control (both access and non-access) and mirrored (two and four mirrors) fish by sex, and then by temperature groups to determine if the VO_2 differed between the control groups and the mirrored fish. T-tests were also performed within the three temperature groups to determine if the weight of the fish, which were chosen at random for test placement, resulted in different VO_2 s. A final comparison of male and female

Bettas in accessible and non accessible vessels was made at the three temperatures.

RESULTS

A total of 659 fish were tested, including 309 females and 350 males. Observations for 10 fish (1.5 percent of the total tested) were not included in the analyses. Their VO_2 /gram/hour values exceeded the mean values for their test temperatures by more than 2.5 standard deviations. The fish excluded were four females with surface access weighing less than 1.5 grams, three females without surface access, two weighing less than 1.5 grams, and one more than 1.5 grams, two males without surface access with two mirrors, each male weighing less than 1.5 grams, and one male without surface access and four mirrors, with a weight of more than 1.5 grams (Table 1).

A comparative summary of the data is shown in Table 2. Fish are separated by sex (male = 1, female = 2), by access to the surface (=1), no access (=2), two mirrors (=3), or four mirrors (=4), fish weighing 1.75 grams or less or more than 1.75 grams. Included is the sample size. The remaining column includes the total fish sampled at each temperature and their VO_2 average.

For males there was a significant difference ($\alpha = 0.05$) in each category except in the comparison of VO_2 between two mirrored and four mirrored vessels (Table 3). For females there was a significant difference ($\alpha = 0.05$) only between females with surface access and the other non access categories. The smaller fish tend to have significantly higher ($\alpha = 0.05$) VO_2 s than the larger fish with similar temperatures, within either sex (Table 4). Male VO_2 s are significantly higher ($\alpha = 0.05$) than female VO_2 s in each temperature group, except in the surface accessible low temperature group (Table 5).

Table 1. *Betta splendens* Outliers Not Included in the Statistical Analyses

Temperature	Sex (M / F)*	Access**		Weights m (g)	VO ₂
		(AC/NA ₂ /2/4)			
35°C	2	1		0.65	0.2148
34°C	2	1		0.67	0.2381
34°C	2	1		0.68	0.1955
34°C	2	1		0.89	0.2134
31°C	2	2		0.95	0.364
32°C	2	2		1.79	0.3529
35°C	2	2		0.53	0.3387
31°C	1	4		1.62	0.3888
28°C	1	3		1.03	0.3952
29°C	1	3		1.03	0.3959

* 1 = Male; 2 = Female, ** 1 = Access; 2 = No Access; 3 = No Access 2 Mirrors; 4 = No Access 4 Mirrors

Table 2. Comparison Summary for *Betta splendens* in Different Categories

Sex	Temp Group	Access/No	Data	Weight Category		Total Result	
				1.75g or less	>1.75g		
1	19 – 25	1	Count – Average – VO ₂	36 0.08	2 0.09	38 0.08	
		2	Count – Average – VO ₂	42 0.13	13 0.13	55 0.13	
		3	Count – Average – VO ₂	24 0.16	12 0.14	36 0.15	
		4	Count – Average – VO ₂	7 0.16	40 0.15	47 0.15	
	26 – 30	1	Count – Average – VO ₂	10 0.13	3 0.1	13 0.12	
		2	Count – Average – VO ₂	18 0.18	1 0.2	19 0.18	
		3	Count – Average – VO ₂	12 0.2	6 0.19	18 0.19	
		4	Count – Average – VO ₂	7 0.23	49 0.19	56 0.19	
	31 – 36	1	Count – Average – VO ₂	16 0.13	1 0.12	17 0.13	
		2	Count – Average – VO ₂	19 0.23	3 0.18	22 0.22	
		3	Count – Average – VO ₂	16 0.25	5 0.22	21 0.24	
		4	Count – Average – VO ₂	1 0.25	4 0.23	5 0.24	
	2	19 – 25	1	Count – Average – VO ₂	15 0.09	41 0.06	56 0.07
			2	Count – Average – VO ₂	10 0.12	29 0.1	39 0.11
			3	Count – Average – VO ₂	3 0.15	22 0.12	25 0.13
			4	Count – Average – VO ₂	3 0.08	20 0.12	23 0.1
26 – 30		1	Count – Average – VO ₂	3 0.06	15 0.09	18 0.08	
		2	Count – Average – VO ₂	3 0.12	15 0.16	18 0.15	
		3	Count – Average – VO ₂	1 0.18	20 0.14	21 0.14	
		4	Count – Average – VO ₂	3 0.18	24 0.15	27 0.15	
31 – 36		1	Count – Average – VO ₂	11 0.13	28 0.09	39 0.1	
		2	Count – Average – VO ₂	8 0.23	24 0.17	32 0.19	
		3	Count – Average – VO ₂		4 0.18	4 0.18	
Total Count				268	381	649	
Total Average – VO₂				0.15	0.13	0.14	

*1 = Male; 2 = Female

Table 3. Statistical Comparison for Males and for Females Between Access, No Access Two Mirrors, No Access Four Mirrors

1-1 vs. 1-2	Sig
1-1 vs. 1-3	Sig
1-1 vs. 1-4	Sig
1-2 vs. 1-3	Sig
1-2 vs. 1-4	Sig
1-3 vs. 1-4	Not Sig
2-1 vs. 2-2	Sig
2-1 vs. 2-3	Sig
2-1 vs. 2-4	Sig
2-2 vs. 2-3	Not Sig
2-2 vs. 2-4	Not Sig
2-3 vs. 2-4	Not Sig

* First column represents sex: males = 1, females = 2. Second column represents: surface access = 1, no surface access = 2, 2 mirrors = 3, 4 mirrors = 4.

Table 5. Temperature Group Effects on Oxygen Consumption Mae Bettas vs. Female Bettas

	95%
19—25°	Not significant
26—30°	significant
31—36°	significant

DISCUSSION

Male Bettas have higher VO_2 s than females in vessels where they have surface access, and when access is denied. In vessels where mirrors are present the males increased VO_2 is not matched in the female mirrored vessels. Males used approximately 20 per cent more O_2 than females when each group had surface access. With increased temperatures the VO_2 almost doubles for both (a Q10 of less than 2) males and females with surface access and when denied surface access.

Size appears to be a factor in VO_2 for both males and females. Generally, using an arbitrary division in this study, fish, including both males and females, weighing 1.75 grams or less have greater VO_2 s than those weighing more than 1.75 grams. This weight division considered the heavier weight of females used, and attempted to

Table 4. Summary of Significant Differences of Weight Effects on the Volume of Oxygen Consumption of Fish 1.75g Grams or Less and Fish weighing More Than 1.75g.

Males	Confidence Level, 95%
1-1	Yes
1-2	Yes
1-3	No
1-4	Yes

1-1 No Mirrors – Accessible
 1-2 No Mirrors – Not Accessible
 1-3 2 Mirrors – Not Accessible
 1-4 4 Mirrors – Not Accessible

Females	Confidence Level, 95%
2-1	Yes
2-2	No
2-3	NA
2-4	Yes

2-1 No Mirrors – Accessible
 2-2 No Mirrors – Not Accessible
 2-3 2 Mirrors – Not Accessible
 2-4 4 Mirrors – Not Accessible
 NA Not Applicable – Insufficient amount of data

have adequate sample sizes for statistical comparisons for both males and females. In the 24 possible categories (two sexes X four test vessel environments X three temperatures), in 16 out of 21 categories the smaller fish had higher VO_2 s than the larger fish. In one category the VO_2 was equal, and two categories lacked adequate fish for comparative purposes. When large and small adults of a species, or differently sized species of the same general type of animal, are compared, it is found that the total metabolism (ml O_2 per animal) is higher in the larger animals but that the metabolic rate (QO_2 or VO_2) is higher in the smaller animals¹⁹. A comparison of males, and females, in mirrored vessels yielded no significant difference ($\alpha = 0.01$) within the sexes between two mirrors and those in four mirrors, although fish in the two mirrored vessels had higher VO_2 s than those in four mirrored vessels. In the four mirrored vessels habituation probably

occurs more quickly than in two mirrored vessels since, if the fish maintains itself, at least momentarily, in a normal position, it can escape its image in the two mirrored vessel, but cannot do so in the four mirrored vessel. Because of the small test vessel size habituation may occur in the four mirrored vessels within five minutes²¹ as opposed to longer habituation periods for single mirror exposures^{1,2}. The reduction in habituation time and a concomitant reduction in threat displays and the magnitude of the response¹⁹ may account for the reduced VO₂s observed in the mirrored comparisons.

The *B. splendens* VO₂ values obtained in this study are comparable to those values obtained in other studies where the temperatures are similar¹⁹. However, when body weight of the fish is considered, those fish in this study weighed considerably less than most of those reported in the literature.

The 1-2 mm air space in the respirometer generates little diffusion of oxygen across the air-water interface within the test vessel since the vessels were capped and movement of air restricted.

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The 39th Annual MACUB Conference Poster Presentation Award Winners

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Distribution of Periodontal Pathogens in Families. Paul, C., R. Subramaniam, and P. Schneider, Queensborough Community College

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Investigation of the PKC Substrate, MARCKS in Human Breast Cancer Cells. Perez, R., P. Abeyweera, R. Sullivan and S.A. Rotenberg, Queensborough Community College

Third Place

Study of Actin Structure and MARCKS Phosphorylation in Murine Melanoma Cells. Aboley, N., X. Chen¹, R. Sullivan and S. A. Rotenberg¹, Queensborough Community College and ¹Queens College

Senior College Division

First Place

The Role of Hypoxia-Inducible Factor-1 in Testicular Torsion Injury. Pirlamarla, P. Monmouth University, Faculty Mentor: Dr. Michael A. Palladino

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Neurotoxic Effects of Manganese on Biogenic Amines of the Nervous System and Innervated Organs of *Crassostrea virginica*. King, C., D. Lecky, M.A. Carroll and E.J. Catapane, Medgar Evers College

Third Place

Toll Like Receptor Mediated Activation of Microglia *in-vitro*. Babcock, E.¹, K. Dan² and S. Daryl², ¹Wagner College and ²Institute of Basic Research for Developmental Disabilities, Staten Island, NY

Graduate Division

A Phylogenetic and Environmental Comparison among *Zostera Marina* Ecotypes in Barnegat Bay, New Jersey. Smith, S.M., E.B. Rosenzweig, J.J. Campanella, and P.A.X. Bologna, Montclair State University

The 39th Annual MACUB Conference Poster Abstracts

Study of Actin Structure and MARCKS Phosphorylation in Murine Melanoma Cells. Abolely, N., X. Chen¹, R. Sullivan and S.A. Rotenberg¹, Queensborough Community College and ¹Queens College.

Metastasis is the multistep process by which cancer cells leave primary tumors and establish secondary sites. Cell migration is a key step in metastasis. Previous studies have shown that the serine/threonine kinase Protein Kinase C (PKC) is involved in the signaling pathways controlling migration. However the direct substrate of PKC is unknown. This study investigated the expression level of Myristoylated-Alanine Rich C Kinase Substrate (MARCKS) in murine melanoma cells. MARCKS, a substrate of PKC, has been shown to be regulator of the actin cytoskeleton. Since migration involves actin cytoskeletal arrangements, MARCKS could be the direct substrate of PKC. Confocal microscopy revealed that the actin cytoskeleton was disorganized in melanoma cells overexpressing a kinase-dead PKC alpha. Further, Western blot analysis showed reduced phosphorylation of MARCKS in melanoma cells displaying lower metastatic potential. These results suggest that both PKC alpha and MARCKS are key components in the signaling pathways governing migration.

Anemia As an Independent Predictor of Elevated Pro-BNP Levels in Patients Without Evidence of Heart Failure and Normal Renal Function. Alam, M. E.¹, S.A. Haq², L. Bernstein², L. T. Banko², B.I. Saul², L.Y. Lee², T.J. Sacchi² and J.F. Heitner², ¹Medgar Evers College and ²New York Methodist Hospital.

Pro-BNP emerged as a non-invasive modality for diagnosis of congestive heart failure (CHF). Levels of pro-BNP are affected by renal insufficiency (RI) and age independent of diagnosis of CHF. Anemia may effect pro-BNP levels. This project assessed effects of anemia on pro-BNP independent of CHF. 746 consecutive patients of the emergency room on which pro-BNP was ordered were evaluated. Patients were included if they had a normal trans-thoracic echocardiogram and CHF was excluded based on clinical evaluations. Patients were excluded if they had RI or sepsis. Results show 218 patients (138 anemia, 80 no anemia) met the criteria. There was a significant difference between pro-BNP levels based on the WHO diagnosis of anemia. Patients with anemia had a mean pro-BNP of 4,735 pg/ml compared to 1,230 pg/ml without anemia. There was no difference in pro-BNP levels between patients that had an hgb > 12 compared to those with 10.0 to 11.9. There was a significant difference in patients with an hgb > 12 (median 295 pg/ml) compared to those < 10 (median 2131 pg/ml). Linear regression analysis comparing hgb with log pro-BNP was statistically significant. This study suggests pro-BNP is associated with anemia independent of CHF, RI, sepsis or age.

Hypoxia-Inducible Factor Regulatory Proteins in the Ischemic Rat Testis. Alite, F. and S. Kazmi, Monmouth University, Faculty Mentor: Dr. Michael A. Palladino.

Hypoxia-Inducible Factor-1 (HIF-1) acts as a master regulator of gene expression in response to hypoxia. Previously we have shown that unlike in most tissues, HIF-1 is abundant in both normoxic and hypoxic testes. We believe that HIF-1 plays important roles in regulating oxygen homeostasis in the testis. Prolyl hydroxylases (PHDs) and Factor Inhibiting HIF (FIH) are oxygen dependant enzymes that hydroxylate the HIF-1 α subunit under normoxic conditions, leading to its degradation. We hypothesized that HIF-mediated regulation of oxygen tension in rat testis is controlled by changes in PHD and FIH expression. To test this, testicular ischemia was induced in adult rats (n=3) by 720° unilateral torsion of the spermatic cord followed by reperfusion at several time points. Cytoplasmic protein extracts were prepared from torsed and sham-operated testes and examined for PHD1-2 and FIH1 by immunoblot analysis. Levels of PHD1-2, and FIH1 were unchanged after each time point of ischemia. The constant levels of HIF regulatory proteins in normoxic and ischemic testes coincides with HIF expression suggesting that the HIF-regulatory pathway is constantly active even in normoxic testes. These results advance an understanding of oxygen homeostasis in the testis and are important for understanding how ischemic injury results in cell damage.

A Determination of the Presence of Dermo (*Perkinsus marinus*) in the Gastropod *Ilyanassa obsoleta* (The Mud Snail) Found in Jamaica Bay, New York. Atwell, A., S. Portnoy and G. Sarinsky, Kingsborough Community College.

The Eastern Oyster (*Crassostrea virginica*) was abundant in Jamaica Bay, until the 1910s when its numbers started to decline and eventually disappear. Studies have shown that the Eastern Oyster (*Crassostrea virginica*) recently grown in Jamaica Bay became infected with the protozoan parasite *Perkinsus marinus* (Dermo). Dermo eventually leads to the oyster's death. It was believed that Dermo was endemic to oysters. Literature suggests that while Dermo is spread from oyster to oyster, the transmission may also occur from molluscan hosts. *Boonea impressa*, a gastropod has been determined to be a transmitter of Dermo but is not present in Jamaica Bay. The Mud Snail (*Ilyanassa obsoleta*) is the most commonly found gastropod in Jamaica Bay. This study attempted to determine if Dermo was present in this gastropod. Snail body tissue and oyster mantle tissue obtained from oysters grown in the Bay were placed in Ray's Fluid Thioglycollate Medium (RFTM). The oyster tissue is the control group. The tissues were examined at the end of the incubation period. The results showed that Dermo was not present in any of the snail tissues but was present in many of the oyster tissue samples. One may conclude that *I. obsoleta* is not a vector for the transmission of Dermo to oysters

Toll Like Receptor Mediated Activation of Microglia *In Vitro*. Babcock, E.¹, K. Dan² and S. Daryl², ¹Wagner College and ²Institute of Basic Research for Developmental Disabilities, Staten Island, NY.

Alzheimer's Disease (AD) is a neurodegenerative disease that affects millions of people, mainly over age 60. During the progression of AD, amyloid- β peptide (A β) plaques aggregate into clumps which cover some neurons in the CNS, leading to cell death. Glial cells present in the CNS, including microglia and astrocytes, are thought to perform phagocytosis on A β plaques. Research performed illustrated ways to increase uptake of A β ₁₋₄₂ plaques by activation of Toll Like Receptors (TLR) in glial cells. The TLRs activated were 3, 4, 5, 7, and 9, and the agonists used to activate them were ODN CpG DNA, poly (I:C), and Lipopolysaccharide. Increased uptake of A β was visible with all three agonists, ranging from 3.12 to 4.05 times more than untreated microglia. This A β was degraded over time made visible by a chase experiment. Although mainly microglia was analyzed for TLR agonist activation, astrocytes have been studied on a smaller scale. Activation through TLR agonists allow glial cells fight A β plaques in AD. More research is necessary to assay if they are beneficial, especially *in-vivo*.

Creating an Algorithm to Find Helitrons in the Genome. Caronna, J. and S.C. Primus, Mentor: Dr. C. Du. Montclair State University.

A new type of transposable element has been discovered called a Helitron. Transposons, also referred to as "jumping genes", are named so because they move around often duplicating themselves in other parts of a genome. Unlike regular transposons, Helitrons do not have terminal repeats, nor do they duplicate in host insertion sites. They are identifiable however, by their consensus sequences: 'aTCT(2bp)A(3bp)CTCTA' at the 5' end and 'CG(9-13bp)CG(8-15bp)CTAGT' at the 3' end which forms a 16 to 20 bp hairpin loop structure. Because these Helitrons are so difficult to detect, a new DNA analysis tool is needed to find more instances of them. We will do this by searching through DNA sequences for looping patterns, as well as exploiting the consensus sequence that identifies them.

Effects of Diltiazem and Lanthanum on Copper Inhibition of O₂ Consumption in Gill of the American Oyster, *Crassostrea virginica*. Collins, S., K. McCoy, M.A. Carroll and E.J. Catapane, Medgar Evers College.

Our oyster rehabilitation studies show *Crassostrea virginica* transplanted to Jamaica Bay, NY accumulated copper. Mitochondria are sensitive to oxidative stress caused by metals. We studied effects of copper on O₂ utilization using a YSI Micro-Biological Oxygen Monitor with continuous flow or micro-batch chambers. 5 or 50 mg of CuSO₄ decreased respiratory rates 12 and 32%, respectively. Oysters grown in Jamaica Bay or copper pretreated with copper were more sensitive to copper additions. We now studied if channel blockers would affect copper's ability to depress mitochondrial respiration. Pretreating mitochondria with diltiazem blocked copper's inhibition, while pretreating with lanthanum did not. Lanthanum had a slight inhibiting effect of its own. The study demonstrates that diltiazem is effective in blocking copper's inhibitory effects on mitochondria and may be useful in blocking copper transport into tissues of other animals as well. The toxic effects of copper on gill mitochondria could be of physiological significance to the growth and long-term health of oysters and other marine animals living in a copper polluted environment and a copper uptake blocker could be of benefit for preventing diseases caused by high serum copper levels in humans.

Specialized Ependymal Cells Control CSF Flow by Characteristic Gating Structures in the Ventricles of the Optic Tectum in Adult Zebrafish: A Morphologic Study. Corbo, C., L. Rath, L. Alba, A. Needle, and Z. Fulop, Wagner College.

The adult zebrafish brain has been gaining growing interest amongst neuroanatomists due to its increasing popularity as a laboratory animal. In this study, the authors focused on the ependymal layer lining the ventricle of the optic tectum that is surrounded by the periventricular grey zone (PVGZ) described by our team elsewhere. The PVGZ was found to contain a deliberate network of cisternae containing cerebrospinal fluid (CSF). Using transmission electron microscopy, now we have found that certain regions of the ventricular ependymal layer include specialized cells with well definable, characteristic gating structures which contain uniquely arranged, individual mitochondria on either side of the gate. This type of gating system was found located either immediately at the ventricle/PVGZ border leading to a bay-like space (ventricular pit) or at the bottom of the pit. Based on the presence of mitochondria, the authors speculate that this structure represent an actively working gating system that controls the cerebrospinal fluid flow from the ventricle to the PVGZ cisternal system. The authors express their gratitude to an anonymous donor whose generous support made this research possible.

Expression of CD45 Isoforms in Normal Brains and Brains with HIV-1 Encephalitis. Cosenza-Nashat, M.A.¹, M.O. Kim², M.L. Zhao³, H.S. Suh³, S.C. Lee³, ¹Borough of Manhattan Community College, CUNY, ²Massachusetts General Hospital and ³Albert Einstein College of Medicine.

CD45 is a membrane tyrosine phosphatase that modulates the development and function of hematopoietic cells. *In vitro*, agonist antibodies to CD45RO or CD45RB isoforms have been shown to suppress microglial activation and HIV infection in human cells, but whether microglia *in vivo* express these isoforms in HIV encephalitis (HIVE) is unknown. Brain sections from control encephalitis and HIVE were immunostained for CD45 isoforms using exon-specific antibodies (RA, RB, RC and RO). RA and RC were limited to rare lymphocytes, while RB expression was robust in microglia and inflammatory cells. RO was low in control microglia, but increased in HIVE. RO was also localized to macrophages and CD8+ T cells. CD45RB may be useful as a histological marker of resting and activated macrophages and microglia. In addition, targeting CD45 *in vivo* with isoform-specific antibodies remains a therapeutic option for neuroinflammatory diseases. *Acknowledgements:* Autopsy tissues for this study were supplied by the Manhattan HIV brain bank (R24MH59724) of the National NeuroAIDS Tissue Consortium. This study was supported by NIH RO1 MH55477 and the Einstein CFAR AI051519. MCN was supported by the NIH Training Grant NS 07098.

Pharmacological Study of the Control of the Lateral Ciliated Gill Epithelium by the Cerebral Ganglion of *Mytilus edulis* (Bivalvia) and the Neurotoxic Effects of Manganese. Crawford, A., M.A. Carroll and E.J. Catapane, Medgar Evers College.

The function of the cerebral ganglion of *Mytilus edulis* was investigated for its role in the control of lateral ciliary activity. The lateral cilia are known to be dually innervated by serotonergic and dopaminergic neurons situated in the visceral ganglion and this innervation was hypothesized to originate from neurons situated in the cerebral ganglion. The present study sought to investigate this. Ciliary beating rates were directly measured by stroboscopic microscopy of gill preparations which had the ipsilateral cerebral and visceral ganglia attached. Superfusion of the cerebral ganglion with serotonin increased ciliary beating rates. This response was antagonized by pretreating with methysergide. Superfusion with dopamine decreased beating rates and this was antagonized by ergonovine. Acute treatment of *M. edulis* with manganese, a neurotoxin which induces Parkinson's Disease, reduced the cilioinhibition caused by dopamine, which is in agreement with the mechanism of action of manganese. This study demonstrates that the reciprocal serotonergic-dopaminergic innervation of the lateral gill ciliated cells originates in the cerebral ganglion of the animal and that this preparation is useful as a model to study manganese neurotoxicity and the pharmacology of drugs affecting biogenic amines.

The Disruption Of Sex Ratios, Developmental Process, and Vitellogenin Expression As a Result of Bisphenol-A Exposure in Medaka. Diehl, F., St. Joseph's College, Faculty Mentor: M.E. Royston.

As early as 1936, British chemists reported finding that bisphenol A functions like a weak estrogen. Bisphenol A is used primarily to make polycarbonate plastic and epoxy resins from which it can leach into food and drinks, and possibly impact human health. Bisphenol A is now known as both a xenoestrogen and an endocrine disrupter. Bisphenol A has been linked in mice with aneuploidy, a chromosomal abnormality causing spontaneous miscarriages, birth defects, and mental retardation. This may explain the sudden appearance in England of fish possessing both male and female sex characteristics, as well as male alligators in Florida with sex organs one-third to one-half normal size. In humans exposure to endocrine disruptors before or just after birth could account for an apparent decline in the average quantity and quality of sperm, as well as an increase in the rates of breast, prostate, and testicular cancer. Increased levels of the yolk-precursor protein vitellogenin (Vtg), a widely accepted biomarker of exposure to oestrogens in fish, and high incidences of intersex gonads and testis abnormalities have been found in fish populations sampled from rivers, estuaries or coastal waters. In this experiment, sex ratios, developmental processes, and vitellogenin expression of Medaka (*Oryzias latipes*) is studied with exposure to bisphenol A.

Chromosomal Changes in Human Basal-like Breast Cancers. Duda, A.¹, H.S. Kim² and E. Gabrielson², ¹Wagner College and ²Johns Hopkins University School of Medicine.

Chromosomal alterations are commonly found in many breast cancers. We searched for chromosomal changes in a subset of breast cancers with basal-like gene expression and morphology, and aggressive histological features (high percentage of cells with Ki67 expression). Our methods involved analyzing the genome of certain basal-like breast carcinomas using array-chromosomal genomic hybridization (aCGH) to screen for chromosomal gains or losses. Microsatellite markers were used to analyze sections of chromosome 5q for loss of heterozygosity (LOH). Our results from aCGH show loss on chromosomal arm 5q, which is very uncommon in human breast cancers. Microsatellite analysis on areas of chromosome 5q in these basal-like samples shows high rates of LOH. These findings suggest that this chromosomal arm harbors a gene that is important in the pathogenesis of this subset of breast cancers.

STD Police: Toll-Like Receptors in the Male Reproductive Tract. Dughi, M.K., C.D. Monacelli, M. Savarese and J. Chapman. Monmouth University, Faculty Mentor: Dr. M.A. Palladino.

Bacterial, viral and yeast infections of male reproductive organs can hinder maturation and movement of spermatozoa through the reproductive tract resulting in impaired fertility or infertility. Protection of spermatozoa from microbes is an important function of male reproductive organs such as the epididymis, an organ that is essential for sperm maturation, transport and storage. Toll-like receptors (TLRs) are highly conserved transmembrane proteins that recognize invading microbes and activate innate immunity responses. Thirteen TLRs have been identified to date. We hypothesize that TLRs are involved in antibacterial responses in male reproductive organs where they recognize and help destroy sexually-transmitted pathogens. The goal of this research was to determine which cell types in the rat epididymis produce TLRs. Reproductive organs and control tissues were excised from adult, male retired-breeder Sprague-Dawley rats (n = 5), preserved in formalin and embedded in paraffin for immunocytochemical analysis with commercially available antibodies for TLRs. To date our results have shown that TLRs 1-5, 9, are present throughout all segments of the epididymis and that TLRs are highly localized to the epididymal epithelium. These results are important for advancing an understanding of how the epididymis recognizes and destroys invading pathogens to protect male reproductive organs and spermatozoa.

Prevalence of Periodontal Pathogens Among Asian Indians With Periodontal Disease. Eger, K., R. Subramaniam and P. Schneider, Queensborough Community College.

Severe forms of adult periodontal disease are associated with anaerobic gram-negative bacteria, in particular *Prophyromonas gingivalis*, *Treponema denticola*, and *Tannerella forsythensis*. Recent studies indicate that Asians exhibit high risk for periodontal disease and this increased risk is independent of socio-economic factors. This study investigated the distribution of the three pathogens in Asian Indian periodontal patients at a private dental clinic. The BANA (N-benzoyl-DL-arginine-2-naphthamide) enzyme assay was performed on subgingival plaque samples taken during routine scaling. The polymerase chain reaction (PCR) detected specific pathogens based on the amplification of signature sequences of the small subunit 16S rRNA genes. We examined the relationship between bacterial distribution, BANA score, demographic factors (age and gender) and clinical parameters (pocket depth, dental history and bleeding on probing). Strong positive correlations were found between pocket depth, BANA intensity and patient age. *P. gingivalis* was found in 40% of control subjects indicating that it may be part of the normal flora. *T. denticola* was detected in 90% of patients with mixed infection; rates for *P. gingivalis* and *T. forsythensis* were 80% and 70% respectively. Results indicate that all three bacteria are significant pathogens in this Asian Indian population. However, disease progression appears to be associated with mixed infection.

Male Phonotactic Responses in Gray Treefrogs (*Hyla versicolor*). Enmore, P.¹, C. Gerhardt² and S. Humfeld², ¹Medgar Evers College and ²University of Missouri-Columbia.

Many anuran amphibians use acoustic signals to communicate. Female frogs choose mates by moving towards males making a call (phonotaxis). Non-calling males (termed satellites) may associate with calling males as a result of male-male competition for mates. We studied whether males have phonotactic preferences similar to those of females. Most *Hyla versicolor* females prefer calls with a faster-than-average call rate, longer-than-average duration and low frequency. We studied whether *H. versicolor* males demonstrate phonotactic behavior, and if so, determine whether they have preferences similar to females. I also wanted to learn if non-calling males were inferior to calling males. I used two methods to answer these questions. During field observations, calling and non-calling males were weighed, calls recorded and body temperature taken. We found no evidence that non-calling males are smaller or produce less attractive calls than callers. In laboratory phonotaxis experiments, synthetic signals from two speakers were played and movements of males were observed. Results indicated males express phonotactic responses and have acoustic preferences similar to females. Fourteen of 22 males moved within 20cm of a speaker, and most (13) chose the call with characteristics favored by females. We speculate the ability of males to recognize attractive calls may maximize reproductive success of satellite males. This project was funded by NSF-REU Biology & Biochemistry grant to the Univ. of Missouri-Columbia.

Analysis of Similarities and Differences Between Disease-Causing *Corynebacterium* and *Mycobacterium* Organisms. Fadael, R.¹, C. Bolnet¹, N. Sarkar², R. DeSalle², ¹Medgar Evers College and ²American Museum of Natural History .

Corynebacterium diphtheria, *Mycobacterium tuberculosis*, *M. avium*, and *M. bovis*, are widespread Gram-positive organisms that present serious threat to human and non-human animal health as well as to the global economy. This project investigates the level of similarity and the difference that exist among the 4 species. We organized information from a range of resources into a single resource. The aim of creating this resource is to ultimately put the knowledge into a phylogenetic matrix so that it can be used for studying the organisms using current tools. We used the available scientific literature (research articles, texts, and Medline) to collect information about their shape, size, and rate of growth, incubation period, and diagnosis period as well as the kind of treatments that can be used against them. These characteristics were then categorized into traditional MeSH key terms (used by the National Library of Medicine) and analyzed using the program Mesquite v. 1.05, a phylogenetic program that also performs non-phylogenetic analyses based on character data. In conclusion, we created a phylogenetic matrix that gathers the data in one resource that allows us to identify the level of differences and similarities between disease causing *Mycobacterium* and *Corynebacterium* organisms.

A Study of Acute and Long Term Additions of Copper on Glutathione S-Transferase Activity in Gill Tissue of the American Oyster, *Crassostrea virginica*. Flores, L.¹, N. Docteur², E.J. Catapane² and M.A. Carroll², ¹Kingsborough Community College and ²Medgar Evers College.

Copper is a common aquatic pollutant. While bivalve mollusks are used for monitoring and bioaccumulation kinetics studies, little is known about their biochemical responses to metal accumulation. Metals can increase oxidative stress by various means including depletion of cellular antioxidants such as reduced glutathione (GSH). Glutathione S-Transferase (GSTs) is a Phase II detoxification enzyme that catalyzes conjugation of electrophilic substrates to GSH. While studies have been done on GST in mammals, less is known in invertebrates. To study the effects of Cu⁺² we incubated animals with Cu⁺² (up to 400 µM) for 3 days. Other animals were treated with Cu⁺² (up to 600 µM) for 4 hours. Gill tissue was processed to obtain the post-mitochondrial supernatant. GST activity was measured spectrophotometrically using 1-chloro-2,4 dinitrobenzene and GSH as substrates, and calculated using the conjugate's molar extinction coefficient of 0.0096 µM⁻¹cm⁻¹. We found exposing the animals to Cu⁺² reduced GST activity by up to 61% in the 3-day experiments, and up to 67% in the short-term experiments. This study is important because it will help us gain further insight into role of toxic metal exposures on oxidative stress and the cellular mechanism that defend against oxidative stress.

Comparative Fecundity of Two Grass Shrimp Species, *Palaemonetes pugio* and *Crangon septemspinosa* at Jamaica Bay Wildlife Refuge, New York. Francois, S., M. Phoolbosseea and K. Nolan, St. Francis College.

The grass shrimp *Palaemonetes pugio* (daggerblade grass shrimp) and *Crangon septemspinosa* (mud shrimp) were collected from Jamaica Bay Wildlife Refuge (JBWR) during the months of June and July 2006. This research studies the relationship between the spawning of the two species and the fecundity of gravid females on the occasions that samples were collected. *These species* are consumers of a wide variety of organisms, and are prey to many fish and crustaceans. It is necessary to find new ways to track the fecundity of the grass shrimp in a changing environment. Specimens were collected at low tide and at a maximum of 1 meter of water using a hand net along the coastal regions. The length, width, and weight of all shrimp collected, both males and females, were recorded. Notations of all gravid females were also recorded. The sac containing the eggs of gravid females was removed from the respective grass shrimp and the eggs were separated further into smaller aliquots. Photographs of the eggs were taken using a Motic Camera mounted onto a dissecting microscope. Eggs were counted using Motic Images 2000 version 1.3 and Image J from the photographs. This work was supported by the National Science Foundation Undergraduate Mentoring in Environmental Sciences grant.

Antibiotic Producing Bacteria (*Streptomyces*) in the Most Polluted Urban Area in Brooklyn: The Gowanus Creek Canal. Garcia, S., B. Kinlock, C. Bolnet, Medgar Evers College.

Streptomyces are bacteria that produce antibiotics as secondary metabolites. Because a large number of pathogenic bacteria are resistant to many of the antibiotics now in frequent use, our group is interested in isolating new strains of *Streptomyces*, in Brooklyn locations such as the extremely polluted Gowanus Creek Canal (GCC). To achieve our goals we used i) a phenotypic characterization through selective plating cultures, ii) biological assays, as well as, iii) a genotypic characterization using the 16SrRNA gene. Soils from the barge of the GCC were dried, diluted and plated onto selective agar media and incubated at 28° C for 15 days. Ten colonies were selected for their characteristics suggesting that they belong to the genus *Streptomyces*. Gram staining revealed that 8 out of the 10 colonies are Gram positive, filamentous rod shaped and spore forming bacteria which confirmed the presence of *Streptomyces*. Antibacterial activity tests were performed and none of the colonies exhibited antibiosis against Gram negative or Gram positive bacteria. DNA was extracted from each isolate and a successful PCR amplification of the 16S rRNA gene was performed. We are currently in the process of sequencing the PCR products to characterize the isolates against known *Streptomyces/Actinomyces* database.

Does Leaf Age Affect Plant Defense Responses in *Xanthium strumarium*? Quantification of Gene Expression of DHS1 gene in *Xanthium Strumarium*. Glover, T.¹, J.D.Lewis² and L. Rubino², St. Francis College and ²Louis Calder Center-Biological Station, Fordham University.

The optimal defense theory states that as plants age their relative value decreases as photosynthetic and nitrogen levels decrease. Therefore, older leaves will have decreased defense response than younger leaves. As environmental stress increases due to increased population density and urbanization, plant communities are under increased stress for survival. Exogenously and endogenously applied jasmonic acid is known to produce a defense response. Leaf punches were taken from *X. Strumarium*. RNA was extracted from those leaves using a Qiagen RNA extraction kit. A Reverse-Transcriptase polymerase chain reaction was performed on the extracted samples. The products of the RNA samples were visualized on 1.5% agarose gel. The bands were quantified using ImageJ software (v1.36b). The young treatments: JA increased DHS expression 165% compared to the control. In contrast, the old treatments: JA did not induce DHS gene expression. Age also affected DHS expression. In the control treatment, DHS expression was higher in older leaves than in younger leaves. These results suggest that leaf senescence and flavinoid production may play a more important role in DHS expression in older leaves compared younger leaves. This work was supported by NSF REU program.

The Effect of Diet Quality on Growth, Development and Survivorship of *Acheta domesticus*. Hamdeh, Y., W. Hamilton, M. Poku and J. Fuller, Mentor: Dr. D. Vanderklein, Montclair State University.

Our goal was to find out how much of an impact diet had upon house crickets (*Acheta domesticus*) development. Factors we monitored were growth, wing, and ovipositor development, and survivorship. To do this we had five different populations of immature *Acheta domesticus*, each with a different diet. The diets consisted of ground celery only, celery and sugar, celery and protein, celery, sugar and protein, and cat food. Three times a week, average weights, mortality and general observations were logged for a period of 9 weeks. Our results showed the significance of protein within the diet of *Acheta domesticus*. We found that crickets with a high protein diet grew larger, developed quicker and had a higher survival rate.

Optimization of DNA Extraction and Amplification Procedures From Fecal Samples of African Forest Elephants. Hanson, R.¹, C. Bolnet¹, S.O. Kolokotronis² and R. DeSalle², ¹Medgar Evers College and ²American Museum of Natural History.

Newly revealed African forest elephants (*Loxodonta cyclotis*) are difficult to census due to their dense habitat within central West Africa. Therefore, there is a lack of forest elephant sampling, and very few populations are being monitored. Non-invasive sampling of endangered and elusive species, for genetic analyses, is the most important component of wildlife evolutionary genetics research. It is the most efficient way to acquire knowledge of the genetic makeup of wild species. African forest elephant dung samples were collected and preserved in various media: isopropanol, ethanol, and silica gel. Total optimization of non-toxic DNA extraction protocols (QIAGEN Mini Stool Kit and Epicentre Extract Master Fecal DNA Extraction Kit) was carried out aiming at the maximization of DNA yield. Finally, the optimization of PCR-amplification procedures of various loci located on the mitochondrial genome and the X-chromosome, and SINE retrotransposons was performed. Of 111 samples, from Ghana, Nigeria and the Congo, mitochondrial DNA and nuclear DNA were positively amplified. SINE retrotransposons were also amplified for the first time in forest elephants. In conclusion we have optimized the PCR conditions for the amplification of a new locus that can be a valuable tool in the monitoring of African forest elephants.

Pathologic Fossil Shark Teeth from New Jersey. Harbour, G. and D. Dorfman, Monmouth University.

The senior author has an extensive collection of vertebrate fossils from Monmouth County, New Jersey. He has recovered approximately equal numbers of sharks' teeth from the Cretaceous period (middle Maastrichtian, 75 MYA), from Big Brook, in Marlboro and Ramannessin, in Holmdel, and from the Tertiary period (early Miocene, 26 MYA), from the Manasquan River, in Howell, and Shark River, Neptune. It is believed that the older Cretaceous teeth display a considerably higher amount of dental pathology than later Miocene types. Apparently, 50 million years of evolution had improved the shark dentition to the point where there is less evidence of pathological aberrations by the beginning of the Miocene. This may be due to both the long existence of various shark groups (four hundred million years), and to the need for efficient, reliable teeth for the basic survival of sharks. Further indications of evolutionary advances may be noted by the fact that Cretaceous shark types (Lamniforms) are largely extinct, whereas Miocene shark types (Carcharhiniforms) represent at least 50 percent of all extant shark species. The pathological teeth and their normal counterparts shown include Cretaceous, *Scapanorhynchus texanus*, and *Squalicorax kaupi*, and Miocene sharks, *Carcharias Taurus*. The teeth were collected between 2002 and 2004.

Study the Molecular Mechanism in the Heavy Metal Resistant Cyanobacteria *Anacystis nidulans*. Herrera, A., J. Schifano, W. Perez, L. Lee, Q. Vega, T.C. Chu and B. Lustigman, Montclair State University.

Anacystis nidulans is an obligate photoautotroph that is similar to gram-negative bacteria in cell wall structure, replication and ability to harbor plasmids. *Anacystis nidulans* is often used as an indicator of the presence and level of pollutants in the environment. Mercury and iron are among the heavy metal contaminants found in the environment and in bodies of freshwater. Different microorganisms vary in their tolerance to heavy metals based on exposure and physiological and/or genetic mechanisms. In this study, the concentration 10 mg/L of iron was used in combination with 0.5, 1 and 5 mg/L mercuric respectively. For the study of the combined effects of iron and mercury, several passages were carried out and some resistant cells were observed and isolated. The resistant cells were used to conduct preliminary research on locating the heavy metal resistance genes. Two different methods were used to isolate plasmid; one was using the traditional methods and the other was using Qiagen Mini-Prep Kit. Plasmids were isolated from three different conditions (10 mg/L FeCl₃ with 0.5, 1 and 5 mg/L HgCl₂) and also from the control cells. The results suggested that there might be an induced expression of plasmid which may be linked to resistance.

Invention and Application of a Stereotaxic Apparatus for Adult Zebrafish Brain Surgery. Hobbs, L.M., C.E. Jenkins, C. Corbo, L. Rath and Z. Fulop, Wagner College.

The use of zebrafish (*Danio rerio*) as a laboratory animal has increased in recent years and has significantly contributed to the understanding of early nervous system development. It is known, that fish brains have a high regenerative capacity even during adulthood. This capacity of the adult fish brain makes zebrafish a good model animal to study brain regeneration and recovery after traumatic brain injury (TBI). However, no TBI research has been designed for zebrafish to date. This is possibly due to the minimal size of the zebrafish, as well as the difficulty of maintaining zebrafish respiration during surgery. This study focuses to overcome such obstacles by creating the necessary devices and conditions to perform a stereotaxic zebrafish brain surgery. We fabricated and tested a "holding and restraining plate" and "respiratory irrigating system" for adult zebrafish to be used with a standard rat stereotaxic apparatus (Kopf's), common in neuro-laboratories. The device was tested with different levels of anesthesia and the survival rate of fish after surgery was determined. The transformation of stereotaxic parameters of the adult zebrafish brain to a stereotaxic atlas is in progress. The authors express their deepest gratitude to an anonymous donor whose generous contribution made this research possible.

Research Project Conducted on Insect Distribution of Various Habitats of the Island of Psara, Greece. Hua, H.N., S. Jalal and G. Sideris, Long Island University

Psara (Ψαρά), an island that is almost isolated from other parts of Greece. It is located in the Aegean Sea (38.406/38°34'09" N lat, 25.1267/25°35'04" E long), 22 km from the closest large island of Chios. To the world, Psara might be insignificant but to others it is home, and to us, it is the land of never ending explorations and opportunities. As part of our undergraduate research, we traveled to Psara to conduct a project on the entomology of the island. Our presentation focuses on identifying and determining the distribution of insects under different habitats on the island. Using the methods of hand nets, pond nets, or porters as they flew, swam or crawled, we collected a number of insects. We also used a UV light trap, and glue traps as baits to attract the insects. A total amount of over 300 insects was collected from different habitats like degraded garrigue, abandoned agricultural field, and seasonal stream site. Our collection includes the order of butterflies/moths (Lepidoptera), beetles (Coleoptera), dragonflies (Odonata), grasshoppers (orthoptera), bugs (Hemiptera), bees/wasps (Hymenoptera), flies (Diptera), some mantids (Mantodea). We are in the process of completing specimen identification and making comparisons with insect populations on other Aegean islands such as Crete, and Chios.

Acidity Constant of Acetamide in Water. Igbinoghene, L., P. Svoronis, D. Gao and P. Schneider, Queensborough Community College.

We determined the acidity constant of the weak organic carbon acid acetamide in aqueous solution by using ab initio MO calculations at the mp2/aug-cc-pcdz/hf/6-311+G(d,p) level and the c-pcm-hf/6-31+G(d) solvation free energy calculations. The computed gas phase acidity at the mp2/aug-cc-pcdz/hf/6-311+G(d,p) level is 368.3 kcal/mol. Use of the gas phase acidity and the experimental absolute hydration free energy of proton of 264 kcal/mol gives the calculated pKa value of 31.6 for acetamide, which is in fairly good agreement with the latest experimental value of 28.4. Other methods such as Cramer and Truhlar's generalized Born solvation model, SM6, and combined quantum mechanical and molecular mechanical (QM/MM) Monte Carlo simulations methods were being pursued. This work will provide new and important insight into the use of different models in the evaluation of the pKa values of carbon acids.

Virtual Screening and Identification of Small Molecule Inhibitors of the Melatonin Rhythm Enzyme. Javoroncov, M.¹, L.M. Szewczuk¹, S. Ganguly¹, S.A. Saldanha², R. Abagyan², P.A. Cole¹, Johns Hopkins University School of Medicine and ²The Scripps Research Institute.

Melatonin is a serotonin derivative produced in the pineal gland and retina. It modulates a wide assortment of circadian cycle pathways, especially those concerning sleep and mood. The biosynthetic pathway of conversion from serotonin to melatonin is determined by the concentration of arylalkylamine-N-acetyltransferase (AANAT). Binding sites of AANAT include Tryptamine and Acetyl Coenzyme A. Competitive and uncompetitive small molecule inhibitors were selected from 1.2 million commercially available compounds via ICM virtual ligand screening. The compounds chosen came from Sigma/Aldrich rare chemicals (Salor collection) and NCI repository. Virtual ligand screening and variation of a spectrophotometric assay were utilized to determine activity of the compound at 100 μM. Compounds which inhibited notably were subjected to a doubling of coupling enzyme. Additional spectrophotometric assays were run observing AANAT activity with detergent to determine the presence of aggregation and dose response by decreasing the inhibitor concentration. Radioactive assay was utilized to assure activity without the presence of a coupling enzyme. Electrospray mass spectroscopy assured the presence of the predicted inhibitor. Seven compounds were found to inhibit AANAT. These small molecule inhibitors may be utilized for drug design due to their moderate potency and non-toxicity.

Determination of Bacterial Diversity in Soil Samples from Brooklyn Using Genetic and Morphological Analysis. Jodhan, G., B. Kinlock and C. Bolnet. Medgar Evers College.

Several indices such as the species richness, diversity are used to describe the structural diversity of a community due to environmental fluctuations, land practice and pollution. We explored the diversity of soil bacteria in four different Brooklyn locations: Manhattan Beach (MB), Coney Island Beach (CIB), Downstate (DS) and Prospect Park (PP). Soil samples were diluted, inoculated onto enriched agar plates and incubated at 28° C for 2-7 days. Seven different types of colonies were found: yellow, white, gray-red, brown, orange, black, and white with a fuzzy coating. The percentage of each type varied within each sample. The yellow and brown colonies were the most dominant in all soil samples but the orange colonies seemed to thrive better in CIB soils. In CIB cultures, the bacterial density was significantly higher than the one found in the three other soil samples. The physiological tests indicated a functional diversity among the seven colonies which confirms the morphological diversity observed. DNA was extracted from each of the seven colonies. A PCR to amplify the 16S rRNA gene was performed successfully. We are currently sequencing the PCR products to access at a molecular level the composition of the soil bacterial community.

Cellular Roles for VHL Gene Products that Are Independent of HIF-α Regulation. Kaplani, E.¹, M. Hughes¹, R.D. Burk² and A.R. Schoenfeld¹, ¹Adelphi University, ²Albert Einstein College of Medicine.

Germline mutations in the *VHL* gene predispose individuals to various tumor types. The product of the *VHL* gene, pVHL, has been determined to be a crucial member of an E3 ubiquitin ligase complex, targeting hypoxia-inducible factor alpha (HIF-α) subunits for degradation. pVHL has been shown to regulate important cellular functions such as differentiation, cell cycle arrest of cells grown on extracellular matrices, cell morphology, and deposition of fibronectin. In order to determine whether these pVHL functions depend on the ability of pVHL to downregulate HIF-α, we utilized RNA interference to knock-down levels of HIF-2α in renal cells that lack functional pVHL. Following verification that HIF-2α and a downstream target of HIF are inhibited in these cells, we compared these cells to isogenic cells containing replaced pVHL and determined which VHL cellular functions were phenocopied by lowered HIF-2α levels. While cell cycle arrest of cells grown on an extracellular matrix was observed with HIF-2α knockdown, other VHL-mediated cellular phenotypes were either only partially reproduced or not observed at all with HIF-2α knockdown cells. These results indicate that in addition to HIF-2α regulation, pVHL is likely to have additional cellular roles that may contribute to tumorigenesis following loss of *VHL*.

Neurotoxic Effects of Manganese on Biogenic Amines of the Nervous System and Innervated Organs of *Crassostrea virginica*. King, C., D. Lecky, M.A. Carroll and E.J. Catapane, Medgar Evers College.

Manganese is a neurotoxin which induces Parkinson Disease resulting in mental and emotional disturbances, and slow and clumsy body movements also called "manganism." Manganese injures dopaminergic neurons in the brain. *Crassostrea virginica*, a sedentary animal the EPA lists as a model animal for studying marine pollutants, possesses a simple nervous system with monoaminergic neurons. We studied if exposure to manganese would cause deficits in biogenic amine levels. Animals were exposed to 0.1 and 1 mM of manganese for 3 days. Biogenic amines were measured utilizing HPLC with fluorescence detection. Cerebral ganglia, visceral ganglia, gill and palps were dissected, weighed, homogenized, centrifuged, filtered and injected into an HPLC system with a Phenomenex Gemini 5μ C18 column and Spectrofluorometer. The mobile phase was 50 mM acetate buffer (pH 4.7) with 1 mM EDTA, 1.1 mM SOS and methanol (85%/15%, v/v). 1mM manganese caused statistically significant reductions in dopamine in tissues but no changes in norepinephrine, octopamine or serotonin. These results are consistent with reported mechanisms of action of manganese in humans. This study demonstrates marine invertebrates can be damaged by high environmental levels of manganese and *C. virginica* is a suitable test animal to study neurotoxic actions of manganese and related agents.

Glucosinolates as a Chemical Defense Mechanism Against Generalist and Specialist Insect Herbivores. King, J. and A.M. Shumate, Fairleigh Dickinson University.

Insect herbivores in nature feed upon plant material that may be defended in a variety of ways. Plants from the family Brassicaceae produce a group of sulfur-based secondary compounds called glucosinolates. These compounds serve as the primary chemical defense against herbivores, and plants vary in both concentration and type of glucosinolates present. We studied plants of the species *Boechea holboellii* from four sites in the western United States which vary in glucosinolate production. For each plant family we tested the preference and feeding success of four typical insect herbivores - two Brassica specialists (*Trichoplusia ni* and *Plutella xylostella*), and two generalist feeders (*Agrotis ipsilon* and *Spodoptera exigua*). Theory would suggest that generalist herbivores would respond differently than specialist herbivores to defended plant tissue, as specialists would be more likely to have evolved tolerance over the long term. Responses of the four insect species to the plant families were mixed, with some predictable and some unpredictable responses. Overall, there is some evidence for rejection of leaf tissue by herbivores that might have been intolerant to the glucosinolates, but this study does not show clear support for the hypothesized coevolutionary response between plants and insect herbivores, warranting further study.

Assortative Shoaling in Zebrafish (*Danio rerio*): Tests for the Effects of Body Size and Sex. Kurta, A., A. Etinger and B. Palestis, Wagner College.

It has been predicted that fish should prefer to shoal (school) with similar individuals, as an adaptation versus predators via the "confusion effect". Zebrafish (*Danio rerio*) shoaling was studied through observations of twenty groups of four fish, divided by body size and/or sex. Observations were recorded every two minutes on a camera connected to a computer, and nearest-neighbor distance was measured. Each trial lasted twelve minutes. Females had a statistically significant preference for shoaling with other females, and males had less or no preference; preference for body size was not established in either sex. The lack of a size effect was surprising, based on previous studies in many species. The assortment by sex confirms earlier work in our lab that used a different methodology, and has not been reported by other researchers. We thank an anonymous donor for support.

Sex Ratio Alterations Caused by Bisphenol A in *Poecilia reticulata*. LaGrandier, T. and M.E. Royston, St. Joseph's College.

Sex ratio alterations affect the number of females compared to males. Ratios of male to female differ from species to species, but abnormal ratios have been found due to chemical alterations in embryos. Bisphenol A is a steroid mimic known to have similar effect to that of estrogen. Too much estrogen can cause disorders such as cancer, sex reversals, and sex ratio alterations. Bisphenol A can be found in the environment at concentrations affecting species as low as one part per billion, due to the output of paper and plastic industries. Bisphenol A is a plasticizing agent, which provides flexibility to plastic products. It can also be used as a bleaching agent for paper, aiding in the removal of impure substances. *Poecilia reticulata*, or the common guppy, proves to be an ideal candidate for this experiment because the ratio of males to females for each birthing is most often 50:50. They also mature and reproduce very quickly, providing many generations in a short period of time. In this experiment, Bisphenol A will be introduced at a concentration of one part per billion for a 24-hour period. Sex ratios of *Poecilia reticulata* will be observed from generation to generation to determine the effects of Bisphenol A at low concentrations for the designated period of time.

Effect of Tau Pathology in Spatial Memory of the hTau Mouse. Lopez, A., M. Polydoro and P. Castillo, Albert Einstein School of Medicine.

Tau is a microtubule binding protein. It is often found on the axons of the neurons. Tau pathology occurs when tau is hyperphosphorylated. This changes the conformation of the microtubule. They become neurofibrillary tangles, which have been linked to various forms of dementia such as Alzheimer's disease. The increased amount of tangles, the worse the memory lost. To test if mice with a knock in human tau protein will have a difference in memory lost, ten mice were tested in a Morris Water Maze which tests for spatial memory. In this test, both wild type and hTau mice were tested by placing mice in white non toxic water. Using cues on the wall, mice were to find their way to the submerged platform. To make sure that the mice results were not from other factors, trials testing mice gait, anxiety, and others were tested. Our results confirmed that there was a significant amount of memory lost in hTau mice in comparison to the wild type. Our mice had no other factors that were tested affecting the results.

Steroid Levels in the Bivalve Oyster *Crassostrea virginica* and the Mussel *Mytilus edulis*. Lambert, W. and E. Nduka, Medgar Evers College.

Classical hormones have long been associated mainly with vertebrates. These hormones are known to be chemical messengers and active signal transmitters. In previous studies we measured levels of monoamines, epinephrine, norepinephrine, dopamine and serotonin in the oyster *Crassostrea virginica* using HPLC. Here we measured levels of the steroids, testosterone and estradiol 17 β in tissues of the bivalves, *C. virginica* and *Mytilus edulis*. Results from our present study using Enzyme Linked Immunosorbent Assays (ELISA) indicated detectable levels of testosterone and estradiol in gonads, adductor muscle and gills of these bivalves. The role of these steroids in bivalves is not very clear. Levels of both steroids were detected in higher quantities in gonads compared to the quantities found in adductor muscle and gills. Amounts of testosterone measured in gonadal tissues ranged from 9.371 mg/gm tissue wet weight (ww) to 1.065 mg/gm ww; whereas levels in adductor muscles ranged from 8.475-25.666 μ g/gm tissue ww; gills 5.773-10.559 μ g/gm tissue ww. The presence of high amounts of steroids in the gonads may be associated with the reproductive activity in this tissue. We therefore intend to explore the relationship between levels of the steroids in gonadal tissue during the different seasons especially in spawned animals

Improved Stability of Fluorinated Chloramphenicol Acetyltransferase by a Single-Isoleucine Mutation. Lee, M.X.¹, N. Voloshchuk¹ and J.K. Montclare.^{1,2}, ¹Polytechnic University and ²SUNY Downstate Medical Center.

In vivo incorporation of non-natural amino acids can be used to modify the complex structures and functions of proteins while maintaining their activities. Successful *in vivo* incorporation of fluorinated amino acids has been shown to increase the hydrophobicity and thermostability of proteins. However, chloramphenicol acetyltransferase (CAT), an enzyme that acetylates chloramphenicol, demonstrates a loss in thermostability with the incorporation of 5', 5', 5'-trifluoroisoleucine (TFL), a leucine analog. Here, we show that a mutant form of CAT (L158I) has an increased thermostability upon the incorporation of TFL. Thus, with a single substitution of leucine to isoleucine, we have engineered a thermally stable fluorinated variant of CAT.

Bacteria, Birds, Beachgoers. Is it Safe to Go into the Water? Lewis, K.J., A.M. Stavroulakis, A. Robbins, M.T. Ortiz and A.N. Zeitlin. Kingsborough Community College.

Beaches around the United States attract millions of people every year for swimming and fishing among other activities. Often we hear about hundreds of beaches closing around the country because of high levels of bacteria. This past summer regional beaches in New York were deemed unsafe, and were periodically closed due to high bacterial levels, including Manhattan Beach at Kingsborough Community College (KCC). Numerous diseases result from water contaminated with human and animal fecal wastes. This study included testing the water at two beaches for comparison, the beach at KCC which is utilized by beachgoers and Dead Horse Bay (DHB) which is not utilized by swimmers. Contamination with fecal coliforms, trash, along with the number of people and birds were evaluated at KCC and DHB. Our study showed that pollution is a problem at both beaches. This study identified *Escherichia coli* and *Enterobacter aerogenes* in water samples. *Enterobacter* spp colonies were consistently higher at KCC, showing the highest growth in water sampled from areas with large flocks of birds. Coliforms were present in areas that people access for swimming, as well as not utilized for swimming. These results highlight the need to address water quality in these publicly accessed areas.

Control of the Lateral Ciliated Gill Epithelium of *Crassostrea virginica* (Bivalvia) by the Visceral Ganglion and the Neurotoxic Effects of Manganese. Martin, K., T. Huggins, M.A. Carroll and E.J. Catapane, Medgar Evers College.

Lateral gill cilia of *Mytilus edulis* is controlled by serotonergic-dopaminergic innervation from their ganglia. Other bivalves have been studied to lesser degrees. Lateral cilia of most, including *Crassostrea virginica*, respond to serotonin and dopamine applied to gill, indicating a neuro mechanism. Little work has been done with respect to ganglionic control. Here we examined the role of the visceral ganglia in innervating lateral gill cilia of *C. virginica*. Ciliary beating rates were measured by stroboscopic microscopy of gill preparations with ipsilateral visceral ganglia attached. Superfusion of gill with serotonin increased ciliary beating rates, which methysergide antagonized. Superfusion with dopamine decreased beating which ergonovine antagonized. Superfusion of visceral ganglia with serotonin increased beating which was antagonized by methysergide. Superfusion of visceral ganglia with dopamine decreased beating which was antagonized by ergonovine. Treatment of *C. virginica* with 1mM manganese, a neurotoxin inducing Parkinson's Disease, reduced cilio-inhibition caused by dopamine in agreement with the mechanism of action of manganese in humans. This study demonstrates a reciprocal serotonergic-dopaminergic innervation of lateral gill cilia from the visceral ganglion of the animal, similar to *M. edulis* and this preparation is useful as a model to study manganese neurotoxicity and the pharmacology of drugs affecting biogenic amines.

The Oxygen Regulatory Protein Hypoxia-Inducible Factor-1a and Germ Cell Apoptosis in Response to Testicular Ischemia and Torsion Injury. McNamara, J.K., Monmouth University, Faculty Mentor: Dr. M.A. Palladino.

Hypoxia-inducible factor-1 (HIF-1) is the major transcription factor involved in adaptive responses to hypoxia in many tissues. Testicular torsion is a hypoxic condition that produces tissue ischemia in the testis that can lead to germ cell death via apoptosis resulting in impaired fertility or infertility. Our working hypothesis is that HIF-1a plays essential roles in regulating cell death and cell survival signaling pathways in the testis following testicular torsion injury. We hypothesize that HIF-1a may serve proapoptotic and/or antiapoptotic roles in response to hypoxia following torsion of the rat testis. The purpose of this study was to investigate which cell types express HIF-1a in the testis, and to determine if HIF-1a co-localizes in apoptotic cells in the ischemic testis. Surgically induced testicular ischemia was achieved by 720° torsion ranging from 1-6h followed by variable times of reperfusion. Immunohistochemistry demonstrated that HIF-1a is localized to Leydig cells under both normoxic and hypoxic conditions. *In situ* apoptosis using a TUNEL assay showed that apoptosis occurred exclusively in germ cells. In conclusion, these results support the hypothesis that HIF-1a is not involved in germ cell apoptosis but may serve important antiapoptotic roles to protect Leydig cells from the effects of hypoxia following testicular torsion.

The Effect of Dibutyl Phthalate and Bisphenol-A on the Sex Ratios of Guppies. Melville, J. and M.E. Royston, St. Joseph's College.

Steroid hormones play a large role in sexual development and sexual maturation. Alarming, there are several commonly used chemicals that seem to be acting as mimics of sex hormones or act as antagonists of the hormones. There seems to be a link between these chemicals and disruptions of normal sexual development of organisms observed in the wild. Two chemicals that seem to act as steroid hormone mimics, specifically estrogen mimics, are bisphenol A and dibutyl phthalate. Both these chemicals are commonly used in the production of plastics. It may be proposed that the effect of both of these chemicals in combination would be more severe than if they acted individually. In this research, the combined effects of dibutyl phthalate and bisphenol-A on the sex ratios of guppies is investigated.

Isolation of Antibiotics Producing Bacteria from Soil samples Collected in Brooklyn NY. Mitchell, R., B. Kinlock and C. Bolnet, Medgar Evers College.

Streptomyces are producers of antibiotics in commercial and medical use. Here we focus on isolating *Streptomyces* from soil obtained from 4 different areas in Brooklyn: Manhattan Beach (MB), Coney Island Beach (CIB) Downstate (DS) and Prospect Park (PP). Soil samples were dried, diluted, inoculated on selective media for *Streptomyces* and incubated at 28°C for 7-15 days. Cultures from CIB soil displayed the most bacterial density and diversity. Interestingly, these cultures were also found to have three colonies of *Streptomyces* showing signs of antibiotic production. Gram staining revealed that they are Gram positive, filamentous, rod-like shaped and spore producers which confirm the presence of *Streptomyces*. Physiological tests were performed to compare the substrate utilization patterns of our isolates to the controls. Our results indicate that one bacterium is of the genus *Streptomyces*, while the other two could not be accurately identified by the tests used and are therefore unknown. DNA was extracted from each isolate and a Polymerase Chain Reaction (PCR) to amplify the 16S rRNA gene was performed successfully as indicated by the size of the amplicons in the electrophoresis gel. We are currently in the process of sequencing the PCR products to access the novelty of the isolates to known *Streptomyces/Actinomycetes* database.

Study the Effect of Mercury and the Combined Effect of Iron and Mercury on the Growth of Cyanobacteria *Anacystis nidulans*. Mugisha, A., H. Khalil, T.A. Musulin, S.N. Hong, L. Lee, T.C. Chu and B. Lustigman, Montclair State University,

Anacystis nidulans is a unicellular cyanobacterium. It has been proposed as a good indicator for environmental contamination especially heavy metals in freshwater. In this study, mercuric chloride (0, 0.5, 1 and 5 mg/L) were added separately to *A. nidulans* cultures. Another set was the combined effect of ferric chloride and mercuric chloride on the growth of the cells. The growth was monitored by direct count using hemocytometer and turbidity studies using spectrophotometer. The results suggested that this organism is quite sensitive to the presence of mercuric chloride. At concentrations of 0.5 mg/L of mercuric chloride, the growth of the cells is reduced slightly. The growth was severely inhibited at 1 mg/L and completely inhibited at 5 mg/L. In the combination study, the concentration of 10 mg/L of ferric chloride was used in combination with 0.5, 1, and 5 mg/L of mercuric chloride respectively. When the combinations of heavy metals were used, 10 mg/L ferric chloride with 0.5 mg/L mercuric chloride and 10 mg/L of ferric chloride with 1 mg/L of mercuric chloride, a long lag phase of growth was observed in these cultures. At 10 mg/L ferric chloride and 5 mg/L mercuric chloride, the growth was completely inhibited.

Distribution of Manganese in the Oyster *Crassostrea virginica* Raised in Jamaica Bay, NY and Its Accumulations in Oysters Acutely Exposed to High Levels. Murray, S.¹, A. Lovell², M.A. Carroll² and E.J. Catapano², ¹Kingsborough Community College and ²Medgar Evers College.

Manganese, a neurotoxin which induces Parkinson Disease also called "manganism," injures dopaminergic neurons in brain. *Crassostrea virginica*, a sessile marine bivalve identified by the EPA as a test animal for studying marine pollutants, possesses a simple nervous system with monoaminergic neurons. We studied if exposure to manganese would result in increases in tissue levels of manganese. Manganese in oysters raised in Jamaica Bay, NY for 2 years and animals obtained from an oyster farm which were exposed to 10 mM of manganese for 3 days were determined. Cerebral ganglia, visceral ganglia, gill, mantle, adductor muscle, stomach and palps were dissected, dried and digested in nitric acid. Manganese was measured using electrothermal vaporization with deuterium lamp background correction in a Perkin Elmer AA800 Atomic Absorption spectrophotometer with a THGA graphite furnace. Manganese was distributed in tissues of untreated animals in µg/g dw amounts, with palps and gill having the highest. Treated animals accumulated a 100 fold increase in manganese in gill and palps, and a doubling in ganglia. The study shows sessile marine invertebrates can accumulate high levels of manganese, which may cause neurotoxic effects and that *C. virginica* is a suitable test animals to study the mechanism of manganese uptake.

Indoor Air Quality Study-Vapor Intrusion of Volatile Organic Compounds. Ogero, F.¹, D. Skeets¹ and J. Heiser², ¹Medgar Evers College and ²Brookhaven National Laboratory.

Growing response to residential exposure to Volatile Organic Compounds (VOCs) and Semi-VOCs have prompted concerns by the EPA to promulgate regulatory limits for VOCs in residential homes. Major sources of VOCs are dry cleaners, service stations and leaking underground storage tanks. Threat can be realized from vapors that migrate into residences, posing chronic health risk for residents if the detectability level is low. The objective of this project was to validate the Johnson-Ettinger model and other 2-dimensional and 3-dimensional models using the Brookhaven National Laboratory Air Infiltration Measurement System Technique to determine subsurface contribution of VOCs intrusion in buildings. Four per fluorocarbon tracers (PFTs) sources were deployed in Building 830. Sources were left for approximately 48 hours in six zones. Passive samplers were used to trace infiltration and exfiltration. Analysis showed flow rate in three of the six zones were comparable. The hallway had a relatively high concentration rate upwards of 6m³/h. However, the crawl space had low source rates hence there was little detection of PFT sources. This miniature source and sampling tracer kit can measure infiltration rates on the order of 0.2 to 5 changes per hour over time-averaged periods of 1 day to several months or years.

Monoethylhexyl Phthalate (MEHP) Alters Steady-State Levels of Mitochondrial Proteins Mediating Oxidative Stress Responses in an Immortalized Male Germ Cell Model. Onorato, T.M.¹, P.L. Morris^{1,2}, ¹Population Council, and ²The Rockefeller University.

Phthalates, used to soften polyvinylchloride, have deleterious effects on the male reproductive system, especially germ cells (GC), inducing oxidative stress, cytochrome c release and apoptosis. This study sought to further elucidate the molecular mechanisms involved by analyzing proteins associated with mitochondrial integrity and the oxidative stress response: peroxiredoxin 3 (Prx3), mitochondrial Hsp70 (mtHsp70), phosphorylation of protein kinase C (pPKC), and inducible cyclooxygenase-2 (Cox2). The SV-40 immortalized mouse spermatocyte-derived cell line, GC-2spd(ts), was used as a model system to determine effects of various doses of MEHP (24-h). MEHP increased mitochondrial Prx3 levels 2-fold, findings consistent with the protective role of Prx3 against pro-apoptotic effects of reactive oxygen species. MtHsp70 decreased (40%) whereas, at higher MEHP doses, cytoplasmic levels significantly increased (40%). Decreases in mitochondrial (45%) and nuclear pPKC levels (65%) were accompanied by increased cytoplasmic pPKC (1.7-fold). Cox2 was induced with increases in both nuclear (1.5-fold) and cytoplasmic (4-fold) levels observed. Additionally, higher doses of MEHP decreased cell proliferation (40%) without altering viability. In summary, these data indicate that male germ cell exposure to MEHP can alter levels and subcellular distribution of regulatory proteins involved in mitochondrial homeostasis and cellular stress response signaling. Studies supported by NIH grants HD-29428 and 039024 to PLM. TMO is a NIEHS Kirschstein-NRSA Postdoctoral Fellow.

Distribution of Periodontal Pathogens in Families. Paul, C., R. Subramaniam, and P. Schneider, Queensborough Community College.

Severe forms of adult periodontal disease are associated with anaerobic gram-negative bacteria, in particular *Prophyromonas gingivalis*, *Treponema denticola*, and *Bacteroides forsythus*. While there is evidence that these bacteria can be spread from person to person through saliva, the impact of demographic variables and household pets on familial infection is largely unknown. This study examined the distribution and routes of transmission of periodontal bacteria among family members. Subgingival plaque samples from patients, their spouses, children and household dogs were tested for pathogens by enzyme assay and DNA analysis. The BANA (N-benzoyl-DL-arginine-2-naphthamide) test detected arginine hydrolase, an enzyme produced by all three periodontal pathogens. The polymerase chain reaction (PCR) detected specific pathogens based on the amplification of signature sequences of the small subunit 16S rRNA genes. We examined the relationship between bacterial distribution, BANA score, clinical parameters (pocket depth, dental history and bleeding on probing) and demographic variables (ethnicity, gender and age). Cynthia Paul and Dianna Quinteros are participants in the NIH Bridges to the Baccalaureate Program at Queensborough Community College (grant 1 R25 GM65096-04).

Investigation of the PKC Substrate, MARCKS in Human Breast Cancer Cells. Perez, R., P. Abeyweera, R. Sullivan and S.A. Rotenberg, Queensborough Community College.

The normal human epithelial mammary cell line, MCF-10A is used to study the role of the serine/threonine Protein Kinase C (PKC) in human breast cancer. MCF-10A express very low levels of PKC. However when the cells are genetically engineered to overexpress PKC, phenotypes associated with metastatic breast cell are observed. The direct substrate of PKC in these cells is unknown. This study investigated the possibility that Myristoylated-Alanine Rich C Kinase Substrate (MARCKS) is a PKC substrate is involved in metastatic phenotypes. Western blot analysis showed reduced phosphorylation of MARCKS in less aggressive human breast cancer cells. The cell sedimentation assay was used to study cell migration. Invasive cancer cell lines were transfected with gain of function and loss of function MARCKS constructs. These results showed that cells overexpressing the loss of function construct had reduced migration. Taken together these studies suggest that MARCKS and PKC play a role in the migration of human breast cells.

An Estimate of Gene Flow in Hudson River and Jamaica Bay Grass Shrimp (*Palaemonetes pugio*) and *Crangon septemspinosa*. Phoolbosseea, M., S. Francois and K. Nolan, St. Francis College.

Shrimp species were collected in the summer of 2006 from the Hudson River and Jamaica Bay in order to ascertain if there was intra-specific gene flow between the two regions. *Palaemonetes pugio* and *Crangon septemspinosa* were the two species found: Length-frequency analyses were conducted. DNA was isolated from 96 samples, and a ~300 base pair 16 S rRNA fragment was amplified from 34 samples. Eight samples (four from Pier 40 Manhattan and four from Jamaica Bay) were sent to Gene Link for DNA sequencing. A Multi Alin was conducted of the eight specimens and a cluster diagram was made. There was no correlation with diversity of the samples with location, which indicated extensive gene flow between the locations. Seven of the eight samples showed divergence of only two base pairs (in pair-wise comparisons). However, one Jamaica Bay sample revealed a 20 bp divergence in all pair-wise comparisons (6% divergence). This could be an example of genetic drift. BLAST was conducted with the samples and the 100 closest matches were determined. A tree was designed which placed *Palaemonetes pugio* with other crustaceans. This work was supported by the Tibor T. Polgar Fellowship Program of the Hudson River Foundation.

The Role of Hypoxia-Inducible Factor-1 in Testicular Torsion Injury. Pirlamarla, P., Monmouth University, Faculty Mentor: Dr. M.A. Palladino.

Testicular torsion occurs when the spermatic artery twists, restricting oxygen to the testis, leading to germ cell-specific damage. Since hypoxia inducible factor-1(HIF-1) regulates oxygen homeostasis in many tissues, we hypothesize that HIF-1 regulates oxygen tension in the testis during torsion. Active HIF-1 contains a hypoxia-dependent α subunit and a constitutively-expressed β subunit. This study aims to determine ischemia (I)/ischemia-reperfusion (I/R) effects on HIF-1 α in the adult rat testis, determine testicular cell types expressing HIF-1 α , and examine mechanisms regulating HIF activation. Unilateral testicular I and I/R were surgically induced by 720° torsion for 1-6h and variable reperfusion and nuclear proteins were analyzed by immunoblotting and immunoprecipitation. Results showed, surprisingly, that HIF-1 α was abundant and non-ubiquitinated during normoxia. Immunoblotting and immunocytochemistry experiments showed HIF-1 α localized mainly in Leydig cells. To examine HIF-1 activation mechanisms, nuclear proteins from freshly cultured Leydig cells, cells cultured at 5% or 21% oxygen, or in 250 μ M H₂O₂ underwent immunoblotting. HIF-1 α in cells at 5% and 21% was significantly reduced compared to fresh Leydig cells. H₂O₂ treatment as a source of reactive oxygen species did not increase HIF-1 α levels. Therefore, active HIF-1 α is present during normoxia in Leydig cells, suggesting they play important roles in testicular oxygen homeostasis.

The Northern Quahog (*Mercenaria mercenaria*), the Blue Mussel (*Mytilus edullus*) and the Ribbed Mussel (*Geukensia demissa*) as Possible Vectors for the Transmission of Dermo (*Perkinsus marinus*) to the Eastern Oyster (*Crassostrea virginica*) Grown in Jamaica Bay, New York. Portnoy, S., A. Atwell and G. Sarinsky, Kingsborough Community College.

Previous research utilizing oysters (*Crassostrea virginica*) grown in Jamaica Bay under controlled conditions, has shown that some have become infected with the protozoan pathogen, Dermo (*Perkinsus marinus*). Oysters infected with Dermo eventually die. Dermo is transmitted from oyster to oyster. Literature suggests that molluscan hosts can serve as important reservoirs for Dermo. Oysters have not been observed in Jamaica Bay in the recent past. We attempted to determine if Dermo is present in the three most common bivalve organisms in Jamaica Bay: the Northern Quahog (*Mercenaria mercenaria*), the Blue Mussel (*Mytilus edullus*) and the Ribbed Mussel (*Geukensia demissa*). If it is present in one or more of these bivalves, it could explain the presence of Dermo in the oysters. Mantle tissue was excised from the three bivalves under study, and from four-year-old oysters grown in Jamaica Bay. These tissue samples were incubated in Ray's Fluid Thioglycollate Medium (RFTM). If present, *P. marinus* will form round hyphospores. The Northern Quahog and the Ribbed Mussel showed positive results while the Blue Mussel did not. The oysters were positive as well. Since 2 of the 3 bivalves tested were positive for dermo, they remain possible vectors for the transmission of dermo to oysters.

Tropospheric Ozone Profiles In The North East. Renee, B.¹, A. Jones², S.A. Austin¹, L.P. Johnson¹ and J. Merrill³, ¹Medgar Evers College, ²City College of New York and ³University of Rhode Island.

Ozone is being linked to health problems, including respiratory system irritation, asthma, increased vulnerability to respiratory infections, hardening of arteries and Alzheimer's disease. Monitoring of ozone is seen as a key to maintaining the highest quality of life. Monitoring of tropospheric ozone and its correlation to stratospheric ozone and meteorological events offers opportunities for long term prediction of ozone concentrations in urban areas. An Electrochemical Concentration Cell, Ozonesonde, was used to measure atmospheric ozone. Attached to a high altitude weather balloon and equipped with a radiosonde, real time data was received and transcribed, giving ozone concentrations as the sondes rose about 100,000 feet. The flights were coordinated by the Goddard Space Flight Foundation as part of the IONS 2006 campaign. Data will be used as part of the ozone monitoring instrument network data validation network. Flights coincided with atmospheric satellite over passes. Simultaneous launches were coordinated with the University of Rhode Island and surface ozone sampling was done in New York City using the GLOBE protocol. The analysis indicates that the ozone concentrations at URI, a relatively industrialized area, and NYC were significantly higher than Paradox NY.

The Effects of Gulls on Water Quality. Richardson, G. and K. Polizzotto, Kingsborough Community College.

In recent years, beach closings due to bacterial contamination have been an issue at Kingsborough Community College in Brooklyn, NY. The New York Department of Health and Mental Hygiene set the enterococcal limit for recreational water at 35/100 ml, and this level was exceeded at least twice in 2005, resulting in beach closings at Kingsborough even while surrounding beaches remained open. Since previous studies have found that gulls are a major source of bacterial contamination, KCC administrators decided in 2005 to purchase a dog to chase gulls from the campus beach. To assess the effectiveness of this plan, we compared bacterial concentrations in the summer of 2006 to those in 2004 and 2005. Bacterial concentrations at another campus beach where the dog did not chase gulls were also tested. We also recorded the number of gulls, the tidal level, temperature, salinity, dissolved oxygen, phosphate, and nitrite on both beaches to determine whether these factors affected bacterial concentration. At the recreational beach, we found no significant differences in average bacterial counts in 2006 compared to the two previous years, and the physical parameters and gull numbers also did not differ appreciably at the two beaches. It appears that the presence of the dog had no noticeable impact on bacterial concentrations.

A Comparison of Algae at Two Beaches in Jamaica Bay, NY. Robbins, A., M.T. Ortiz, K.J. Lewis, A.M. Stavroulakis, and A.N. Zeitlin, Kingsborough Community College.

Algae may affect water quality and health conditions at beaches. In this study two beach sites in Jamaica Bay, NY: Kingsborough Community College (KCC) and Dead Horse Bay (DHB) were studied and compared, to determine if there is a relationship between physical water parameters, algae counts, and beach closings. Physical water parameters (tide, pH, ammonia nitrogen, nitrate nitrogen, nitrite nitrogen, dissolved oxygen, temperature) were measured during July - August 2006 at KCC and DHB using the LaMotte Salt Water Aquaculture test kit. Algae levels were measured using Ward's Water Quality Assessment Kit. In addition, bird, human, and garbage counts were tabulated at KCC beach. Physical parameters at both sites were comparable and within normal ranges. There was a greater diversity of algal organisms at DHB compared to KCC. Algal levels coincided with higher bird counts and increased beach closings in August 2006. Algal counts averaged higher at DHB as compared to KCC (189 and 115 units/ml seawater, respectively). Increased amounts of human-made garbage at KCC beach coincided with higher numbers of recreationists. These data may prove useful for determining water safety limits for marine recreational activities (swimming, fishing). Further, studies will expand upon these data and contribute to recreational safety.

Towards Understanding the Interactions Involving Dihydropteridine Reductase (DHPR) and One of its Inhibitors Methotrexate (MTX). Robinson, E.¹, T. Sivarajah² and R.Z.B. Desamero², ¹Queensborough Community College, CUNY and ²York College, CUNY.

The objective of this study was to understand the interactions involving the ligand, methotrexate (MTX), and the cofactor, nicotinamide adenine dinucleotide (NADH), with a vital enzyme dihydropteridine reductase (DHPR). DHPR is an enzyme that is important in a biochemical pathway that recycles a substance called tetrahydrobiopterin. Tetrahydrobiopterin is essential in the conversion of aromatic amino acids to precursors of neurotransmitters like serotonin and catecholamines. Using fluorescence and vibrational spectroscopy, we hope to gain an understanding of the mechanism involved in the catalytic activity of DHPR. In this particular work, we investigated how MTX interacts with the enzyme. By systematically measuring the spectroscopic characteristic of MTX when in solution by itself and when bound to the protein, we found that MTX interact weakly with the protein.

Control of the Lateral Ciliated Gill Epithelium of *Crassostrea virginica* (Bivalvia) by the Cerebral Ganglion and the Neurotoxic Effects of Manganese. Robinson, J.¹, E.J. Catapano² and M.A. Carroll², ¹Kingsborough Community College and ²Medgar Evers College.

Lateral gill cilia of *Mytilus edulis* are controlled by a serotonergic-dopaminergic innervation from their ganglia. Other bivalves have been studied to lesser degrees. Lateral cilia of most respond to serotonin and dopamine indicating neuro mechanisms. Lateral cilia in *Crassostrea virginica* react to serotonin and dopamine, but little was done with respect to ganglionic control. We examined the role of cerebral ganglia in innervating lateral gill cilia of *C. virginica*. Beating rates were measured by stroboscopic microscopy of gill preparations with ipsilateral cerebral and visceral ganglia attached. Superfusion of gill with serotonin increased ciliary beating rates which was antagonized by methysergide. Superfusion with dopamine decreased beating which was antagonized by ergonovine. Superfusion of cerebral ganglia with serotonin increased beating which was antagonized by methysergide. Superfusion with dopamine decreased beating which was antagonized by ergonovine. Treatment of *C. virginica* with 1mM manganese, a neurotoxin which induces Parkinson's Disease reduced cilio-inhibition caused by dopamine, which is in agreement with the mechanism of action of manganese in humans. This study demonstrates a reciprocal serotonergic-dopaminergic innervation of lateral gill cilia originating in cerebral ganglia, similar to *M. edulis*. This preparation is useful as a model to study manganese neurotoxicity and the pharmacology of biogenic amines.

Role of Environmental Factors in the Eradication of the Lyme Disease Causing Agent: *Ixodes scapularis*. Rosa, D.¹, A. Tuininga², C. Bolnet¹, ¹Medgar Evers College and ²Fordham University.

Ixodes scapularis, the black-legged tick, carries *Borrelia burgdorferi*, the bacterium that causes Lyme Disease. One way to decrease the spread of Lyme disease is by controlling the tick population. One known technique used to decrease tick populations is fungal biocontrol agents that penetrate through the tick cuticles. Potential entomopathogenic fungal species include *Beauveria bassiana* and *Metarhizium anisopliae*. These fungi are most pathogenic at specific temperatures and levels of relative humidity. To test the environmental range at which these species were most virulent, I designed an incubator study in which field-collected nymphal-stage ticks were exposed to either *M. anisopliae*, *B. bassiana* or no additional fungi. There were 10 replicate ticks per fungal treatment in each temperature/humidity combination. Ticks were incubated at a relative humidity of 100%, 95%, 85% or 75% in temperatures of 15° C, 30° C and 40° C over a two week period. I found that both fungi increased tick mortality in comparison to the control ticks, particularly at high levels of humidity. At low humidity or at high temperature, all ticks died quickly regardless of presence of fungi. These findings indicate that entomopathogenic fungi used as biocontrol agents would be most effective at moderate temperatures and high humidity.

Emerging Amphibian Pathogens in Bullfrogs Imported for Human Consumption. Schneider, C.¹, L.M. Schloegel² and P. Daszak², ¹Manhattan College and ²Consortium for Conservation Medicine, Wildlife Trust.

The Chytrid fungus, *Batrachochytrium dendrobatidis*, and the FV3 ranavirus are emerging infectious diseases responsible for a series of amphibian die-offs. This project is part of a multi-year study examining the role of international animal trade in the spread of these amphibian pathogens. Amphibian trade at the Port of New York was characterized by analyzing data from the Law Enforcement Management System (LEMIS) of the U.S. Fish and Wildlife Service. Over a three-year period, New York imported approximately 3.5 million live amphibians, 47% of which were taken from the wild. Brazil (46%), Taiwan (23%), Ecuador (12%), and Hong Kong (12%) were the major exporters. Thirty-five percent of these imported amphibians were ranid frogs. Bullfrogs, *Rana catesbeiana*, were purchased from shops in Chinese enclaves surrounding New York City, Los Angeles, and San Francisco. Toe clips and skin swabs were collected for *B. dendrobatidis* PCR testing, and liver sections for FV3 PCR testing. Analysis of these samples is pending. Of the samples analyzed to date, 45% were positive for *B. dendrobatidis*, and 2.1% were positive for FV3 ranavirus. These results suggest that bullfrogs imported for human consumption play a role in the spread of *B. dendrobatidis*, and the FV3 ranavirus,

Medicinal Plants of the Dominican Republic Used to Treat Lymphatic Filariasis in Quisqueya and Diabetes. Silva, J.¹, E. Rodriguez², A. Veloz³, R. Sano⁴, F. Asmar⁵ and A. Lockhart⁶, ¹Medgar Evers College, ²Cornell University, ³Botanical Gardens, Santa Domingo, ⁴Biodiversity Lab, Ecological Reserve, Punta Cana, Dominican Republic, ⁵Botanical Gardens, Cachote, Dominican Republic and ⁶Montclair State University.

Lymphatic Filariasis is a debilitating and disfiguring disease transmitted by the vector *Culex quinquefasciatus* and infected by the parasite *Wuchereria bancrofti*. It is manifested in the lymphatic system causing blockage and hindering lymphatic response to the disease. In addition to Mass Drug Administrations of DEC and ALB used in the program to eliminate LF, we focused on plants used traditionally to treat this disease. Diabetes is an endemic disease in the Dominican Republic. Poverty, lack of proper nutrition and lack of access to healthcare contribute to the causes as a health disparity. Many Dominicans use plants to alleviate symptoms. Plants were collected from two sites (Punta Cana and Cachote), catalogued, dried, extracted in ethanol and TLC was performed. All plants were assayed for anti-microbial activity. We found some within the families of Zamiaceae, Iridaceae, Basellaceae, Euphorbiaceae and Chenopodiaceae showed zones of inhibition against *B. cereus*, *S. aureus*, *E. coli*, *P. aeruginosa*, *S. cerevisiae*, *C. albicans* and *E. coli*. We concluded that plants traditionally used are effective against microbes, combat high-blood pressure, inflammation, promote general health and in addition to pharmacological treatments, teas, and other herbs can combat this disease.

A Phylogenetic and Environmental Comparison among *Zostera Marina* Ecotypes in Barnegat Bay, New Jersey. Smith, S.M., E.B. Rosenzweig, J.J. Campanella, and P.A.X. Bologna, Montclair State University.

Eelgrass (*Zostera Marina*) is a vital member of coastal communities spanning regions from the tropics to the sub-arctic. It serves as a habitat and food source for many organisms, absorbs wave energy, and its rhizomes stabilize sediment. *Zostera* acts as an indicator of long-term water-quality and a measure of ecosystem health. Over the last 25 years, the eelgrass population in Barnegat Bay, New Jersey has declined by 62%, despite restoration programs. In order to address these concerns, our research has focused on the phylogenetics of the *Zostera* populations in NJ coastal waters. We have employed polymorphic microsatellite DNA markers to study the genetic relationships between eelgrass populations and the ecological fitness of each ecotype in its environment. Preliminary genetic studies of five NJ populations indicate that Sedge Island grasses (geographically most southerly) may be possess the greatest genetic distance from the more northerly groups. Light-stressed Oyster Creek, Ham Island, and Manahawkin Bay populations cluster as a clade, suggesting a common genetic link among them, while the sunlit Barnegat Bay Inlet population is found on a separate phylogenetic branch, distanced from the light-stressed clade. Future studies will include additional genetic loci, NJ populations, and generic/geographic out-groups.

Photoperiod, Mortality, and Egg Pad Size and its Relationship to Paternal Care in *Belostoma flumineum* Say (Heteroptera: Belostomatidae). Tanner, A.W. and S.L. Kight, Montclair State University,

A variety of factors can affect the probability that male giant waterbugs, *Belostoma flumineum* Say, will terminate parental care. Males with smaller broods tend to remove eggs before hatching and seek new matings. Since ambient temperature is known to exaggerate this effect, we studied the influence of photoperiod on both full and partially encumbered males. As day length is a predictor of season, it can be a reliable indicator of how much time remains in the breeding season. We predicted that waterbugs would use this cue in parental decision-making, but photoperiod does not have a significant impact on the likelihood that a male will abort. There was a significant difference between males with small and large broods, which confirms the results of previous studies. An interesting, but unexpected, result of our study was that males bearing large egg pads were significantly more likely to die while brooding. Additionally, while high mortality was constant for males with large pads, males with small pads exhibited increased mortality late in the breeding season. These results suggest that for senescent waterbugs, obtaining/bearing eggs comes at a cost, and that for males with small broods this cost grows higher as they age.

Evaluation of Two Sampling Methods to Assess Vegetation in an Acacia-Scrub Savannah. Tollis, M.¹, F. Mesa¹, G. Seo¹, C. Tuailon², ¹Queens College and ²Nassau Community College.

A rapid evaluation of two sampling methods was conducted on a heavily grazed acacia-scrub savannah in Awash National Park, Ethiopia. The two methods used were a line transect and a quadrat method. The relative density obtained by the two methods was compared. When it was compared to the line transect method, the quadrat method determined a slightly higher relative density for grasses, and a lower relative density for common shrubs such as *grewia*. Common herbs such as *Tribulus cistoides* had a slightly higher relative density when the method used was the line transect. In terms of determination of the ground cover, both methods were equivalent. One major difference between the two methods was in accounting for rarer species: those were more easily missed in the quadrat method than in the line transect, which counted a higher species richness than the quadrat method. If an overall assessment of the vegetation is needed, both methods will give a similar account of the vegetation structure. In an Acacia-Scrub Savannah with a low density of acacia, the line transect method is simpler and quicker than the quadrat methods, and will be more likely to give a better account of the plant diversity.

Eco-pharmacology and the Ability of Native Plants from the Dominican Republic to Prevent Bacterial Growth. Torres, M. and R. Sharma, Montclair State University.

In recent years the use of plants for medicinal purposes has increased throughout the world. Many pharmaceutical companies are relying on plants to discover new treatments for life threatening illnesses. This past summer, a group of students, including myself, had the opportunity to go to the Dominican Republic, an island on the Caribbean, and study native plants. We focused on plants people use in food or herbal infusions, to treat common and serious illnesses. Our goal was to find out (through simple scientific analysis) if any of the plants were able to inhibit bacterial growth. Extracts from *Acacia macrocarantha*, *Momordica charantia*, *Cecropia schreberiana* were added to bacterial plates and used in a zonal inhibition assay. In the experiment, *C. Schebetiana* (roots) were able to inhibit growth of *E. Coli* and *Pseudomonas* while *C. Schrebetiana* (leaves) were able to inhibit growth of *E. Coli* and *Staphylococcus Aureus*. *Acacia macrocarantha* was able to inhibit all of the bacteria tested with a minimal zone of inhibition of 1.5 cm. The implications of these results and the possible active agents involved in the process will be discussed.

Invertebrate Diversity at the Jamaica Bay Wildlife Refuge. Warren, S. and K. Nolan, St. Francis College.

Jamaica Bay Wildlife Refuge (JBWR) is a protected wildlife sanctuary in New York supporting a diversity of species that rely on its marsh, beach, and dune habitats. Ongoing research on the dietary habits of diamond backed terrapins, *Malaclemys terrapin*, is currently being conducted at JBWR to establish a baseline understanding of the feeding ecology of this species in this area so that the population can be properly managed. As part of the larger study, this project focused on serving the invertebrates that could make up the diet of the terrapin in JBWR and be seen in stomach and fecal contents. From May to July of 2006, invertebrate specimens were taken from two habitat types in the refuge: a marshland, (West Marsh) and a beach. From both of these areas a sediment sample was taken in the supralittoral zone and the sublittoral zone. In addition, a seine was used to obtain a sample in the epipelagic zone of each area. Invertebrates were also collected from the shoreline by seine combing. Specimens were sorted using a Nikon dissecting microscope and then identified to genus using Peterson's Atlantic Shore Field Guide. Thirty-eight different invertebrate groups were identified. The use of the Shannon Weiner Species Biodiversity Index was calculated. This work was supported by a NSF UMEB grant.

The Role of Estrogen Receptor Alpha on Sexual and Maternal Behavior in Female Mice. Weitz, A. and A. Ribeiro, Rockefeller University.

It is hypothesized that estrogen receptor alpha (ER alpha) expression in the medial preoptic area (MPOA) in the mouse has an influence on maternal care and behavior. Previous studies suggest that estrogen is required for oxytocin (OT) induced increases in maternal responsiveness and that estrogen regulation of OT receptor expression appears to involve ER alpha. However, ER alpha expression seems to occur in regions in MPOA where there is no difference in OT receptor levels, and suggests that ER alpha may influence behavior through mechanisms that are not related to OT. In this experiment, we suppressed ER alpha communication and examined the effect it would have on sexual and maternal behavior in the female mouse.

Adenoviral Transfer of the Melanoma Differentiation-Associated Gene 7 (*mda7*) Induces Increased Expression of the Ryanodine Receptor (RyR) in (LnCaP) Prostate Cancer Cells. Williams, C.¹, S. Naikadie², R. Li¹, P.B. Fisher³, A. DePass¹, ¹Long Island University, ²Harlem Children's Society and ³Columbia University,

Melanoma Differentiation Associated Gene-7/Interleukin-24 (*mda7*/IL-24) specifically induces apoptosis in cancer cells. It was discovered using a subtraction hybridization screen of human melanoma (HO-1) cells whereby growth arrest terminal differentiation were induced by treatment with a combination of INF β and Mezerein. Its anti tumor effects, modulation of immune responses, synergy with radiation and its ability to discriminate between normal and cancer cells and success in clinical trials demonstrates tremendous promise in its potential as an agent for differentiation therapy to treat cancer. Although its anticancer effects are widely known, details of the mechanisms necessary for its activity remain to be elucidated. RT PCR was used to examine the impact of *mda7* treatment of human prostate cancer cells (LnCaP) on the expression of RyR that regulates intracellular calcium release from the endoplasmic reticulum, often as part of a signaling event. We report that with mRNA analysis of RT-PCR, within 24 and 48 hours of *mda7* treatment there is a distinctive increase in expression on RyR compared to the expression of cells that were not treated with *mda7*. Western blot analysis shows protein expression of MDA7 after 24 and 48 hours treatments. Protein expression analysis of the RyR is still underway.

Effect of Heavy Metals on Glutathione S-Transferase Activity in Digestive Gland of the American Oyster, *Crassostrea virginica*. Wiltsie, K., M.A. Carroll and E.J. Catapane, Medgar Evers College.

Heavy metals are common aquatic pollutants. Bivalves are often utilized for metal monitoring and bioaccumulation studies but little is known about biochemical responses to metal accumulations. Metal accumulations increase oxidative stress by including depletion of important cellular antioxidants such as the thiol reduced glutathione (GSH). Glutathione S-transferases (GSTs) are Phase II detoxification enzymes utilizing GSH in conjugation of electrophilic substrates. Extensive research has been done in mammals. Less is known of its activity in oysters and invertebrates in general. Here GST activity of post-mitochondrial fraction of *C. virginica* digestive gland in response to acute additions of silver, manganese, cadmium, copper, mercury and iron was measured. The enzyme's specific activity was calculated using the conjugate's molar extinction coefficient. We found the metals, except iron decreased GST activity. We studied effects of a 2 day incubation with cadmium (8.4 - 67.2 $\mu\text{g/ml}$). The treatments had no significant effects, indicating the animal may be able to protect against short term insults. Understanding toxicological effects of metal pollutants on *C. virginica* will assist federal and local regulators in making informed environmental decisions that protect aquatic ecosystems, improve water quality of the New York harbor area, and advance restoration efforts.

Expression of Neutrophil Gelatinase-Associated Lipocalin in Kidney Development. Zhitnikova, M., M. Suzuki and P. Devarajan, Cincinnati Children's Hospital.

It has been shown that molecules which take part in tubular regeneration are also highly expressed during kidney development [1]. The process of tubular regeneration after kidney injury is poorly understood, therefore studying the function of molecules in kidney development and kidney injury may shed insight on the kidney repair mechanisms as well as disease. Neutrophil gelatinase-associated lipocalin (NGAL), a member of the lipocalin superfamily was recently shown to be one of the maximally induced genes early in ischemic renal injury and reported as an early biomarker for ischemic and nephrotoxic renal injury. Although NGAL has been considered to induce nephron formation in embryonic kidney [2], the precise expression of NGAL during nephrogenesis is still unclear. NGAL expression in mouse developing kidneys was detected from E11.5 to PND1. The amount of its expression increased at E13.5, remaining abundant by E16.5, and began to diminish at E17.5. NGAL signals were detected in a punctate cytoplasmic distribution as well as in a linear distribution along the cell membrane.

Incorporation of *p*-Fluorophenylalanine into Histone Acetyltransferases: Structural and Functional Analysis. Zhu, Y., N. Voloshchuk and J.K. Montclare, Polytechnic University.

Incorporation of fluorinated amino acids can be used to design stable protein motifs with improved thermal stability and resistance against denaturants as well as protease degradation. If properly engineered, these proteins will exhibit great potential for medicinal purposes. In this study, we will be utilizing the cell to biosynthetically replace natural amino acids with non-natural amino acids analogs. Histone acetyltransferases (HATs) represent a group of proteins that acetylate histone tails using acetyl coenzyme. Here, we explore the incorporation of phenylalanine analog, *p*-fluorophenylalanine and its effect on the structure and function of the HAT protein, tGCN5. As part of the structural analysis, high pressure liquid chromatography (HPLC) will be used to investigate the protease degradation of tGCN5. With an understanding of how the fluorinated analog influences protein stability and activity, we plan to utilize directed evolution—a biologically based selection system— to alter its selectivity to create artificial acetyltransferases capable of selectively triggering gene activation.

The 2006 Benjamin Cummings/MACUB Student Research Award Posters

Molecular Mechanisms of IL-10 Mediated Modulation of Dendritic Cell (DC) Activity During Early Stages of Development. Martin, C.A.¹, M.P. Espaillet¹, D. Huestis¹ and F. Santiago-Schwarz^{1,2}. ¹Farmingdale State University and ²State University of New York at Stony Brook.

Dendritic cells (DC) comprise a complex lineage system that orchestrates varied immunological responses. DC function is linked to maturation stages. Immature mono-DC (iDC) avidly ingest/process antigenic material; DC that mature completely in response to proper extra-cellular cues are specialized in antigen presentation and in activating antigen-driven T cell responses. Maturation arrest of mono-iDC is an important regulator of T cell immunity. While immunomodulatory cytokines such as interleukin-10 (IL-10) arrest DC maturation and promote non-antigen presenting "DC" growth, molecular mechanisms linked to these events are unclear. We previously reported that elevated levels of heat shock protein (HSP)/HSP receptors and reduced levels of histocompatibility complex (MHC) class I are novel processes associated with immunogenic mono-DC development. Here, we hypothesized that the effects of IL-10 on DC activity includes altering these events. We analyzed DC morphology, surface marker expression and function in the absence/presence of IL-10 using photomicroscopy, flow cytometry, phagocytosis and T cell stimulation based assays. Our results confirm previously reported IL-10 effects on mono-DC. We also noted changes in the HSP/MHC I response, in the ability of DC to stimulate T cells, and a dramatic change in cellular morphology that was associated with increased ingestion (but not processing) of soluble antigen. This work was supported by Farmingdale State University institutional research funds, the Arthritis Foundation (Long Island Chapter) and a Benjamin Cummings MACUB student research award.

A Preliminary Study of a Gamma Irradiated Forest, Brookhaven National Laboratory, New York. Cerami, M., M.H. Choo and R. Stalter, St. John's University.

The objective of our preliminary study was to compare community development on four vegetation zones and a control, 40 years after exposure to gamma radiation. In 1962, George Woodwell, Brookhaven National Laboratory, subjected a pine oak forest to ionizing radiation which altered the normally stable pattern of ecosystem behavior. Difference in sensitivity among vascular plant species subjected to gamma radiation was pronounced. At the end of the two years study, Woodwell found that the zone at the gamma source receiving greater than 63,000 roentgens (R) was devoid of vegetation. *Carex pensylvanica* was dominant in the zone receiving 27,000-63,000R, ericaceous shrubs were dominant in the zone receiving 11,000- 27,000R while oaks dominated the zone receiving 3,000-11,000R. The original pine-oak forest served as a control. Vegetation was sampled in each of the aforementioned four zones and control the pine oak forest, during the spring and summer, 2006 to determine rates of recovery of vegetation after a forty year interval of exposure to gamma radiation. At least 30 quadrats were established in each zone to sample vegetation. *Pinus rigida* has invaded the zone devoid of vegetation and is the dominant species at this site. The sedge zone is stable and continues to be dominated by *C. pensylvanica*. The relatively stable shrub zone is dominated by ericaceous shrubs, notably *Vaccinium* spp. and *Galyussia baccata*. The oak zone is dominated by *Quercus* spp., while the pine oak forest (control) is populated by *Quercus* spp., and *Pinus rigida* as it did before exposure to gamma radiation.

Investigations into the Effects of Cranberry Juice Cocktail Drink, Concord Grape Juice Drink, and Proanthocyanidins, on the *In Vitro* Inhibition and the *In Vivo* Infectivity of Reovirus-Induced Gastroenteritis in Athymic Mice. Afaneha, T.A.¹, J. Burdowski², G. Stotzky³, A. Burdowski¹ and S. M. Lipson¹, ¹St. Francis College, ²Univ. of Wisconsin and ³New York University.

Comestible juices and endogenous plant components from cranberry (*V. macrocarpon*) or concord grape (*V. labrusca* cultivar) species have been suggested to have beneficial effects on human health (e.g., reduction in hypertension, cholesterol levels, arteriosclerosis, and most significantly, urinary tract infections (UTIs)). Cranberry juice-associated reduction in UTIs is recognized by public health and medical personnel. The purpose of this study was to investigate the potential effects of cranberry (CJ) and concord grape juices (CGJ) and their polyphenolic proanthocyanidin (PAC) constituents as natural antiviral agents. Reovirus type 3, was used as a model virus system. Testing was performed using a commercially prepared cranberry juice concentrate [NutriCran-90™ (NC-90)], and a fruit solid extract [NutriCran-100™ (NC-100)]. At 20% concentrations of NC-100 and NC-90, reovirus infectivity titers were reduced to ca., 20% of control. CJ concentrations of 50% reduced reovirus infectivity titers to ca., 85% of control. These differences probably reflect the increased proanthocyanidin (PAC) concentration in the NC-90™ and NC-100™ cranberry extracts. At a grape juice concentration of 10%, reovirus infectivity loss surpassed 90%. Minimal synergistic activity occurred between CJ and CGJ. Antiviral activity was tested using purified high and low molecular weight cranberry PAC fractions (CB HMW and CB LMW, respectively), a cranberry flavonol glycoside (CB EToAc), cranberry anthocyanins (CB CA), and a grape PAC. Among the PAC fractions, reovirus infectivity titers were reduced from 75% (of control) to undetectable levels at [PAC] concentrations ranging from 10 to 20%. Virus infectivity remained unchanged upon challenge with CB CA. Reovirus loss of infectivity titers were observed among each fraction in the order grape PAC > CB LMW > CB HMW > CB EToAc. Subsequent treatment of CB HMW PAC by probe homogenization enhanced this extract's antiviral activity to levels equal to that of grape PAC. Reovirus titers progressively decreased from 35% (after 10 min) to 15% (after 60 min) in the presence of a 10% grape juice suspension. Utilizing a higher grape juice concentration (20%), no viral RNA was detected in suspension after a 30 min incubation at room temperature (23°C). Gavage inoculation of athymic mice with virus and cranberry or grape suspensions inhibited symptoms of gastroenteritis. Mortality occurred in positive control mice 2 -3 days after inoculation; Positive control mice displayed systemic hemorrhage, diarrhea, and/or dehydration. Our data suggest a potential efficacy of cranberry and grape juices as naturally occurring enteric antiviral agents.

Effect of MAP Kinase Signaling Pathways on Contact Inhibition. Rothenberger, E., M. Slisz and D. Hutter, Monmouth University.

In normal fibroblasts at contact inhibition, there are variations in the levels of phosphorylated (active) MAP kinases and MKPs. Upon contact inhibition there are increased levels of MAP kinase phosphatase-1 (MKP-1), MKP-2 and MKP-3 proteins and a decrease in phosphorylated extracellular signal-regulated kinase (ERK). Fibrosarcoma cells, which do not show contact inhibition, do not have the variations in the levels of the active MAP kinases and MKPs. These data suggest a correlation between cell growth and MAP kinase/MKP activity. Whether these changes are a cause or an effect of the contact inhibition, however, is not known. Altering the levels of MKPs and/or the levels of MAP kinases would show the direct effects of these proteins on cell growth. It is hypothesized that the over-expression of MKPs in normal and cancerous cells will show a decrease in cell growth. Similarly, it is expected that over-expression of phosphatase-resistant MAP kinases will allow normal fibroblasts to overcome contact inhibition. Cells will be transfected with a vector to over-express MKPs. MTT assays will be used to measure the effect of the transfected constructs on the growth of the cultures. Western blot analysis will then be used to confirm the expression of the constructs.

The 39th Annual MACUB Conference Faculty Presentations



Quantitative Studies on the Effects of Environmental Estrogens on the Testes of the Guppy (*Poecilia reticulata*). Nielsen, L. and E. Baatrup, Biological Institute, University of Aarhus, Denmark.

There is concern that estrogens that enter into the water system, such as by sewerage effluent, may affect the reproductive capabilities of aquatic animals. The guppy (*Poecilia reticulata*) was chosen as a model organism to test the level of reproductive disturbance. Male guppies were exposed to environmentally realistic levels of estrogen: 10ng and 50ng 17 β -estradiol, and 10ng, 50ng and 200ng 17 β -ethinylestradiol. After exposure time of 3.5 months, specimens were euthanized and testes removed for histological examination, applied in conjunction with stereological technique. Alterations in quantity of sperm, decreasing intensity of body coloration, and increase body weight were generally significant only in the group exposed to 200ng/L 17 β -ethinylestradiol. No significant changes were seen in GSI. Quantification of the developmental stages of spermatogenesis indicated a trend of greater representation of later stages in specimens exposed to low doses of estrogen, and greater prevalence of early stages in those exposed to high doses of estrogens. Based on the results of this study, environmentally relevant levels of estrogen do not seem to pose a reproductive threat to guppies. Guppies are perhaps not an ideal test organism for estrogenic exposure due to limited sensitivity. Stereological histology can be considered a valuable tool in quantifying estrogenic effects upon fish gonads.



The Role of the UCR of the LT Operon in Response to Osmotic Stress and to Gyrase Inhibitors. Trachman, J., Hostos Community College.

Many of the cases of diarrhea in man and agricultural animals are caused by enterotoxinogenic *E.coli* (ETEC) strains which produce heat-labile enterotoxin (LT). Understanding LT genetic regulation will lead to a better understanding of how ETEC cause disease as well as to the development of improved vaccines. Progressive deletion of the upstream control region (UCR) located upstream of the promoter leads to progressive decreases in LT expression. The UCR is not involved in LT thermoregulation. LT thermoregulation involves binding of H-NS with LT-A subunit DNA, a region called the Downstream Regulatory Element (DRE). The operon is thermo-osmotically regulated; however, H-NS and the LT DRE do not seem to play a role in the LT osmoregulation. We are now investigating the role of the UCR with respect to LT osmoregulation as well as other aspects of LT osmoregulation such as titrating the effects of various commonly used osmolytes such as sodium chloride. LT, like other H-NS sensitive promoters, is sensitive to supercoiling changes. Gyrase inhibitors influence LT operon expression. The role of the LT UCR with respect to the operon's sensitivity to the gyrase inhibitors, novobiocin and naladixic acid, is being investigated. Results of some of these experiments will be discussed.



The Affect of Goose Grazing on Standing Crop and Seed Production of *Spartina alterniflora* in Jamaica Bay Salt Marsh. Resnicoff, M.¹, L. Ames-Dmoch¹, M. Bayer², P. Nguyen¹ and R. Stalter³, ¹Borough of Manhattan Community College, ²Jamaica Bay Wildlife Refuge and ³St. John's University.

The objectives of this study were to determine the affect of goose grazing on the standing crop of *Spartina alterniflora* at Jamaica Bay Wildlife Refuge, New York and to compare the affect goose grazing on seed production of grazed and control (no grazing) plots of *S. alterniflora*. In September 2005, ten 0.25 m² quadrats plots were established in goose grazed and control portions of Jamaica Bay salt marsh. The culms (stems) of *S. alterniflora* within each plot were cut at ground level and brought to the laboratory where samples were dried and weighed. Seeds were removed from the inflorescence from plants in each quadrat were counted and weighed. The standing crop of *S. alterniflora* in the goose grazed plots was significantly lower than the standing crop of the control (no grazing) plots. The number of seeds produced in the grazed plots was lower than the number of seeds produced in the control plots, but not significantly lower (P 0.08). Goose grazing of *S. alterniflora* may contribute to the continued decline of tall marsh cord grass in Jamaica Bay salt marshes, where salt marsh loss has been calculated at a rate of approximately 17 hectares a year from 1924 to 1999.

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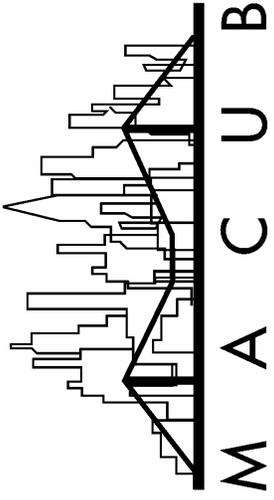
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The 39th Annual MACUB Conference Highlights

**by Carol Bierman,
Kingsborough Community College**

The 39th Annual MACUB Conference, *Highlights of Neuroscience*, was held on October 28th at Kingsborough Community College. Despite the nasty weather outside, there were close to 300 people in attendance, with over 75 poster presentations by students from many colleges in the metropolitan area. Attendees were treated to a morning repast provided by John Wiley & Sons. Our morning keynote speaker, Kenneth Wesson, is known world-wide for his expertise in the field of neuroscience. He presented a stimulating talk on education and brain development. Students and faculty alike enjoyed his witty, informative presentation as noted by the many questions and comments following his talk. After a nutritious lunch, where all in attendance were able to hold meaningful conversations, the group reconvened to hear our afternoon keynote address given by Dr. Evan Balaban, of McGill University. Dr. Balaban discussed his fascinating research on interspecific brain cell transplantations between quail and chicken embryos. He discovered that the transplanted quail midbrain cells changed the chicken's sound patterns and head movements. Dr. Balaban cautioned the audience about trying to apply basic research to the medical field without extensive verification of results and comprehensive knowledge concerning how the central nervous system works. His talk also focused on the issue of the importance of repeatability of findings in all areas of scientific research. Often, researchers are pressured to publish their findings prior to extensive verification due to the nature of scientific funding and other factors. Dr. Balaban discussed a study that examined the results of previously reported research and negated the initially reported results, illustrating the need for caution. This was an important lesson for all concerned with the field of science. Dr. Balaban's presentation was well received. Afternoon breakout sessions followed. The student ice cream social, presented by Kelly Scientific Resources, was a big hit. The Kelly team focused on resume writing and job-hunting opportunities in the sciences. Kingsborough's President, Dr. Regina Peruggi funded the social. Member paper presentations and workshops on *STEM*, *the Use of the Motoc Camera and Image J*, and *Evolution* workshops rounded out this exceptional day.





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