Nan Smith, UF Professor Emeritus

Interview Notes from meetings with Israeli Scientists supporting the art work "Mercury"; an installation conveying science through art

Site visits were conducted at the following Marine Labs in Israel -

(1) National Center for Mariculture in Eilat
(2) Israel Oceanographic and Limnological Research LTD. in Hafia
(3) Kinneret Limnological Laboratory in Migdal near Tiberias
(4) Mekorot - Sapir Center at the Sea of Galilee (Lake Kinneret) in Migdal near Tiberias

National Center for Mariculture in Eilat

I met with **Dr. Arik Diamant,** former Director of the National Center for Mariculture who gave me a tour and orientation to the lab, facilities and outlying study areas. I was able to view the Mediterranean Sea and locate the sea borders with Jordan and Syria. He also took me on an informal tour of Eilat. The center has a large research team and a state-of-the-art lab. This large facility is governmentally funded and seeks international grants and partnerships the support their collaborative and individual research projects.

Dr. Bill Koven and Dr. Amos Tandler work collaboratively and met with me to discuss my project as a team. We discussed the Bluefin tuna, Transdott their most recent research about Bluefin tuna aquaculture, and the state of the species. We discussed how the fish are grown from larvae. They are slow growing fish that grow to be only 3 inches long after 40 days of cultivation. Dr. Koven and Dr. Tandler are researching the domestication of the Bluefin tuna. They e-mailed me resource links, suggested "The end of the Line, a Canadian documentary, the book, "No Safe Place" (about Minamata disease). Dr. Koven allowed me to videotape his commentary on raising Bluefin, its endangered status and the need to protect this species. He also spoke in depth about heavy metals in fish. I photographed their lab and fish tanks. I was able to see and photograph two juvenile Bluefin tuna that were raised from larvae and were approximately 40 days old. They expressed concern for these were the only two surviving juveniles from the 3000 that were hatched. Seeing the color of these small specimens in person was invaluable. Dr. Koven also sent images of larva for possible use as images within my digital photo-montages.

Israel Oceanographic and Limnological Research LTD. in Hafia

Dr. Barak Herut is the Director of the IOLR. His research has been focused on environmental pollution through heavy metals. Dr. Heirut and Dr. Kress told me that they have family members who are artists. They were excited and interested in an art work that would convey information derived in scientific research through creative imagery. Dr. Herut brought up the image of the Mad Hatter as one associated with craziness, and that there was supposed to be mercury in his hat. He also spoke about Galileo and mercury; as well as Minamata Disease. He shares a European Project that focused on Mercury in Aerosols directed by Dr. Yaakov Mamane, an Israeli scientist and Professor at the Technion University. His grant was funded by the European community and looked at the whole east Mediterranean area.

Dr. Herut pointed out that heavy metals are found on earth naturally, so metals are a natural phenomenon. These can be a source of pollution. Other heavy metals are bio-magnified and bio-

accumulated. The pollution we are experiencing is manmade although heavy metals can be found in nature. For instance, he said that oil leaks exist in the Gulf of Mexico. All water and soil have mercury naturally and some in high levels. Pollution can be defined as metals that come through manmade sources; through industry or through mining; i.e. gold mines produce mercury. His point was that mercury can be essential for a living environment. However, when we are talking about pollution, we are talking about the extra levels of mercury which are released into the environment. This is the heavy metal that bio-magnifies through the food web. **He told me that Mercury can be immobilized and made non-available by introducing selenium. He also said that fat in the body locks in mercury and is a protection.** Dr. Moshe Tom, another Israeli scientist research centers upon molecular metals and enzymatic processes that react to mercury contamination. He suggested acquiring his papers about the topic. Dr. Herut said, you can see early warning indicators for mercury contamination; you can see the response of the organism to being contaminated by mercury.

The rest of the interview was really an, in depth, research discussion about methylmercury pollution and was captured on videotape.

Dr. Nurit Kress is a chemist working at the IOLR. Dr. Kress told me that mercury emissions are transported through the air first. She explained that 350 degrees centigrade –is its low boiling point which causes mercury to become airborne. In coal production the emissions are collected and contained by scrubbers that must be safely disposed of.

She e-mailed me links for articles about mercury:

> "Mercury – this is the Problem", by Marion Boros, New York Times – 2008.
>
> www.haaretz.co.il – a source for articles on environmental issues.
>
> "Transition Metals in MA", www.sciencemag.org – Science Vol. 281, 10 July 1998, Page 207. Mercury (Hg) is a transition metal on the Periodic Table. It has a liquid boiling point of 357 degrees centigrade.

Dr. Kress next discussed how mercury is measured in a fish. She told me that the fish is weighed (the part to be measured is extracted), dried in a low-pressure vacuum area to remove the water content. This is weighed out as a gram of dry material. They then put this into a test tube, add acid, microwave it. The result is all the flesh is digested like in the stomach. This is diluted to a certain volume. One it is in solution it is placed in the instrument to get a measurement. PS Analytical makes the machine that measures mercury only. Mercury is in an ionic state. Mercury is 0. They measure the fluorescence of the atom. Florescence is y=ax+b. What is fluorescence? The machine excites the mercury atom and it emits light in a different wave length. So, the measurement would be expressed Mercury plus 2?

She encouraged me to visit the Monterey Aquarium to see their collection of Bluefin tuna for they are on the San Francisco Bay where these salt water fish live. The Monterey Bay has a research institute called the Monterey Bay Aquarium Research Institute. This institute and the University of California in Santa Cruz are doing significant research on Mercury.

Dr. Efrat Shoham-Frider (efrat@ocean.org.il) recently completed her doctoral research on methyl-mercury. Dr. Shoham-Frider was also very excited about the project and struck that an artist was interested to convey mercury research and a public warning through art. In her opinion the key scientific message from science to the public is that mercury has many chemical forms or species. Each species has its own characteristic. Some species are toxic, some are not. For instance, Hg- called quicksilver is the metallic form of mercury and is not toxic; whereas, di-methylmercury, a gas is toxic. Methylmercury, an organic form of mercury is also toxic and enters the food web easily. This form is responsible for Minamata Disease. She explained that sediment receives all sorts of Hg species when conditions are appropriate for bacteria. Without oxygen methylation can occur. Methylmercury exists in nature especially in the sea and in many animals… for instance in dolphins and in whales. It may not be in fish or in humans. These animals have a natural defense against mercury which is selenium (SE). Selenium is found in their liver and captures the mercury and forms the compound mercury solenoid – HgSe. Mercury solenoid is an inert mineral that cannot be attacked by enzymes and this keeps this form of mercury non-toxic.

Research has been conducted in Israel by the waste water plant in the central part of the country which has discovered mercury in the sludge. It is evident that mercury is going out into the sea through this sludge which combines with bacteria.

Inorganic mercury is not usually toxic. Organic mercury is dangerous because it can penetrate the membranes of the cells. Eating fish is about the concentrations of mercury in the fish eaten, the person, and the person's dietary intake.

Minamata Disease occurred in that area of Japan because there was a factory polluting the bay which emitted methylmercury into the food web of which fish, cats, humans were impacted. Exposed cats appeared to be drunk. The mercury can penetrate the brain cells. She suggested viewing the many films about Minamata Disease in Japan currently available for viewing on YouTube. Dr. Shoham-Frider also spoke about an Iraqi toxic mercury event. She said that pesticides in wheat fields went through the crop and contaminated the wheat harvested from these fields. The bread eaten was contaminated by methylmercury.

In conclusion she stated, "Methylmercury is bad for us because this form of mercury can enter the blood barrier of the brain. The blood barrier of the human brain is the natural protection for the brain, but it does not keep methylmercury out of the brain. Symptoms of mercury exposure or Minamata's Disease are shaking, blindness, loss of hearing, loss of memory and finally death. Methylmercury can enter the brain and greatly impact the human nervous system. The effects are like those seen in brain damage victims culminating in certain death.

Kinneret Limnological Laboratory in Migdal near Tiberias

Dr. Tamar Zohary, Director of the Kinneret Limnological Laboratory met with me to offer a history of the lab and it research agenda. I was shown maps of the lake and their study area. The lab has been monitoring national water collection from Lake Kinneret from 1969 when they began pumping water from the lake for use. One third of the research done is monitoring the water quality of the lake to track

its physical and chemical characteristics. The lab is mostly a research organization that gives advice to the Israeli government. This research varies according to the needs that result from monitoring the lake. The scientists employed consider the food web, chemistry, geo-chemical processes, what comes from the drainage basin to the lake. For instance, the study what flows in from the Jordan River. They track pesticides that come from the catchment.

Dr. Zohary discussed the causes of environmental contamination. She told me that whatever feeds the lake's drain basin impacts the lake and can contaminate it. Mt. Hermon which is the highest mountain in Israel feeds Lake Kinneret's catchment, the Hilla Valley.

Mekorot - Sapir Center at the Sea of Galilee (Lake Kinneret) in Migdal near Tiberias

The water station has educational lectures for families to teach parents and children about the need for water conservation in Israel and about what the government is doing to sustain this natural resource. I attended a presentation and was impressed by the interactive nature of the dialogue. The center visitors had many questions and both adults and kids actively participated in what seemed to be an exciting discovery about water in Israel.