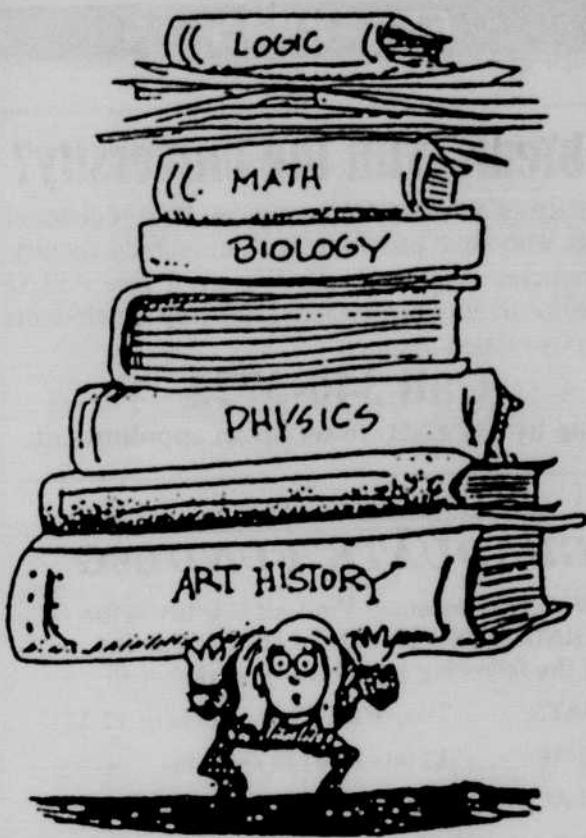


**ACADEMIC LEARNING SERVICES  
WINTER TERM 1994 SCHEDULE  
TEST PREPARATION WORKSHOPS**



**GRE Preparation: \$75**

(Test: Feb. 5, 1994)  
Tuesdays & Thursdays  
Jan. 18, 20, 25, 27; Feb. 1, 3  
6:00 pm - 8:00 pm  
Feb. 2 - practice exam  
5:30 pm - 9:00 pm

**LSAT Preparation: \$95**

(Test: Feb. 12, 1994)  
Jan. 11, 13, 18, 20, 25, 27  
3:30 pm - 5:00 pm  
Feb. 1 - practice exam  
3:30 pm - 6:30 pm

**GMAT Preparation: \$75**

(Test: Jan. 15, 1994)  
Tues., Weds. & Thurs. Jan. 4, 5, 6  
3:30 pm - 5:00 pm  
Saturday, Jan. 8  
9:30 am - 11:30 am; 12:30 pm - 2:30 pm

**MCAT Preparation: \$200**

(Test: April 23, 1994)  
Saturdays  
Feb. 26; March 5, 12, 26; April 2, 9, 16  
9:00 am - 4:00 pm

**TI-81 Graphing Calculator: \$25**

Tuesday, Wednesday & Thursday  
Jan. 11, 12, 13  
3:30 pm - 5:00 pm

To register contact A.L.S. at 346-3226

**Science finds use for  
Navy listening posts**



BELLEVUE, Wash. (AP) — Once, this nation trained giant electronic ears on the ocean, listening for Soviet submarines traveling its depths.

Now, with the Cold War waning, scientists are being given access to those Navy listening posts. One group is listening to undersea earthquakes, another to whales. A third seeks to gather evidence on global warming by measuring how fast low-frequency sound travels through vast stretches of ocean. (The warmer the water is, the faster sound will travel.)

Among the partners in this third project is the University of Washington's Applied Physics Laboratory. Founded during World War II to solve torpedo problems for the Navy, the laboratory still does a lot of defense research. However, as lab director and Bellevue resident Robert Spindel says, nowadays "a lot of the problems we worry about as a nation are environmental problems, and a lot of those problems have to do with oceans."

Another group of Applied Physics Laboratory scientists headed by Kirkland, Wash., resident Jamie Morison has been engaged in another "swords-into-plowshares" effort to measure global warming and to understand what's happening in the oceans. Morison and Bellevue resident Roger Colony participated in a U.S. nuclear submarine's first civilian mission, spending six weeks this summer amid and beneath Arctic Ocean ice.

There is debate, Spindel says, over whether buildup of greenhouse gases is causing irreversible global warming by trapping heat. Some say yes. Others say the effect is self-limiting. They say that as the earth warms up, evaporation and cloud formation increase, less solar energy gets through and the earth cools back down.

What's needed is a means of taking the earth's temperature repeatedly over time.

Right now, Spindel says, most temperature measurements are taken on land near population centers. There's no question that cities are heating up — but that doesn't necessarily mean that the rest of the planet is.

Also, land temperatures are hugely variable — which makes it difficult to detect changes in the magnitude of a few hundredths of a degree per year. The temperatures of the deep waters of the oceans, on the other hand, are very stable.

To measure changes in the temperature of a particular ocean, you could monitor the readings of a large number of thermometers strung from one side to the other — or, says Spindel, you could set out one transmitter and one receiver and periodically measure the speed at which sound traveled from the one to the other. This is possible because loud, low-pitched sound travels easily through water; it's detectable many thousands of miles away unless blocked by some underwater mass.

Scatter a number of transmitters and receivers around the ocean basins of the world, he adds, and you'd get a good picture of ocean temperature changes all over the planet.

Just how many transmitters and receivers would be necessary is still being worked out. "We think maybe 10 transmitters and 30 receivers," says Spindel.

The first transmitter was installed this spring off Kauai, Hawaii, and is being listened to by Navy receivers in the Pacific. Another is being installed off the coast of California near Monterey.

Transmitting underwater sound is not without controversy.

Some scientists are concerned that marine animals are being bombarded by man-made sounds from such sources as industrial underwater explosions, ocean drilling, ship engines and submarine sonar devices. Some experts have observed that loud sounds can frighten whales away from their usual migration routes; others say loud and underwater sounds may damage the hearing of certain animals, which could impair their ability to communicate and navigate.

Spindel agrees that this is a concern. However, he believes that the effects of the 195-decibel sound being used in the ocean temperature study should be minimal because transmissions will be as infrequent as possible — perhaps once a week for 30 minutes. Also, Spindel says, carriers and other ships produce sound that's just as loud — and so can whales.

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