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LETTERS

Glowing reviews

RUBY/MCFALL/NGAI/ORMEROD

Applause is given to scientists who have helped unlock the secrets of cultivating a new research "model" of animal-microbe symbiosis: a Hawaiian squid that harbors glow-in-the-dark bacteria (right). Questions about radiation and cancer dose-risk theories are raised: Is there a threshold below which exposure to radiation can be deemed safe? Is acute or continual exposure more dangerous? According to public health specialists, many lives could be saved by acknowledging the safety of plasma-derived hepatitis B vaccine in developing countries. And theories of immune system functioning and evolution are discussed.

Squid Pro Quo?

I was pleased to see the coverage in Random Samples (5 Apr., p. 37) of the new little squirt (*Euprymna scolopes*) now under culture at the Marine Biological Laboratory (MBL). It is exciting to have a new squid in the village and to look forward to the future research use of the organism.

It seems appropriate, however, to also credit the work of the scientists who are making this development possible. Roger Hanlon, the MBL's Director of Marine Resources, working with Paul Dunlap, Susan Ashcraft, Michael Claes, and others, have conducted the first significant egg-to-egg cultivation of *Euprymna* since they were raised by John Arnold in Hawaii (the squid's home waters) in the 1970s (*1*). Without the provision of a stable source of these fascinating cephalopods, *Euprymna*-based research could not progress to its next stage.

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References

1. J. Arnold, C. Singley, L. William-Arnold, *Veliger* **14**, 361 (1972).

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Risks from Low Doses of Radiation

We disagree with some of the statements in Marvin Goldman's Perspective (29 Mar., p. 1821) challenging the traditional linear-nonthreshold paradigm for estimating cancer risks at low doses of ionizing radiation. It contains, in our opinion, a number of misleading interpretations of scientific data and ignores the considerable weight of evidence in support of linearity.

It is widely accepted that carcinogenesis is a multistage process in which a single cell gives rise to a tumor, with mutation of cellular DNA required in one or more of the steps leading to malignancy. Since cancer is a common disease, obviously the background rate for each of these steps is not zero, and any filtration mechanism for removing precancerous cells is imperfect. Therefore, any exposure that increases the rate of somatic mutations would be expected to increase the risk of cancer. Radiation is believed to be mutagenic down to the lowest doses, as ionization clusters generated by a single track can produce DNA damage that is not always faithfully repaired. Consequently, a threshold for radiation carcinogenesis seems unlikely.

Goldman states, "We now know that continual radiation exposure is less carcinogenic than acute exposure, all else being equal." Although this has been demonstrated in laboratory experiments, the limited evidence in humans suggests that the reduction risk is generally very modest (about a factor of 2 or less) (*1*, *2*). Goldman writes that comparative studies of cancer rates in areas of differing background levels are suggestive of a beneficial effect of radiation but does not point out that most epidemiologists consider such "ecologic" studies to be noninformative because of statistical limitations and potential confounding. He cites data on bone cancer induction by ingested radium as evidence that the latent period between irradiation and cancer expression increases with decreasing dose rate to suggest that there may be a "practical threshold" at low dose rates, below which the latency would exceed the lifespan. A refutation of this interpretation of the bone cancer data has been published by Mays (*3*), and there is no suggestion at all of a varia-