

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：科學英文閱讀測驗【海生聯合碩士班】

題號：468002

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1. Translate the following words into Chinese (10 points; 1 point each):

manipulation; strategy; accuracy; standardization; parameter; optimization; subjective; evidence; diagnosis, inductive reasoning

2. Translate the following words into English (10 points; 1 point each)

理論，預測，海洋學，變異性，虛無假設，海洋酸化，生態模擬，

全球暖化，試驗設計，生物多樣性

3. Translate the following passages into CHINESE (15 points) (Adapted from: Jack Lucentini. 2003. *Hydra* of my heart. DISCOVER, December 2003 24(12): 14. (附註: *Hydra*, 水螅; You do not need to translate the names of persons and city)

Two geneticists have identified link between the human heart and a group of contracting cells in *Hydra*, a simple creature that may resemble some of the earliest multicellular animals. The water-dwelling *Hydra* is basically a quarter-inch tube topped with a set of tentacles for dragging food into one end. The area around the other, sealed end of the tube, called peduncle (i.e., a stalk-like part of a structure), can contract in a pumping motion that helps mix nutrient. Hiroshi Shimizu and Toshitaka Fujisawa of Japan's National Institute of Genetics propose that the heart may be evolved from the peduncle of *Hydra* or a similar creature.

Shimizu and Fujisawa injected ink into the peduncle and noted that the pumping action there is suggestive of the beating of a heart. Several clues indicate this similarity is no coincidence. *Hydra* has a gene that instructs nerve cells to produce a molecule that powers the peduncle's contractions. Higher organisms possess a related gene that similarly revs up (i.e., accelerates) the heart. Another gene active in the peduncle is related to one that, in higher organisms, functions prominently in embryonic heart tissue. This finding fits with evidence that embryos at times pass through stages resembling their species' ancestors, the researchers note.

The peduncle was apparently "refined during evolution and relocated more to the middle of the body," says Hans Meinhardt, a theoretical biologist at the Max Planck Institute for Developmental Biology in Tübingen, Germany. Even in humans, heart tissue originates at the tip of the embryo, where *Hydra*'s peduncle would be. Anatomic and genetic evidence suggest another surprise, he adds: *Hydra*'s mouth corresponds to our rear end.

4. Based on the following report, answer the two comprehension questions (A and B) (20 points). (Adapted from: Waters of change. The Economist. October 29th 2011: 82-84.)

It is not often that biologists have a chance to watch natural selection in action. The best-known cases—the evolution of resistance to antibiotics in bacteria and to pesticides in insects—are responses to deliberate changes people have made in the environment of the creatures concerned. But mankind has caused lots of accidental changes as well, and these also offer opportunities to study evolution.

Recently, two groups of researchers, one at New York University (NYU) and the other at the Woods Hole Oceanographic Institute in Massachusetts, have taken advantage of one of these changes to look at how fish evolve in response to environmental stress. The stress in question is pollution by polychlorinated biphenyls (PCBs). These chemical-widely used in the middle

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decades of the 20th century to manufacture electrical insulation, coolants, sealants and plasticisers—often ended up dumped in lakes, rivers and coastal water. Eventually, such dumping was banned (in America, this happened in 1977). But PCBS are persistent chemicals, and their effects are felt even today. In particular, they disrupt the immune systems of animals such as fish, cause hormonal imbalances and promote tumours.

As in the way of evolution, however, some fish species have developed resistance to PCB poisoning. Issac Wirgin, at NYU, and Mark Hahn, at Woods Hole, have been studying PCB-resistant fish, to see how they do it. After that, the two researchers will be able to look at how these populations evolve yet again as the environment is cleaned up.

The species of interest to Dr. Wirgin is the Atlantic tomcod of the Hudson River in upstate New York. Part of the Hudson was polluted with PCBs by two General Electric plants. Dr. Hahn is looking at a different animal, the killifish. In New Bedford harbour, Massachusetts, which was polluted by other producers. Both Hudson tomcod and New Bedford killifish are able to tolerate levels of PCBs far higher than those that would kill such fish in cleaner waters. The question is, why?

PCBs do their damage by binding to a protein called the aryl hydrocarbon receptor, or AHR, thus stopping it working properly. AHR is a transcription factor, meaning that it controls the process by which messenger molecules are copied from genes. These messenger molecules go on to act as the blueprints for protein production, so preventing a transcription factor from working can cause all sorts of problems. Both Hudson tomcod and New Bedford killifish, however, have unusual AHR molecules. And it is this that seems to explain their immunity.

A protein is a chain of chemical units called amino acids. In tomcods, AHR is composed of 1,104 such units. Except that in Hudson tomcod it frequently isn't, these fish generally have 1,102 amino acids in their AHRs. The two missing links in the chain (a phenylalanine and a leucine) are encoded in the gene for ordinary tomcod AHR by six genetic "letters" that are missing from the DNA found in PCB-resistant Hudson tomcod. The shortened version of AHR does not bind nearly so easily to PCBs. It still, however, seems to work as a transcription factor. The result is fish that are more or less immune to PCB poisoning.

In the case of the New Bedford killifish the situation is similar, but more complicated. There are no missing amino acids. Dr. Hahn has, however, found nine places along the amino-acid chain of killifish AHR where the link in the chain varies between individuals. Altogether, he has identified 26 such variations. Two of them seem particularly resistant to the effects of PCBs. It is not that the pollutants do not bind to the protein—they do. But the protein does not seem to mind. It appears to work equally well, whether or not it has PCB passengers on board.

Questions:

(A). With regard to the main subject of this report, give the key sentence of the first paragraph? (2 points)

(B). Hudson tomcod and New Bedford killifish are able to tolerate higher levels of PCBs. What are the differences in their AHR and why they are more or less immune to PCB poisoning? ANSWER IN CHINESE (18 points)

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5. Based on the following report, answer the four comprehension questions (A-D) (20 points). For multiple-choice question, select the SINGLE correct answer (單選). (Adapted from: The Economist. October 8th 2011, p. 88)

Most biological molecules—and hence, most living organisms—are ultimately the result of photosynthesis. Most, but not all. Some creatures are part of food chains that begin with methane gas which seeps from the Earth's interior in particular places, frequently at the bottom of the sea. Bacteria living in these seeps process the methane into complex molecules, and worms and clams feast on the bacteria. It now seems, though, that such methane-based food chains may stretch farther up the tree of life than mere invertebrates—and may have done so for millions of years.

Recently, as they report in Marine Ecology Progress Series, Tina Treude of the IFM-GEOMAR marine-research institute in Kiel, Germany, and her colleagues sent a remotely operated vehicle called Cherokee to investigate a seep known as the North Alex mud volcano, which is located in the Mediterranean, to the north of the Nile delta. Cherokee, which was equipped with a digital camera and a flashgun, started transmitting mages of golden and dark-brown objects, 50-70 mm across, that were scattered among the worms and clams. The researchers quickly realized that these were sharks' eggs. Moreover, on closer examination they were able to see yolks, indicating that the embryos inside the eggs were alive and developing.

They do not know which species the eggs belong to, but Dr. Treude speculates they are from the deep water catshark, which is known to produce egg capsules of this size, colour and shape. And the North Alex volcano is not alone. She has found that another site, the Concepcion methane seep area, off the coast of Chile, is littered with thousands of large, black egg capsules of the sort often laid by skates and rays—fish that are, to all intents and purposes, flattened sharks.

In light of these discoveries her colleague Steffen Kiel, at the University of Gottingen, turned his attention to a fossilized methane seep in the American state of Washington. The rocks in this seep, which are 35m years old, were already known to contain lots of mussels and worm tubes, similar to those found in a modern seep. Lo and behold! When Dr. Kiel looked more closely, these rocks, too, contained fossil shark eggs.

Methane seeps, then, look as if they act as nurseries for sharks—and may have done so for a long time. Presumably (though this has still to be proved) the hatchling sharks are eating the worms and perhaps, if their teeth are up to the necessary crunching, the clams. Instead of being powered by the sun, then, some young sharks seem to run on fossil fuel.

Questions:

(A). What is the most suitable title for this report? A. New evidence for the embryonic development of deep-sea shark; B. What a gas!; C. Food chain in the deep-sea; D. New findings at the North Alex mud volcano. (2 points)

(B). The content of this report should be categorized to: A. Marine Phycology; B. Developmental Biology; C. Marine Ecology; D. Ethology. (2 points)

(C). Remotely operated vehicle is a: A. manned-submarine; B. boat; C. under-water robot; D. water scooter. (2 points)

(D). Give a condensed summary in CHINESE for the main subject and new findings given in

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this report. (14 points)

6. Write an ENGLISH essay no less than 200 words on the topic: Some characteristics of a good research advisor. (25 points)