DEPARTMENT OF BIOLOGY

MODULE: 022632 NERVE, MUSCLE AND MOVEMENT

MODULE ASSESSMENT TEST

DATE: THURSDAY 27TH JUNE 2002

TIME: 9.30AM – 10.30AM

BIOLOGY TEACHING LABORATORIES

- DURATION OF EXAM: 1 HOUR

- PLEASE WRITE YOUR CANDIDATE NUMBER NOT YOUR NAME ON THE TOP OF EVERY PAGE.

- PLEASE WRITE YOUR BENCH NUMBER ON THE TOP OF EVERY PAGE.

- YOU SHOULD ANSWER:

  2 OF THE 3 NERVE & BRAIN SHORT ANSWER QUESTIONS,
  2 OF 3 MUSCLE & MOVEMENT SHORT ANSWER QUESTIONS
  AND 1 OF THE 4 PAPER QUESTIONS.

- ANSWER THE QUESTIONS IN THE SPACE PROVIDED (UNLESS INDICATED OTHERWISE).

- THE MARKS AWARDED TO EACH QUESTION ARE INDICATED ON THE SCRIPT. TOTAL MARKS AVAILABLE – 80.

- A UNIVERSITY CALCULATOR MAY BE USED.
The Short Answer section is worth 40 marks (35% of the module).

**Nerve & Brain:** Answer 2 of the 3 questions. Each question carries 10 marks.

1. Draw an annotated diagram of the structure of an axonal sodium channel. Use your diagram to explain the mechanisms of opening and closing. [10 marks]

2. In a rhythmic neural network, how would you show that a cell was [each 2 marks]
   2.1. a mechanosensory neuron responds to touch,
   2.2. a motor neuron
   2.3. a cpg interneuron
   2.4. a modulatory neuron
   2.5. a command neuron
3. With the aid of diagrams, explain the difference between blindsight and blindspot
**Muscle & Movement:** Answer 2 of the 3 questions. Each question carries 10 marks.

4. **Muscle:**

   Outline the experimental data which suggests that the sliding of thick and thin filaments in the muscle sarcomere is driven by independent force generators. *(10 marks)*

5. **Locomotion:** Explain, using a diagram, the energetic advantage(s) obtained by hopping in a kangaroo? [10 marks]

6. **Locomotion:** This question is about soaring in vultures

   6.1. What is the minimum sinking speed for a vulture, and at what horizontal air speed does this occur?

       6.1.i. sinking speed [1 mark]

       6.1.ii. horizontal speed [1 mark]

   6.2. How can a vulture keep aloft in a thermal? [2 marks]
6.3. Why does a vulture sink faster when it flies at a different speed to your answer to 3.1?

6.3.i. slower [2 marks]

6.3.ii. faster [1 mark]

6.4. Why do large birds need a bigger wing area than small birds? [3 marks]

**PAPERS:**

**Answer ONE question in this section.**

**This is worth 40 marks (35% of the module).**

**Put your answer on the last page of the paper.**

1. Use the paper by Vinogradova IM, Zajicek J, Gentile S, Brown ER. (2002) Effect of glycine on synaptic transmission at the third order giant synapse of the squids Alloteuthis subulata and Loligo vulgaris Neuroscience Letters 325: 42-46 to answer the following questions:

1.1. What effect did bath applied glycine have on the synaptic transmission at the stellate ganglion?

1.2. The authors applied β-alanine and taurine instead of glycine. What did they expect from this experiment, and were their expectations fulfilled?

1.3. What is the difference between an agonist and an antagonist?

1.4. Why did the authors apply AP-5, CPP and MK801?

1.5. What did the authors conclude from this set of experiments?

2. Use the paper by Poulet JF, Hedwig B. (2003) A corollary discharge mechanism modulates central auditory processing in singing crickets. J Neurophysiol Mar;89(3):1528-40 to answer the following questions:

2.1. Why is ON1 called an omega neuron?
2.2. What are the PADs & IPSPs that the authors studied, and where do they come from?

2.3. What responses of the omega neuron were recorded in sonorous, silent and fictive stridulation?

2.4. In figure 2, what does the arrow labelled 3 indicate, and what is its significance?

2.5. Why important role should efference copy (Holst and Mittelstaedt, 1950 also known as corollary discharge Sperry 1950) play in the calling song of the cricket?

3. Use the paper by Burhop et al., (2001) Effects of a cardiomyopathy-causing Troponin T mutation on thin filament Function and Structure J. Biological Chemistry 276: 20788-20794 to answer the following questions:

3.1. What are the authors’ aims in the paper (i.e. what are they testing?).

3.2. Briefly describe what is being measured in the experiments which produce the data shown in Figure 1.

3.3. What is the major difference between this experiment and what they did in a previous paper (Ref 6)? (they describe this is the text of the current paper)

3.4. What do they conclude about the mutant from their EM reconstructions of the mutant thin filament in the presence and absence of Ca\(^{2+}\)?

3.5. What do the authors think is happening in the mutant muscle cells in vivo at low Ca\(^{2+}\)?

4. Use the paper by Korsmeyer, KE et al (2002) Energetics of median and paired fin swimming, body and caudal fin swimming, and gait transition in parrotfish (Scarus schlegeli) and triggerfish (Rhinocanthus aculeatus) The Journal of Experimental Biology 205, 1253-1263 to answer the following questions:
4.1. What is a recirculating flume respirometer?

4.2. Explain in your own words the difference between MPF and BCF, drawing a diagram to show how the fish swim.

4.3. What was the percentage increase in metabolic rate when *Rhinocanthus* was spontaneously active?

4.4. What does TCOT stand for, and how is it determined?

4.5. Why did the authors do these experiments?
Write your answer to the Paper question here:

Paper Answered: