



Australian and New Zealand College of Veterinary Scientists

Fellowship Examination

June 2016

Veterinary Oncology Paper 1

Perusal time: **Twenty (20)** minutes

Time allowed: **Four (4)** hours after perusal

Answer **ALL EIGHT (8)** questions

All eight questions are of equal value.

Answer **EIGHT** questions each worth 30 markstotal 240 marks

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Paper 1: Veterinary Oncology

Answer all eight (8) questions

1. Invasion and metastasis

Answer **all** parts of this question:

- a) List the steps required for a cancer to invade and metastasize. (5 marks)
- b) Explain the role ezrin plays in veterinary cancer. Include in your answer a veterinary tumour type as an example. (6 marks)
- c) Hypoxia is associated with a more malignant phenotype. Describe and give examples of **three (3)** mechanisms that may contribute to the association of hypoxia and increased malignancy. (6 marks)
- d) Hypoxia-induced factors (HIF) are induced in response to changes in available oxygen. List **three (3)** cellular pathways that may be influenced by HIF-targeted genes and, for **each** pathway, provide **three (3)** examples of HIF-target genes. (7 marks)
- e) Explain the role of the FAK (focal adhesion kinase) pathway in invasion and metastasis of cancer. (6 marks)

2. Chemotherapy

Answer **all** parts of this question:

- a) Describe the mechanisms of resistance for alkylating agents. (10 marks)
- b) Drug resistance to chemotherapeutic agents is the major limiting factor to curing many veterinary and human cancers. Discuss how and why drug resistance may occur. (14 marks)
- c) Explain why using cisplatin and cytosine arabinoside in combination may be more effective than either agent alone, and justify why these two drugs could be administered concurrently. (6 marks)

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3. Radiation biology

Answer **all** parts of this question:

- a) Radiation can be directly or indirectly ionizing. Explain the difference in these two mechanisms, and provide examples of **each type**. (8 marks)
- b) A single dose of whole body radiation is administered to a dog. Predict the effects of **each** of the following doses: (10 marks)
 - i. 3Gy
 - ii. 8GY
 - iii. 100Gy
- c) The treatment recommendation for an incompletely excised soft tissue sarcoma is 3Gy per day for 19 treatments. The owner wants to take a week off in the middle of the protocol. From a radiation biology perspective, explain why this should not be encouraged. (12 marks)

4. Autophagy

Answer **all** parts of this question:

- a) Autophagy has a dual role in cancer development. Contrast the opposing effects of autophagy on tumours, specifically the effect on tumour suppression and tumour cell survival. (18 marks)
- b) Briefly describe the morphological changes associated with the following types of cell death: (8 marks)
 - i. autosis
 - ii. classical type II autophagic cell death
 - iii. apoptosis
 - iv. necrosis.
- c) List **two (2)** examples of anti-apoptotic proteins and identify a veterinary or human tumour involving **each** protein. (4 marks)

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5. Genetics

Answer **all** parts of this question:

- a) Define multiple endocrine neoplasia (MEN). (2 marks)
- b) List the subtypes of MEN and identify **three (3)** of the most common tumours that occur with **each** subtype. (4 marks)
- c) For **each** of the following, describe their normal function and role in cancer development. Include in your answer an example of a cancer where the gene/protein induces tumorigenesis, in addition list a potential targeted treatment for **each**. (18 marks)
 - i. BRCA1
 - ii. Bcr-Abl
 - iii. Phosphatase and tensin homolog (PTEN).
- d) Briefly describe the function and role of **each** of the following in cancer development. Include in your answer an example of a cancer where the gene/protein induces tumorigenesis: (6 marks)
 - i. NMI (N-myc and STAT interactor)
 - ii. BMI-1

6. Tumour immunity

Answer **all** parts of this question:

- a) Increasing evidence supports a role for innate immune effector cells in tumour surveillance. List **two (2)** cells involved in tumour surveillance. (2 marks)
- b) Describe immune contexture. (3 marks)
- c) Explain the concept of immunoediting. (5 marks)
- d) Identify and explain mechanisms of tumour escape from immune surveillance and provide **one (1)** therapeutic strategy for **each** mechanism. (20 marks)

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7. Tumour metabolism

Answer **all** parts of this question:

- a) Discuss ways in which energy production differs in neoplastic cells, relative to normal cells, and describe in detail the metabolic pathway(s) of cancer cells. Include regulators of these mechanisms in your answer. (23 marks)
- b) Briefly explain how ^{18}F -fluoro-2-deoxy-D-glucose (^{18}F -FDG) is used as a marker of glycolysis. (2 marks)
- c) List the factors that contribute to ^{18}F -fluoro-2-deoxy-D-glucose (^{18}F -FDG) being retained in the cancer cell. (5 marks)

8. Viral (RNA) oncogenesis

Answer **all** parts of this question:

- a) Discuss the mechanisms that retroviruses use to induce oncogenesis. Include in your answer an example of a virus that acts via **each** mechanism. (16 marks)
- b) Describe the mechanism of oncogenesis of FeLV with reference to current literature. (8 marks)
- c) Discuss factors that affect the interpretation of results from the ELISA test currently available for the diagnosis of FeLV. (6 marks)

End of paper



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Veterinary Oncology Paper 2

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Paper 2: Veterinary Oncology

Answer all eight (8) questions

1. Discuss why the dog can be considered a model for cancer in humans. In your answer, compare and contrast aspects of a cancer of your choice in dogs and humans. Explain the challenges facing researchers when using the dog as a spontaneous cancer model for humans. (30 marks)

2. There are many different forms of radiation therapy used in veterinary oncology. Discuss the following radiation modalities, integrating the type of radiation they produce, fraction size and dosing schedules, advantages over conventional external beam radiation therapy and potential disadvantages. Provide **one (1)** example of a clinical application in the veterinary literature for **each**: (30 marks)
 - a) intensity modulated radiation therapy (IMRT)

 - b) stereotactic radiation therapy (SRT)

 - c) plesiotherapy.

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3. You are presented with a seven-year-old female neutered Boxer who has had intermittent episodes of weakness. The owner reports these are becoming more frequent, and yesterday the dog collapsed completely, but had recovered by the time the owner took him to their regular veterinary clinic.

Answer **all** parts of this question:

- a) Formulate a list (oncologic and non-oncologic) of differential diagnoses for this patient. (3 marks)
 - b) As part of your initial work up, routine blood tests confirmed hypoglycaemia (serum glucose 2.0mmol/L (ref 4.4–7.8mmol/L)), so you performed a serum insulin level, which returned a reading of 70 μ U/L (ref <30 μ U/L), with a concurrent serum glucose of 1.8 mmol/L. State the most likely differential diagnosis. (1 mark)
 - c) You formulate a diagnostic plan to further investigate this case. Discuss the merits of different imaging modalities described for the condition you have identified. (8 marks)
 - d) Diagnostic imaging did not identify any obvious lesions. Design a treatment plan for this patient, presuming she is not in an acute hypoglycaemic crisis currently. Your answer should briefly include the mechanism of action of any medical therapies prescribed. (14 marks)
 - e) Briefly compare and contrast this disease in the domestic ferret. (4 marks)
4. Multiple myeloma can result in a number of pathophysiological and paraneoplastic conditions in the canine and feline patient. For **each** of these conditions, describe why these changes occur, the resulting clinical syndrome, and appropriate management of these clinical effects. Include in your answer an estimate of how frequently **each** condition occurs in dogs and cats. (30 marks)

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5. Mammary neoplasia

Answer **all** parts of this question:

- a) Compare and contrast the reported prognostic factors for canine and feline mammary cancers. Include in your answer at least **five (5)** factors for both the canine and feline disease. *(5 marks)*

- b) A referring veterinarian seeks your opinion as to whether ovariohysterectomy is indicated in a nine-year-old female dog scheduled for excision of a mammary mass later the same day. Relate the available literature to this case, and provide an appropriate rationale for the advice you would provide in this instance. *(10 marks)*

- c) Adjuvant chemotherapy is frequently used in multimodal treatment of canine and feline mammary carcinomas. With reference to current literature, discuss the use of adjuvant chemotherapy for **both** canine and feline mammary carcinomas, and comment on the justification for **each** protocol or agent considered. *(15 marks)*

6. Toceranib

Answer **all** parts of this question:

- a) Describe the mechanism of action of toceranib phosphate and explain how cancer cells develop resistance to the effect(s) of this drug. *(8 marks)*

- b) List the potential adverse effects of this medication, and explain why these adverse effects may occur. *(8 marks)*

- c) With reference to current literature, discuss the role of toceranib in the management of canine and feline tumours. *(14 marks)*

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7. Discuss prognostic factors for osteosarcoma in dogs including how **each** factor specifically relate to survival time. For **each** factor provide at least **one (1)** reference from veterinary literature. *(30 marks)*

8. Compare and contrast canine multicentric, gastrointestinal and epitheliotropic lymphoma. Your answer should address the diagnosis and management of **each** condition. *(30 marks)*

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