



# Australian and New Zealand College of Veterinary Scientists

## **Fellowship Examination**

November 2020

## **Veterinary Oncology**

### **Paper 1**

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

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

Answer **ALL EIGHT (8)** questions

All **eight (8)** questions are of equal value.

Answer **EIGHT (8)** questions, each worth 30 marks.....total 240 marks

# Paper 1: Veterinary Oncology

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Answer all eight (8) questions

1. Answer **both** parts of this question:

- a) Describe how intratumour heterogeneity (ITH) develops and explain how it contributes to lethal outcomes in cancer, and to drug resistance. Include in your answer the stressors that influence the development of ITH. *(15 marks)*
- b) Describe the changes that occur in a cell's genome as a result of genomic instability. Explain how genomic instability can impact tumour progression and how it can be exploited in cancer treatment. *(15 marks)*

2. Answer **all** parts of this question:

- a) Discuss the role of immunoediting in tumour progression, including the three phases of immunoediting. *(10 marks)*
- b) Compare and contrast the mechanisms and effect of tumour-specific and non-specific immunotherapy. *(10 marks)*
- c) Discuss the checkpoint molecules, PD-1 and PD-L1, in canine lymphoma. Include in your answer, their role and how their expression changes in chemotherapy resistant cells. *(10 marks)*

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3. Answer **all** parts of this question:
- a) Describe how cell cycle progression is mediated by the sequential activation and inactivation of cyclin-dependant kinases (CDKs). Include in your answer their interaction with cyclins, CDK inhibitors and the retinoblastoma protein.  
(20 marks)
  - b) Answer **both** parts of this sub-question:
    - i. List **two (2)** examples of cell-cycle-specific chemotherapy drug classes and include the phase in which they act. (4 marks)
    - ii. List **two (2)** examples of cell-cycle phase non-specific chemotherapy drug classes. (2 marks)
  - c) Describe the mechanism of action of the CDK-inhibitor drug, flavopiridol.  
(4 marks)
4. Describe the mechanism of action and the toxicities of the following chemotherapy drugs:
- a) Carboplatin (6 marks)
  - b) Vincristine (6 marks)
  - c) Doxorubicin (6 marks)
  - d) Cyclophosphamide (6 marks)
  - e) 5-FU. (6 marks)

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5. Answer **all** parts of this question:
- a) Briefly discuss the importance of epithelial-to-mesenchymal transition (EMT) in cancer and include the pathways and transcription factors involved in the process. *(12 marks)*
  - b) List the **six (6)** classes of mammalian proteinases. *(6 marks)*
  - c) List **three (3)** processes that are important to cancer, that can be altered by tissue inhibitors of metalloproteinases (TIMPs). Note whether they inhibit or promote (or both) the process. *(6 marks)*
  - d) Using examples, discuss why protease activity in the tumour micro-environment is thought to contribute to the process of tumour metastasis. *(6 marks)*
6. For a dog with an incompletely excised oral melanoma, discuss the impact on the four R's (repair, repopulation, redistribution and reoxygenation) when choosing a fractionated radiation protocol (16 fractions over four weeks, 3 Gy per fraction) over a hypofractionated radiation protocol (three fractions over three weeks, 8 Gy per fraction). *(30 marks)*
7. You are approached by a pharmaceutical company to develop a clinical trial for their new cytotoxic drug. Their drug has been extensively tested and found to be effective in a rodent model of B-cell lymphoma, with a cure rate of 70% and acceptable toxicity. A phase 1 trial was performed in research beagles and a maximum tolerated dose was identified. The dose-limiting toxicity was myelosuppression, with some gastroenteritis, and occasional, mild liver enzyme elevations were also noted.
- List and briefly discuss the factors that you need to consider when designing a phase 2 trial in dogs with high-grade B-cell lymphoma. Include in your answer the factors from initial ethical concerns and trial design through to the publication of the results. *(30 marks)*

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8. Answer **all** parts of this question:

- a) List Hanahan and Weinberg's original six 'hallmarks of cancer'. Provide **one (1)** oncogene or protein or enzyme as an example for each. *(12 marks)*
  
- b) List and briefly discuss Hanahan and Weinberg's two emerging hallmarks in the development of cancer. Include **two (2)** examples to illustrate your answer. *(8 marks)*
  
- c) List and briefly discuss Hanahan and Weinberg's two enabling characteristics in the development of cancer. Include **two (2)** examples to illustrate your answer. *(10 marks)*

**End of paper**



# Australian and New Zealand College of Veterinary Scientists

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## **Veterinary Oncology Paper 2**

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

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

Answer **ALL EIGHT (8)** questions

All **eight (8)** questions are of equal value.

Answer **EIGHT (8)** questions, each worth 30 marks.....total 240 marks

# Paper 2: Veterinary Oncology

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## Answer all eight (8) questions

1. A 10-year-old, female, domestic short-haired cat is presented following unilateral chain mastectomy and inguinal lymphadenectomy for a mammary adenocarcinoma in the caudal mammary gland. Chest and abdominal computed tomography (CT), prior to surgery, showed no evidence of distant metastasis. The tumour measured 1.5 cm at the time of surgery and was grade 3, using the modified Elston and Ellis grading scheme. Excision was complete, no lymphovascular invasion was noted and the inguinal lymph node was negative for metastatic disease

Based on the available evidence, discuss the recommendations for the management of this case. (30 marks)

2. Answer **all** parts of this question:

- a) Discuss the prognostic value of c-KIT mutation status in canine mast cell tumours. Include in your answer, the prevalence, type and location of the most studied mutation. Support your answer with information from the current literature. You are not required to specifically cite the literature. (10 marks)
- b) Discuss the prognostic value of KIT protein localisation in canine mast cell tumours. Support your answer with information from the current literature. You are not required to specifically cite the literature. (10 marks)
- c) Discuss the value of a c-KIT mutation status in predicting response to therapy with tyrosine kinase inhibitors in dogs with mast cell tumours. Support your answer with information from the current literature. You are not required to specifically cite the literature. (10 marks)

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3. Answer **both** parts of this question:
- a) List **three (3)** reported laboratory methods for detecting minimal residual disease in dogs with lymphoma. Include in your answer suitable sample(s) and limitation(s) for each method. *(10 marks)*
  - b) With justification from the literature, describe how the measurement of minimal residual disease could influence the management and prognosis of canine lymphoma. *(20 marks)*
4. An eight-year-old, large-breed dog presents with a brief history of lameness from a mid-humeral lytic and proliferative bone lesion. Whilst osteosarcoma is a possible diagnosis, discuss **five (5)** other cancers (other than osteosarcoma) that could be possible differential diagnoses. For each differential, indicate: *(30 marks)*
- immunohistochemical stains to aid in the diagnosis (either to rule in the diagnosis, or rule out others)
  - the approximate risk of metastatic or systemic disease
  - the appropriate treatment approach
  - the approximate prognosis.

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5. A dog has been referred to you with a two-centimetre cutaneous mast cell tumour over the lateral left stifle, that has been present for three months and recently doubled in size. The dog is otherwise well. The original cytology report described the tumour as low grade.

Answer **all** parts of this question:

- a) Describe the cytological criteria used to grade a mast cell tumour. *(10 marks)*
- b) Discuss the accuracy of cytological grading in canine cutaneous mast cell tumours. *(5 marks)*

Cytology of the left popliteal lymph node and abdominal ultrasound with liver and spleen cytology are performed. Cytology from the left popliteal lymph node is consistent with metastatic disease, but no distant metastatic disease is detected on imaging or liver and spleen cytology.

- c) State the stage and sub-stage of this patient's mast cell tumour. *(1 mark)*
- d) Describe and justify the treatment recommendations for this patient. *(14 marks)*

6. A dog presents to you after the complete resection of a stage II oral malignant melanoma. Full staging was negative at the time of surgery, and four fortnightly injections of the Oncept™ canine malignant melanoma vaccine were administered without complication.

Three months later, the patient presents with an enlarged right mandibular lymph node with cytologically confirmed metastatic melanoma.

Answer **both** parts of this question:

- a) Discuss the possible immunologic reasons for failure of the vaccine to control disease in this case. *(18 marks)*
- b) Discuss the management and treatment options for this case, justifying your approach using the literature. You may assume no financial limitations. *(12 marks)*

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7. Answer **both** parts of this question:

- a) An eight-year-old, entire male Afghan hound was referred for evaluation of a four-centimetre mass within the scrotum and a two-week history of lethargy and reduced appetite.

Answer **all** parts of this sub-question:

- i. List the differential diagnoses. *(5 marks)*

Haematology performed prior to surgical removal revealed a moderate normocytic, normochromic, non-regenerative anaemia and moderate thrombocytopenia. CT of the thorax and abdomen revealed no other disease. You suspect that the haematologic changes are due to a paraneoplastic syndrome.

- ii. Describe the most likely paraneoplastic syndrome in this patient and describe the clinical findings and diagnostic test results that would support this diagnosis. *(3 marks)*
- iii. Discuss how the presence of this paraneoplastic syndrome impacts the prognosis for this patient. *(3 marks)*
- iv. Describe the initial management recommendations for this patient. *(4 marks)*
- b) Discuss the evidence for reducing sex hormone receptor stimulation with ovariectomy or drugs in dogs with mammary carcinoma. *(15 marks)*

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8. Answer **all** parts of this question:
- a) In a ferret with an adrenal tumour:
    - i. List **three (3)** presenting clinical signs. *(3 marks)*
    - ii. Give an example of **one (1)** useful diagnostic test, in addition to imaging. *(2 marks)*
  - b) You are presented with a rabbit that has been diagnosed with thymoma. Describe and justify your recommended treatment for this patient. *(10 marks)*
  - c) You are presented with a five-year-old ferret that has multiple, enlarged peripheral lymph nodes, but no weight loss or other signs of illness. Describe and justify your approach and treatment advice for this case. *(9 marks)*
  - d) List **three (3)** methods for the management of melanoma in horses. List **one (1)** advantage and **one (1)** disadvantage for each method. *(6 marks)*

**End of paper**