

100% ONLINE

BONE MARROW CERTIFICATE

Bone Marrow Certificate course offers a highly illustrated, step-by-step approach for cytologic and histologic evaluation of bone marrow samples in cats and dogs. This course will teach you to critique the bone marrow aspirate and core specimens, integrating clinical information with bone marrow findings to establish a definitive diagnosis.

Throughout the course, high-resolution, annotated images illustrated clinical cases, and Aperio scanned bone marrow slides are integrated with text materials to highlight the topics covered.

PLAN OF STUDY

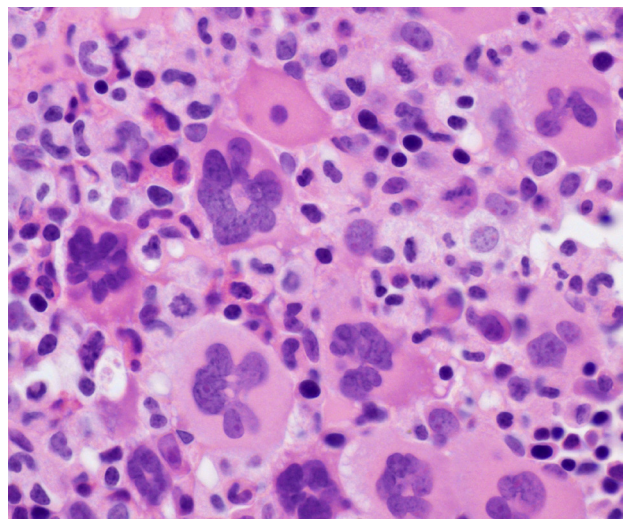
COURSE MODULES

Hematopoiesis and Bone Marrow Organization

In this lesson, you will learn bone marrow organization and hematopoiesis.

Learning Objectives:

- Describe the structure and function of cortical and trabecular bone
- List the components of the extravascular microenvironment of the bone marrow and discuss the function of each as they relate to hematopoiesis.
- Describe the maturation sequence, salient features, and lineage specific surface antigens of erythroid, myeloid, and megakaryocytic lineages.



- List surface molecules expressed by B- and T-lymphocytes and for monocytes/macrophages/dendritic cells.

Bone Marrow Evaluation

In this lesson, you will learn to evaluate bone marrow aspirate cytology and histology biopsies. You will learn to examine cellularity, erythroid lineage, myeloid lineage, megakaryocytic lineage, lymphocytes, plasma cells, mast cells and other bone marrow cells, including stroma, vessels, and trabecular bone as well as distinguish bone marrow artifacts.

Learning Objectives:

- Describe the merits of evaluating a bone marrow aspirate versus a core biopsy.
- Explain how to assess bone marrow cellularity

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in both cytologic and histologic specimens and the effects of age, breed size and species

- Discuss the evaluation of erythroid, myeloid and megakaryocytic lineages in bone marrow specimens, including individual cell characteristics, topography, and the relationship of specific abnormal findings/features to underlying pathology.
- List and describe the various stromal and trabecular bone changes that may be observed in histologic sections of bone marrow.
- Recognize bone marrow artifacts such as inadequately decalcified bone, inadequately rinsed tissue sections, fragmented trabeculae, muscle, cortical bone, and cartilage.

Special Techniques

In this lesson, you will learn to evaluate bone marrow aspirate and bone marrow core biopsy samples treated with or prepared using techniques including cytochemical and histochemical stains, immunocytochemistry, immunophenotyping, and cytogenetic analysis. You will be able to interpret many results from ancillary special stain and other techniques to establish a diagnosis.

Erythroid Lineage

In this lesson, you will learn about critical components to be taken into consideration when evaluating bone marrow to diagnose non-neoplastic disorders of the erythroid lineage. The topics covered are erythropoiesis, erythroid abnormalities, overview of anemia and approach, erythrocyte production defects, erythrocyte maturational defects, erythrocyte survival defects, and erythrocytosis.

Learning Objectives:

- Describe the various blood and bone marrow manifestations of immune mediated destruction of cells of the erythroid lineage (ie. IMHA, PIMA, PRCA)
- Compare and contrast the blood and bone marrow findings typically associated with chronic kidney disease (CKD), anemia of inflammatory disease (AID), and iron deficiency anemia (IDA)

- List blood, bone marrow, and other testing that support a diagnosis of primary erythrocytosis.

Myeloid Lineage

In this lesson, you will learn about critical components to be taken into consideration when evaluating bone marrow to diagnose non-neoplastic disorders of the myeloid lineage. The topics covered are disorders of neutrophils including both acquired and heritable disorders, abnormal granulocytic morphology, neutropenia and agranulocytosis, neutropenias of extrinsic etiology, neutropenias of intrinsic etiology, as well as disorders related to eosinophils and basophils, and monocytes.

Learning Objectives:

- Describe the distinguishing blood and bone marrow features for physiologic and non-neoplastic pathologic conditions/diseases associated with the myeloid lineage.
- Discuss specific blood and bone marrow features that raise your level of suspicion for a reactive versus neoplastic process.
- List bone marrow features that support a toxic insult to the myeloid precursors versus an immune mediated process (ie. production versus destruction process) leading to neutropenia.

Megakaryocytic and Platelet Disorders

In this lesson, you will learn about critical components to be taken into consideration when evaluating bone marrow to diagnose non-neoplastic megakaryocytic and platelet disorders. The topics covered are megakaryopoiesis and thrombopoiesis, classification of non-neoplastic megakaryocytic/platelet disorders, heritable thrombocytopenia, acquired thrombocytopenia, acquired thrombocytosis, and mimics of megakaryocytes.

Learning Objectives:

- Explain how to evaluate megakaryocyte numbers in bone marrow aspirate and core samples.

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- Describe morphologic features of platelets and megakaryocytes, including findings that provide clues as to an underlying process/pathology for specific abnormalities.
- Discuss the normal and abnormal distribution of megakaryocytes in bone marrow and clinical indications for specific abnormalities.
- List the mechanisms of thrombocytopenia and thrombocytosis, including specific etiologies and bone marrow findings.

Aplastic Anemia BMF

In this lesson, you will learn about aplastic anemia, a condition associated with bone marrow failure. While aplastic anemia is not a single entity, it is distinguished by a common endpoint – multiple peripheral cytopenias with trilineage bone marrow aplasia and replacement with fat tissue. The topics covered will include congenital/inherited aplastic anemia as well as primary and secondary acquired aplastic anemias.

Learning Objectives:

- Define the pathologic endpoints for diagnosing aplastic anemia and explain how this differs from other causes of bone marrow failure.
- Explain the underlying mechanism of AA and its treatment, including the use of eltrombopag.
- List the most common causes of pancytopenia in dogs and cats.

- Discuss rule outs for AA, including blood and bone marrow features as well as additional testing to help establish a definitive diagnosis.

Stromal and Trabecular Responses

In this lesson, you will learn about bone marrow stromal responses, bony trabecular bone responses, and about pitfalls in grading of bone marrow fibrosis, collagen deposition, and osteosclerosis.

Learning Objectives:

- List rule outs and describe distinguishing features of ‘pink deposits’ in the bone marrow space.
- Compare and contrast the trabecular bone changes in osteopenia, osteosclerosis, and osteopetrosis.
- Describe the various bone marrow changes that may be observed in a patient with chronic kidney disease (CKD).
- Discuss pitfalls that may be encountered in grading of bone marrow fibrosis, collagen deposition, and osteosclerosis