Plate 1. Photomicrographs of leukocyte abnormalities (all blood films stained with Wright stain) (5 μm bar in L applies to each frame).

Plate 2. Photomicrographs of leucocyte abnormalities (all Wright-stained blood films unless otherwise stated) (5 μm bar in L applies to each frame).

Plate 4. Photomicrographs of erythrocyte abnormalities (all Wright-stained blood films unless otherwise stated) (5 μm bar in L applies to each frame).

Plate 5. Photomicrographs of erythrocyte abnormalities (all Wright-stained blood films unless otherwise stated) (5 μm bar in L applies to each frame).

Plate 7. Photomicrographs of platelet abnormalities in Wright-stained blood films (5 μm bar in L applies to each frame).
A. Activated giant platelet with pseudopods and central granules, canine. B. Activated giant platelet with pseudopods and central granules, dog. C. Activated giant platelet with pseudopods and central granules, cat. D. Giant activated platelet with pseudopods and central granules, Cavalier King Charles spaniel. E. Giant platelet, unactivated, dog. F. Anaplasa plathy morulae in platelets, Panóctico Rápidio dip stain (all four quarters), dog (slide courtesy of C. Lucidi, Universidade Estadual Paulista, Botucatu, Brazil). F. Platelet containing a probable fragment of nucleic material that can be mistaken for an organism, dog. G. Abnormal giant and hypogranular platelet associated with megakaryocytic leukemia (M7), dog (from ASVCP slide contributed by J. Messick et al., 1989). H. Megakaryoblast with cytoplasmic blebs, 47,XY/M+3,t(3;21)(p21q22)t(4;5)(p15q35)þ, dog. I. Megakaryoblasts, megakaryocytic leukemia (M7), dog (from ASVCP slide contributed by M. Ameri et al., 2006). J. Monocyte containing phagocytized platelet (rare finding), immune-mediated thrombocytopenia, dog. K. Trypanosoma cruzí, dog (from slide contributed by P.K. Penny et al., 2006). L. Trypanosoma theileri, cow (from ASVCP slide contributed by H. Bender et al., 1989).

Plate 9. Photomicrographs of cells and other microscopic findings in marrow samples; major reason for image is provided (all Wright-stained films of marrow aspirates unless otherwise stated) (scale bar in O applies to all frames except inserts and frames with separate scale bars).
A. Promegakaryocyte, dog. B. Mature megakaryocyte and smaller immature megakaryocyte, dog. C. Erythroid 'island' of nucleated erythroid series, dog. D. Granulocytic series from late myeloblasts to segmented neutrophil, dog. E. Hypercellular marrow fragment with darkly stained hemosiderin, high magnification insert with nonstained golden hemosiderin, dog. F. Marrow fragment with decreased hematopoietic cellularity, dog. G. Macrophages with engulfed rubriblast and degranulated cell (left) and polychromatophilic rubricyte (right) associated with immune-mediated nonregenerative anemias, dog. H. Myeloblastos with bundles of fibrocytes and collagen, marrow core, hematoxylin and eosin stain, dog. I. Macrophage laden with amastigotes of Leishmania sp., insert with high magnification of amastigotes and their rod-shaped kinetoplasts, dog. J. Undifferentiated blast cells of acute leukemia, dog. K. Dysplastic myelomonocytic monocytes, cat. L. Dysplastic erythroid cells (left and right), cat. M. Dysplastic megakaryocyte with hypostructured nucleus and mature cytoplasm (micromegakaryocyte), cat. N. Pleomorphic neoplastic plasma cells, multiple myeloma, dog. O. Neoplastic histiocytes with phagocytized neutrophil (top left), phagocytyzed rubricyte (bottom left), and large cell with anaplastic nuclei (right), histiocytic sarcoma, dog.

Plate 10. Photomicrographs of cells and other microscopic findings in lymph node aspirates or imprints (except O); major reason for image is provided (all Wright-stained films of aspirates or imprints unless otherwise stated) (scale bar in N applies to all frames except O).
sediment photomicrographs were taken using a high-dry objective (use scale bar in frame L) except for G, which was taken using a 10x objective (grey scale bar).

A. USG_4 = 1.013, osmolality = 410 mmol/kg; (2) yellow, USG_4 = 1.014, osmolality = 531 mmol/kg; (3) yellow, USG_4 = 1.013, osmolality = 292 mmol/kg; and (4) dark yellow, USG_4 = 1.023, osmolality = 551 mmol/kg. B. Leukocytes and erythrocytes.


**Plate 12.** Serum protein electrophoresis densitometer tracings, cellulose acetate strips, and serum protein concentrations from dogs and cats. Reference intervals for total protein, albumin, and globulin concentrations for cats and dogs are in sections A and E, respectively.

A. Cat, healthy: The densitometer tracing is within expected results for healthy cats and is provided as a reference pattern; minor variations in the distribution of protein fractions would be found in other healthy cats. B. Cat, panhyperproteinemia: The densitometer tracing is within expected results for a healthy cat but is found in a hyperproteinemic sample. Thus, protein concentrations are increased proportionately (panhyperproteinemia) and are consistent with hemoconcentration due to dehydration.

C. Cat, inflammatory dysproteinemia: The densitometer tracing shows a selective pattern—relatively less albumin compared to the globulin regions. Even though total globulin concentration is WRI, there are relatively more of α1-globulin and γ-globulin fractions compared to the other globulin fractions. The increased γ-globulin region is probably due to increased concentrations of haptoglobin or α-macroglobulin (positive acute-phase proteins). The increased γ-globulin region is broad-based and is thus due to a polycional gammopathy (probably mostly IgG). Overall, the dysproteinemia is a delayed-response pattern caused by an inflammatory process of more than 7 d duration.

D. Cat, inflammatory hyperproteinemia: The densitometer tracing shows a selective pattern—relatively less albumin compared to the globulin regions. The hyperglobulinemia is due to increased γ-globulin concentration. The increased γ-globulin region is narrow and thus could be a monoclonal gammopathy or a polyclonal gammopathy with restricted migration. In this case, a post mortem diagnosis of feline infectious peritonitis and the absence of B-lymphocyte neoplasia indicated that the hyperproteinemia, hypoalbuminemia, and hyperglobulinemia were due to chronic inflammation.

E. Dog, healthy: The densitometer tracing is within expected results for healthy dogs and is provided as a reference pattern; minor variations in the distribution of protein fractions would be found in other healthy dogs. F. Dog, inflammatory hyperproteinemia: The densitometer tracing shows a selective pattern—relatively less albumin compared to the globulin regions. The hyperglobulinemia is due to increased β- and γ-globulin concentrations. This broad-based region represents a pronounced polyclonal gammopathy. In this case, clinical signs and an extremely high titer to *Ehrlichia canis* indicated that the hyperproteinemia was due to a chronic rickettsial (bacterial) infection.

G. Dog, β₁-monoclonal gammopathy: The densitometer tracing shows a selective pattern—relatively less albumin compared to the globulin regions. The hyperglobulinemia is due to increased β₁-globulin concentration. The β₁-globulin region is a narrow peak and an anodal shoulder. The combination of narrow β₁-globulin region and an apparent decrease in the γ-globulin concentration is indicative of a monoclonal gammopathy of a non-IgG immunoglobulin. This dog’s hyperproteinemia was due to a myeloma and the serum IgA concentration was markedly increased.

H. Dog, panhyperproteinemia: The densitometer tracing is within expected results for a healthy dog but is found in a hyperproteinemic sample. Thus, protein concentrations are decreased proportionately (panhypoproproteinemia). Causes of panhypoproproteinemia include acute blood loss, malabsorptive disorders, starvation, cachexia, and occasionally hepatic failure. This dog had intestinal lymphoma.

I. Dog, selective hyperproteinemia and globulomer proteinuria

1. Serum: The densitometer tracing shows a selective pattern—relatively less albumin compared to the globulin regions. In a hypoproproteinemic sample, this selective pattern indicates that albumin concentration is decreased more than some globulin concentrations. Even though the total globulin concentration is decreased, the relative excess of γ-globulin region indicates that concentrations of other globulin fractions decreased more than the α₂-globulin concentration. This pattern is indicative of protein-losing nephropathy in which the glomerular filtration barrier has become more permeable to plasma proteins because of glomerular nephritis or glomerular amyloidosis. In such cases, there is a relative excess of the γ₂-globulin region because α-macroglobulin is too large to pass through the filtration barrier but smaller proteins can. Note that even though there is hyperproteinemia, hypoalbuminemia, and hyperglobulinemia, there was not truly a panhypoproproteinemia because the concentration of α₂-globulins was not decreased.

2. Urine: The densitometer tracing shows that most urine proteins are in the albumin region, consistent with a protein-losing nephropathy with a glomerulomer proteinuria. Note that the proteinuria is a selective proteinuria as the urine protein pattern is not the same as the dog’s serum protein pattern.

J. Dog, non-selective hypoproproteinemia and Benece Jones proteinuria

1. Serum: The densitometer tracing is within expected results for a healthy dog but is found in a hypoproproteinemic sample. Thus, protein concentrations are decreased proportionately (panhypoproproteinemia). Causes of panhypoproproteinemia include acute blood loss, malabsorptive disorders, starvation, cachexia, and occasionally hepatic failure. This dog had multicentric lymphoma with Mott cells and its hypoproproteinemia was probably due to multiple processes.

2. Urine: Most urine proteins are in the β₂-globulin region, consistent with migration of immunoglobulin light chains. The Benece Jones urine test was positive; that is, urine supernatant was initially clear, formed precipitate at 40–60 °C, cleared at 100 °C, and then appearances reversed as the sample returned to room temperature. Note that the proteinuria is a selective proteinuria as the urine protein pattern is not the same as the dog’s serum protein pattern and represents one type of a prenal proteinuria (see Chapter 8).

Note: The serum total protein and albumin concentrations were measured by biuret and BCG methods, respectively. The serum globulin concentrations were calculated by subtraction from the measured values. When the electrophoresis strips were scanned, the densitometer was set so that the darkest protein band in the sample caused the maximum deflection of the tracing pen. Hyperproteinemic samples were diluted (either 1 part serum to 1 part saline or 3 parts saline) prior to electrophoresis so that there was a more linear relationship between quantity of protein in the darkest band and the amount of light that passes through the strip. The urine total protein concentrations were measured by the Coomassie brilliant blue assay. The urine samples were concentrated 10-fold prior to electrophoresis.

**Plate 13.** Photomicrographs of direct urine sediment findings. Sediment was unstained except where noted (I). All photomicrographs were taken using a high-dry objective (use scale bar in frame L) except for E, which was taken using a 10x objective (grey scale bar).


**Plate 14.** Photomicrographs of cells and other microscopic findings in direct smears (G, J, and N) or cytospin preparations of cavitary effusions; erythrocytes are not described unless of major significance (all Wright-stained unless otherwise stated) (scale bar in O applies to all frames unless a frame has a separate scale bar).

A. Nondegenerate neutrophils and macrophages, peritoneal fluid, horse. B. Nondegenerate neutrophils and macrophages including two leukocytes, peritoneal fluid, horse. C. Filamentous, beaded, branching (*upper area*) bacilli and small bacilli, consistent with *Actinomyces* sp. or *Nocardia* sp. (left), mildly degenerate neutrophils with phagocyzized bacteria (right), pleural bacterial exudate, dog. D. Degenerate neutrophils (some containing short chains of cocci)
Plate 15. Photomicrographs of cells and other findings in direct or cytocentrifuge (A, H, K–M and O) preparations of cavitary effusions; erythrocytes are not described (Wright-stained unless otherwise stated) (scale bar in O applies to all frames unless a frame has a separate scale bar).

A. Mostly eosinophils and blue fibrinous material consistent with clotting, eosinophilic exudate, cat.
B. Pleomorphic large cells, neoplastic effusion, metastatic mammary carcinoma, dog.
C. Pleomorphic large mesothelial cells, neoplastic effusion, mesothelioma, horse.
D. Squamous epithelial cells and neutrophils, neoplastic effusion with exudation, gastric squamous cell carcinoma, horse (ASVCP slide contributed by M.J. Burkhard et al., 1995).
E. Mostly degenerate neutrophils (one containing bacilli), bacterial exudate, dog.
F. Mostly neutrophils (one containing morulae—another morula magnified in inserted image), exudate with Anaplasma phagocytophilum, horse (ASVCP slide contributed by D. Wood et al., 2001).
G. Pseudohyphae of Candida sp. and damaged adherent cells, pericardial mycotic exudate, dog.
H. Intestinal protozoa (left and right), bacterial peritoneal exudate due to intestinal rupture, horse.
I. Calcium carbonate crystals and nucleated cells (out of focus), equine uroperitonium (ASVCP slide contributed by L. Vap et al., 1994).
J. Sperm heads in neutrophils, exudate of seminoperitoneum, mare (ASVCP slide contributed by P. McWilliams, 1992).
K. Bile pigment, neutrophils, and macrophages, bile peritonitis, dog.
L. Small lymphocytes, nondegenerate neutrophils, and macrophages, insert with Sudanophilic lipid in and adjacent to macrophage, chylous effusion, cat.
M. Vacuolated macrophages and nondegenerate neutrophils, exudate, pancreatitis, dog.
N. Macrophages, granular protein and protein crescents, proteinaceous exudate, feline infectious peritonitis, cat.
O. Nucleated and anucleated squamous epithelial cells, amnionic fluid collected during attempted abdominocentesis, alpaca.