DESCRIPTIVE TECHNIQUES
IN MICROSCOPIC
PATHOLOGY

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There is not a single way of
describing a microscopic slide.

Develop a manner that is comfortable and
gives consistent results.

What is Organization and Clarity?

• a clear description that leads the reader
to the diagnosis (some call it style)

• demonstrates a clear understanding of the
process and separates 1° from 2° lesions.

• use of correct scientific terminology

Be concise.

Be concise.

Cutaneous lipoma, dog.
Be concise.

Avoid redundancy or the use of unnecessary verbiage.

- “Red in color”
- “Characterized by”
- “Associated with”
- “Three natural borders and one cut border”

1. Describe in an “inverted pyramid” or from most important to least important.

2. Put the most important event first.

Write your description with the reader in mind.
The little things are important too.

- Handwriting
- Punctuation
- Grammar
- Spelling

TIMING IS EVERYTHING.

At the beginning, list the tissue.

- “Liver: There are multifocal………”
- “Adrenal Gland: There is an encapsulated ……”
- “Skeletal muscle with fat and fragments of squamous epithelium (tongue)”

Describe organs in a consistent manner. Break each tissue down into its individual components.

Kidney
- Glomeruli
- Tubules
- Interstitium
- Vasculature
- Capsule

Lungs
- Alveolar spaces
- Alveolar septa
- Airways
- Vasculature
- Pleura
- Interstitium

Describe the components.

Parainfluenza viral pneumonia, alveolar spaces, ox.

Describe the components

Parainfluenza viral pneumonia, alveolar septa, ox.
Describe the components.

Parainfluenza viral pneumonia, airways, ox.

Parainfluenza viral pneumonia, vasculature, ox.

Parainfluenza viral pneumonia, interstitial emphysema and edema, ox.

Morbilliviral pneumonia, dolphin.

Pneumonyssus simicola, lung, Rhesus macaque.

Dirofilaria immitis, lung, dog.
Describe the components.

Villous endarteritis, pulmonary artery, dog.

Intestinal amyloidosis, Rhesus macaque.

Don’t reinvent the wheel.

Sperm granuloma, dog.

Don’t reinvent the wheel.

Toxocara canis larval granuloma, kidney, dog.

Don’t reinvent the wheel.

Calcinosis circumscripta, dog.
Don’t reinvent the wheel.

Coffee senna toxicosis, skeletal muscle, ox.

Terminology

Normal Bursa of Fabricius, chicken.

Terminology

Gumboro Disease, chicken.

Terminology

Accessory sex glands, guinea pig.

Terminology

Eosinophilic myositis, ox.

Terminology

Eosinophilic myositis, ox.
Terminology
Simian hemorrhagic fever, spleen, Rhesus macaque.

Terminology - nematodes
*Spirocerca lupi* adult, esophagus, dog.

Terminology - nematodes
*Pelodera* larva, hair follicle, dog.

Terminology - nematodes
*D. immitis* microfilaria, cutaneous vessel, dog.

Terminology - nematodes
*A. abstrusus* adult, larva and eggs, lung, dog.

Terminology - cestodes
Transverse section of *C. fasciolaris*, rat.
Terminology - cestodes

*H. nana*, small intestine, mouse.

*Echinococcus granulosus*, lung, camel.

*Mesocestoides sp.*, abdomen, dog.

Terminology - trematodes

*Paragonimus kellicotti*, lung, cat.

Terminology - arthropods

*Pneumonyssus simicollis*, lung, Rhesus macaque.
Terminology - apicomplexans

*Eimeria furonis*, bile ducts, liver, ferret.

*Klossiella equi*, kidney, horse.

*Toxoplasma gondii*, liver, cat.

*Encephalitozoon cuniculi*, cerebrum, rabbit.

*Encephalitozoon cuniculi*, kidney, dog.

*Trypanosoma cruzi*, heart, dog.
Terminology - fungi

Aspergillus fumigatus, lung, horse.

Aspergillus fumigatus, lung, horse (GMS)

Zygomycetes, lung, nutria

Mouse hepatitis virus infection, liver, nu/nu mouse.

Glioblastoma multiforme, cerebrum, Rhesus macaque

Streptococcus pneumoniae, pleura, guinea pig.
Terminology
Manheimia hemolytica, lung, ox.

Terminology
Mycobacterium tuberculosis, cerebrum, macaque.

Terminology
Polyarteritis nodosa, mesentery, rat.

Terminology
Polyarteritis nodosa, mesentery, rat.

Terminology
Thiamin deficiency, cerebrum, ox.

Terminology
Vitamin K deficiency, cerebrum, prenatal guinea pig.
You should not only describe, but also interpret what you see

"...eosinophilic, beaded material (fibrina..."
"...hepatocytes with hypereosinophilic and condensed cytoplasm and with pyknotic and karyorhectic nuclei (necrosis)..."
"...20 µm round cells with many intensely eosinophilic cytoplasmic granules (globular leukocytes)..."

Interpretation

Feline infectious peritonitis, liver capsule, cat.

Interpretation

Rift Valley Fever, liver, ewe.

Interpretation

Listeria monocytogenes, brainstem, horse.

When all else fails....

- Don’t panic. No one gets every slide right.
- Go back to basics:
  - Is there a color change somewhere in the slide?
  - Is something thicker or thinner than normal?
  - Has something been added or lost?

Learn from you mistakes! (Not applicable in Ames, Iowa or Hanover, Germany) !
Go back to basics

Hypothyroidism, skin, dog.

Acanthosis nigricans, skin, Dachshund.

Go back to basics

Light-induced retinal degeneration, rat (control, right).

Myofiber hypoplasia, quadriceps, deer.

Go back to basics

In-utero bovine pestivirus infection, cerebellum, calf

In-utero bovine pestivirus infection, cerebellum, calf
Go back to basics

Ehlers-Danlos Syndrome, skin, dog.

NEOPLASIA

SENTENCE ONE

Location
• You have already described the location.
• Is the neoplasm restricted to a certain anatomic location in the tissue?
  (for example, white matter vs. grey matter; epidermis vs. dermis)
• Does it extend to the cut borders?

Size (a descriptor of great importance)

SENTENCE ONE

• Shape (a descriptor of great importance)
• Cellularity
• Demarcation
• Expansile or infiltrative
• Encapsulation
• More than one population of neoplastic cells

Shape

Spindle cell sarcoma of the skin and subcutis, dog.

Shape

Apocrine cystadenoma, skin, dog.
Canine cutaneous histiocytoma, dog.

Transmissible venereal tumor, penile mucosa, dog.

Fibropapilloma, skin, green sea turtle.

Sebaceous epithelioma, skin, ferret.

Renal cell carcinoma, kidney, dog.

Fibrous epulis, gingiva, dog.
Celullarity

Fibroma, skin, dog.

Demarcation

Sebaceous epithelioma, skin, dog.

Demarcation

Perianal adenoma, skin, dog.

Demarcation

Adrenocortical adenocarcinoma, ferret.

Expansile or infiltrating?

Trichofolliculoma, skin, guinea pig.
Expansile or infiltrating?

Expansile or infiltrative?

Chordoma, cervical vertebra, ferret.

Intestinal adenocarcinoma, ileum, dog.

Encapsulation

Encapsulation

Interstitial cell tumor, testis, dog.

Islet cell tumor, pancreas, ferret.

More than one neoplastic cell population

More than one neoplastic cell population

Giant cell tumor of bone, cat.

Ganglioneuroblastoma, adrenal gland, dog.
More than one neoplastic cell population

Fibroepithelial hyperplasia, mammary gland, cat.

SENTENCE TWO

1. **Cellular pattern:**
   - Carcinoma - nests, packets, lobules
   - Adenocarcinoma – tubules and acini
   - Sarcomas – bundles, streams,
   - Round cell tumors - sheets

   ❗ Avoid mixing descriptors from different tumor types – this will confuse the reader.

2. **Type of stroma – very important!**

Cellular patterns

Squamous cell carcinoma, periorbital area, ox.

Cellular patterns

Squamous cell carcinoma, periorbital area, ox.

Cellular patterns

Chemodectoma, dog.

Cellular patterns

Plasmacytoma, skin, dog.
Cellular patterns

Nasal adenocarcinoma, sheep.

Cellular patterns

Mammary adenocarcinoma, cat.

Cellular patterns

Gastric adenocarcinoma, dog.

Cellular patterns

Metastatic cholangiocarcinoma, lymph node, dog.

Cellular patterns

Vaccine-induced sarcoma, skin, cat.

Cellular patterns

Hemangiopericytoma, skin, dog.
Cellular patterns
Meningioma, cat.

Cellular patterns
Dysgerminoma, ovary, dog.

Cellular patterns
Malignant melanoma, oral cavity, dog.

Cellular patterns
Malignant melanoma, oral cavity, dog.

Other Modifiers
Mast cell tumor, skin, dog.

Other Modifiers
Peripheral nerve sheath tumor, skin, dog.
Other Modifiers

Multilobular tumor of bone, skull, dog.

Other Modifiers

Apocrine adenocarcinoma of the anal sac, dog.

Other Modifiers

Granulosa cell tumor, ovary, dog.

Stroma

Ciliary body adenocarcinoma, eye, dog.

Stroma

Mesothelioma, testis, F344 rat
SENTENCE THREE

Cytologic Characteristics:

1. Cell shape
2. Size
3. Cell borders
4. Cytoplasm

Cell Shape

Adenocarcinoma, nasal, sheep

Cell Shape

Bronchial adenocarcinoma, lung, rat.

Cell Shape

Rhabdomyosarcoma, skin, rat.
Size - a descriptor of great significance.

Transmissible venereal tumor, dog.

Interstitial cell tumor, testis, dog.

Choroid plexus papilloma, dog.

Xanthoma, skin, macaque

Granular cell tumor, dog.
1. **Nuclear characteristics:**
   - shape
   - size
   - location within the cell
   - chromatin distribution (pattern)

2. **Nucleolar characteristics:**
   - number
   - color
Nuclei
Fibroma, skin, dog.

Nuclei
Seminoma, testis, dog.

Nuclei
Schwannoma, eyelid, ferret.

Nuclear Atypia
Anaplastic mast cell tumor, skin, dog.

Nuclear Atypia
Malignant melanoma, dog.

Nuclei
Implantation site, ferret.
SENTENCE FIVE

Unique Characteristics:

- Multinucleate cells
- Cellular variation (anisokaryosis, anisocytosis)
- Keratinization
- Secretion or production of something
- Invagination of the cytoplasm
Unique Characteristics
Mast cell tumor, skin, dog.

Unique Characteristics
Osteosarcoma, bone, dog.

SENTENCE SIX
Mitotic Activity:

"Mitoses are _____ per 40x field."

"Mitoses range from ___ to ___ per 40x field, with an average of ___ per 40X."

If there are less than 1 per 10 fields at 40X, then mitoses are RARE.

Also at this time, note the presence of any abnormal or bizarre mitotic figures.

Mitotic Figures
Cholangiocarcinoma, cat.

Mitotic Figures
Retinoblastoma, mouse.

SENTENCE SEVEN
Evidence of malignancy (If there is none, then omit this sentence).

• Vascular invasion
• Capsular invasion
• Necrosis
• Hemorrhage
Evidence of Malignancy

Gastric adenocarcinoma, dog.

Evidence of Malignancy

Carcinoma adrenocortical, ferret.

Evidence of Malignancy

Malignant melanoma, skin, dog.

The clean-up:
- inflammation
- ulceration
- hemorrhage
- mineralization

These are changes that are not part of the neoplasm.

Non-neoplastic lesions
SENTENCE ONE
1. Location
   • You have already identified the tissue.
   • Is the lesion restricted to an anatomic site in the tissue?
   • Does the lesion extend to borders?
2. Distribution (focal, diffuse, etc.)
3. Shape and Size

Location and Distribution
Afghan Hound Myelopathy, spinal cord, dog

Location and Distribution
Selenium toxicosis, spinal cord, pig

Location and Distribution
Lymphocytic bronchiolitis, lung, pig

Location and Distribution
*Eimeria stiedae*, liver, rabbit

Location and Distribution
Old Dog Encephalitis with demyelination, cerebellum, dog.
Rhodococcus equi, lung, foal.

Clostridium piliforme, liver, foal

Myelomalacia, gray matter, spinal cord, dog.

Fibrocartilagenous embolism, spinal cord, dog.

Aspergillus fumigatus, lung, penguin.

Histoplasma capsulatum, lung, cat.
Infectious Laryngotracheitis, trachea, chicken.

Clostridium collinum, small intestine, quail.

Inflammatory Components

1. Inflammatory Cells
   - list all types in the order of prevalence
   - list all cell types by name

2. Quantify everything you see

3. Interpret your results

Brucella suis infection, testis, pig.

Dermatosis vegetans, lung, pig.

Atypical Interstitial Pneumonia, lung, ox.
Inflammatory Components

*Clostridium piliforme*, liver, rabbit.

Brugia malayi, skin, ferret.

Ethmoid hematoma, nasal passages, horse.

Chronic obstructive pulmonary disease, lung, horse.

Islet cell amyloidosis, leopard.

Amyloid, liver, duck (polarized).
Inflammatory Components

Quantify Everything!
- Small quantity (a few)
- Moderate quantity
- Large quantity (many)
- Myriad
- Too many too count
- One, two, three, etc.

Interpret Your Results

Causative Agents
1. Location
   - Intraepithelial, intracellular, extracellular, intraluminal
   - What types of cells is it in?
2. Size and shape (descriptors of great significance)
3. Interpretation (bacteria, fungal hyphae, amoeba, etc.)

Influenza, lung, macaque (left - HE, right - polarized).

Pneumonyssus simicola, lung, Rhesus macaque.

Avian encephalomyelitis, cerebrum, chicken.

Cryptosporidium sp., bursa, chicken.
4. Inclusion Bodies

- Color (red, basophilic, amphophilic)
- Location (intranuclear, intracytoplasmic)
- Size and shape (descriptors of great significance)

Causative Agents

Trichosomoides crassicauda, urinary bladder, rat.

Capillaria aerophila, trachea, cat.

Toxoplasma gondii, lung, cat.

Actinomyces sp. (sulfur granules), thoracic cavity, dog.

Feline herpesvirus, tonsil, cat.
**Forumulatation of the Morphologic Diagnosis**

1. Site (should be the same as how you started your description)
2. Lesion (be as specific as possible)
   - “Nephritis, plasmacytic”
   - “Dermatitis, superficial and eosinophilic”
3. Duration (acute, subacute and chronic)
4. Distribution (focal, diffuse, etc.)
5. Severity (minimal, mild, moderate, severe)
6. The “withs” – significant findings that support your diagnosis

**Example: Scrapie**

**Good Morphologic Diagnosis:**
Cerebellum, brainstem: Vacuolization, neuronal, diffuse, mild with gliosis and axonal degeneration, Suffolk, ovine.

**Bad Morphologic Diagnosis:**
Ovine spongiform encephalopathy, scrapie agent.
Example: Cirrosis

Good Morphologic Diagnosis:
Liver: Hepatitis, chronic, diffuse, moderate, with hepatocellular degeneration and loss, minimal biliary hyperplasia, cholestasis, nodular regeneration and hemosiderosis, Skye Terrier, canine.

Bad Morphologic Diagnosis:
Liver: Cirrosis, diffuse.

Morphologic Diagnosis

Neoplasia
Site
The name of the neoplasm

Examples:
Hairless skin, ear: Histiocytoma, Boxer, canine.
Kidney, cortex: Renal cell carcinoma, domestic shorthair, feline.
Eye, ciliary body: Melanoma, Boxer, canine.

Questions?
DESCRIBING MICROSCOPIC SPECIMENS
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GENERAL

1. There is **NO ONE WAY** to describe a slide. Develop a style that is comfortable and consistent.

2. Be concise. Almost all slides can be described in 7 sentences or less.

3. Describe in an "inverted pyramid" or from big to little. Place the main event first; leave the ancillary changes for last.

4. Write with the reader in mind. If, after reading your description, the reader can give you the diagnosis, then you have done a good job.

5. List the tissue first (i.e., kidney). Do not embellish ("We have a triangular section of kidney measuring 2x2x3 centimeters") - this is unnecessary verbiage.

6. Describe organs in a consistent manner. If you can break each organ down into components which you describe for EVERY slide, you will never overlook a major lesion. (For instance, when describing a section of lung, always look at these five components: alveolar space, alveolar septa, airways, vasculature, and pleura. All hollow organs have both a lumen and a wall, which generally has multiple distinct layers.) Make sure to look at each part, even if you don't describe them.

7. You do not have to describe every cell or every pattern that you see on the slide. This will only serve to confuse the reader. (If most cells have indistinct cell borders, while some have distinct cell borders, describe the cells as having indistinct cell borders rather than "primarily indistinct, but rarely distinct". Go with the **majority** of the cells.)

8. Don't describe normal, except when interpreting electron micrographs. This simply wastes your time - you're a pathologist, not an anatomist. Also avoid any negative comments, (i.e., "There is no evidence of vascular invasion." If you would have seen it, you would write it down.) These sentences add nothing to your descriptions and take time to write.

9. Know your terminology and use it in your descriptions. This includes
names of anatomic locations (which are often species-specific), features of protozoans and metazoans, and specific descriptors for varying types of inflammation and necrosis, as well as many other instances. Specificity in terminology imparts to the reader that you know what you are talking about, even if you are not quite sure. The use of buzzwords can cover up a tremendous amount of uncertainty.

10. Use size and shape whenever possible in your descriptions; these are powerful descriptors. Sarcocystis zoites can be described as "1 X 2µ basophilic banana-shaped zoites". ("Guesstimations" are acceptable in testing situations - it is better to be little off on your estimate than not to have tried at all.)

11. Do not be afraid to interpret lesions, but make sure to separate this from your descriptions by a set of parentheses. (i.e. "Covering the pleura is a mat of loosely arranged eosinophilic beaded material (fibrin)."

12. Avoid redundancies or otherwise useless terms that do not add anything to your description, like "blue in color", or "characterized by", or "associated with". These terms mean nothing and take up your valuable time while writing them down.

13. Little things are important - spelling, punctuation, grammar. All of these help your descriptions "flow". Descriptions that flow pick up all of the points awarded for style.

14. Work on your handwriting. If the audience can't read it, you won't get credit for either your effort or your genius.

15. Time, time, time. You'll never get credit for slides you don't get to look at. This one factor is the major stumbling block for people on the ACVP exam. Train yourself to take no more than twelve minutes per slide, and stick with your schedule. That will give you thirty minutes to come back to slides that you have had difficulty with. If you don't get to several slides, you're sunk.

16. When all else fails, go back to the basics. Look for something added, and if you don't see it, look for something lost. (Actually, when you add something to many organs, you generally lose something, namely parenchyma, or at least architecture. "...There is multifocal loss of hepatocytes with replacement by nodular aggregates of foamy macrophages admixed with lesser numbers of lymphocytes and rare neutrophils."
NEOPLASMS

I. Organ. Most slides will be obvious. For those of which you are unsure, give a brief
description and an interpretation.

II. SENTENCE ONE: Subgross description. This is THE most important sentence in
any neoplasm description. You will receive a lot of points from this one
sentence, and set the tone for the rest of the description.

1. Location. Does it extend to cut borders? Is it limited to one anatomical part
   of the tissue, such as the grey matter or the renal cortex?

2. Size (a powerful descriptor).

3. Densely or sparsely cellular.

4. Well-demarcated or poorly demarcated

5. Shape. (Nodular, multilobular, verrucous, etc.)

6. Expansile or infiltrative

7. Encapsulated or unencapsulated

Also, this is the place to state two populations of cells, or one population
differentiating along several lines.

III. SENTENCE TWO: Patterns of cells and type of stroma.

A. Different broad classifications of neoplasms have fairly characteristic
   patterns.

   1. Carcinoma - Nest, packets, lobules, cords
2. Adenocarcinoma - Tubules, acini
3. Sarcomas - Bundles, streams
4. Round cell tumors - Sheets.

Avoid mixing patterns - "Nests, packets, and bundles". This sends mixed signals, and confuses the reader.

B. Modify your pattern description with adjectives such as closely-packed, loosely arranged, etc.

C. Stroma - fibrovascular, fibrous, pre-existing, fine, coarse, etc. This should be the last part of EVERY second sentence of EVERY neoplasm description that you do. (Almost always worth a point).

IV. SENTENCE THREE: Cytologic features.

A. Shape (round, spindled, oval, cuboidal, columnar, polygonal, pleomorphic)

B. Size (a powerful descriptor)

C. Cell borders (distinct or indistinct).

D. Cytoplasm

1. Amount (scant, moderate amount, abundant).
2. Color (eosinophilic, basophilic, red, blue, etc.)
3. Character (homogenous, fibrillar, granular)

E. Nucleus.

1. Shape (round, oval, elongate, spindled, crimped, etc.)
2. Location in cell (central, paracentral, eccentric)
3. Chromatin distribution (vesicular, finely stippled, coarsely stippled, clumped, etc.)
4. Chromatin staining (hyperchromatic)
F. Nucleolus
   1. Number
   2. Color

V. SENTENCE FOUR. Unique features - multinucleate cells, variation in cells
   (anisokaryosis, anisocytosis, karyomegaly, etc.)

VI. SENTENCE FIVE. Mitotic activity.
   A. Mitoses are _ per _ HPF.
   B. Mitoses range from _ to _ per HPF, averaging _ per HPF.
   C. Bizarre mitoses.

VII. SENTENCE SIX. Evidence of malignancy.
   A. Vascular invasion
   B. Capsular invasion
   C. Necrosis
   D. Hemorrhage (if applicable)

VIII. SENTENCE SEVEN (and more if necessary. Cleanup. These are observations
      not directly related to the neoplasm.
   A. Inflammation
   B. Ulceration
   C. Hemorrhage
   D. Mineralization
   E. Others

NON-NEOPLASTIC LESIONS

I. Organ. (One word set off from your description by a period. As before, if you are
    unsure of the organ, describe it briefly and give an interpretation.)

II. Location, distribution and size. This is an important first sentence. If you aren't
    including the all of the above descriptors, chances are your first sentence has
III. Components.

A. List all cell types seen in order of prevalence, and relate the numbers to each other. (i.e., large numbers of viable and degenerate neutrophils surrounded by lesser numbers of macrophages, lymphocytes, and plasma cells, and rare eosinophils and Langhans' type multinucleate giant cells.

B. Cellular components. Use the names of the cells. Refrain from using the terms "mononuclear cell infiltrate", non-suppurative inflammation" or "subacute inflammation".

C. Non-cellular components. These are often as important as the cellular components - fibrin, edema, hemorrhage, and that most commonly overlooked denizen of the inflammatory focus -- cellular debris.

D. Quantify everything. (Small amount, moderate amount, abundant amount; few neutrophils, moderate numbers of neutrophils, many neutrophils, myriad or innumerable neutrophils, etc.)

E. Do not be afraid to interpret your descriptions. ("Vessel walls contain a small brightly eosinophilic granular material admixed with a few neutrophils and cellular debris (fibrinoid necrosis)....

IV. Causative agent.

A. Location.

B. Size and shape (powerful descriptors)

C. Interpretation (bacilli, cocci, fungal hyphae, etc.)

D. Inclusion body (eosinophilic, basophilic, or amphophilic, ICIB or INIB)

MORPHOLOGIC DIAGNOSIS

General. There are many ways to formulate a morphologic diagnosis, and they often vary from institution to institution. The "AFIP diagnosis" is well-known for its thoroughness, and often its length. For us, it works; it's not for everyone.

I. Site. This should match the organ listed in the morphologic description, however,
you should localize it further, if possible ("Kidney, glomeruli:" or "Brainstem, paraventricular nuclei:" or simply "Liver:")

II. Lesion. Be as specific as you can by adding applicable modifiers to characterize the cellular infiltrate (Dermatitis, suppurative" or "Myocarditis, granulomatous and eosinophilic")

III. Duration. Acute, subacute, chronic. (Perhaps its a combination such as a lesion with a lot of fibrosis and scattered areas of suppuration, so you may want to use the term "chronic-active". It's a short list of modifiers here, though.)

IV. Distribution. Focal, multifocal, multifocal to coalescing, diffuse. (There are a few others - massive, disseminated, etc. You can even combine some: "multifocal and random".

V. Severity. Minimal, mild, moderate, severe, and everything in between - "mild to moderate", etc.

VI. Neoplasms. The morphologic diagnosis for a neoplasm is simply the site and type of neoplasm, i.e. (Femur: Osteosarcoma or Haired skin: Plasmacytoma.) Ancillary changes seen in the tissue as a result of the presence of a neoplasm are usually not included in the morphologic diagnosis.