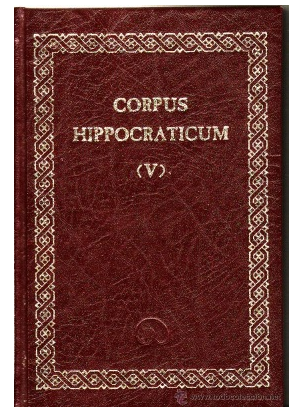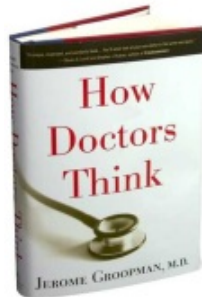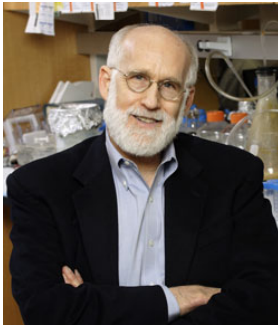# COGNITIVE ERRORS IN VETERINARY DIAGNOSTIC PATHOLOGY *Why We Make Mistakes and How to Manage the Risk*

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Life is short, the art is long, opportunity is fleeting, experience delusive. Judgment difficult.
Hippocrates of Cos, 460 BC

"Every doctor is fallible. No doctor is right all the time. Every physician, even the most brilliant, makes a misdiagnosis or chooses the wrong therapy"
Jerome Groopman, MD

Recent studies in human medicine show that ~ 80% of the errors made by doctors are caused by a cascade of *cognitive errors, not ignorance of the clinical facts*. **As many as 15% of all diagnoses in human medicine are inaccurate**. Because of the nature of what veterinary pathologists do, we are "immune" to some of these errors.

1.   We are separated from our "patients"
2.   We have little emotional involvement
3.   We neither like or dislike them
4.   We do not interact with or even elicit a history for the owners
5.   We usually have little or no clinical data

The errors veterinary pathologists make are related to Perception and Analysis of gross and microscopic visual patterns. Good research on errors in human radiology is highly relevant to veterinary pathologists reading biopsies. Currently the average diagnostic **error rate** in interpreting medical images is in the **20-30% range**. No studies have been done in veterinary pathology but there is every reason to believe the error rate is far higher than any of us want to admit. The practice of veterinary pathology has two components which are liable to error.

1.   **Perception** – we make an observation
2.   **Cognition** – we analyze what we see, what it may mean and the possible explanations for it.(*Reading our "Rosetta Stone*)
3.   These processes are repeated over and over.

Perception

We teach our students to
1. Systematically inspect each component of the organ or tissue
2. Deconstruct the image pattern before them and
3. See the component parts.

Then by analysis of all the component parts, we make a judgment and arrive at a diagnosis
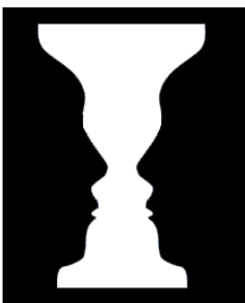

| The Observation *"It's a smart phone"* | Deconstructed iPhone 6s plus | The Interpretation *"It's an iPhone 6s plus"* |

But with experience, we abandon this deliberate deconstruction of images and "see" at a glance what is abnormal. This is called *"Pattern Recognition" But different observers may "see" different patterns.*

We have already briefly discussed *Visual Pattern Recognition* in pathology. It is an intuitive assessment based on visual data that does not always occur in a linear, step by step combination of clues. Yet that is how we teach our students to approach diagnosis. Pattern recognition is a very "soft" subconscious thing; that psychologists call *"Gestalt".* It is affected by the innate variability of the image or pathologic process as well as technical aspects of the slide. It is also impacted by our mental and physical state, our emotions and fatigue.

Classic Lesion

Variations around the classic lesion
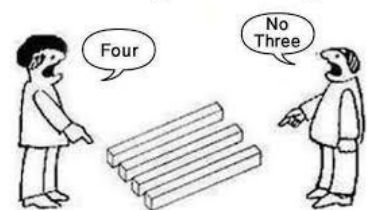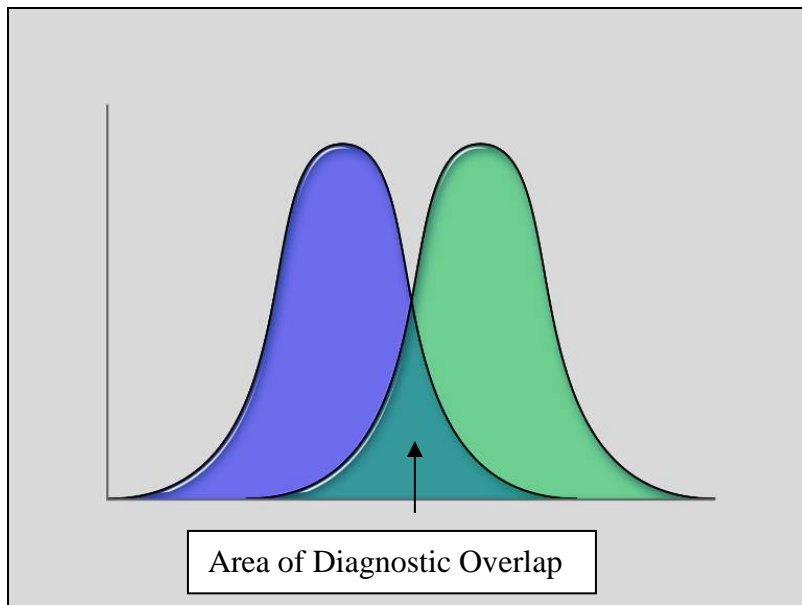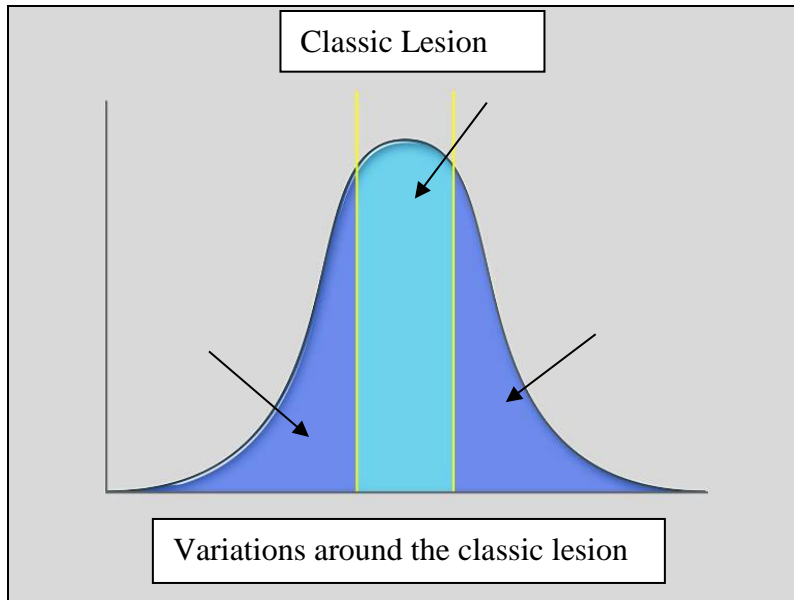
Pathologic lesions or processes have a range of expression. Residents and graduate students learn the "Classic" or "Prototype" appearance and then spend the rest of their lives learning the variation around the classic. With time, they become comfortable with the fuller range of expression. It is the ability to operate confidently in the ranges iof variation that marks the experienced pathology.

Area of Diagnostic Overlap

But the patterns of different entities may overlap at the margins of their expression and this is where experience pays dividends in sorting out the diagnosis. This is also where the variability in diagnosis among pathologists originates and is the area where errors in cognitive thinking originate as we sort through the list of differential diagnoses and try to settle on one or another diagnosis. It is the area of data collection that reinforces our bias for competing overlapping diagnostic entities. The information found here by one pathologist may stimulate a diagnosis of "histiocytoma" and another pathologist to say histiocytic sarcoma" Some of this may be mitigated by proper framing of the case and additional testing results; the **"Total Patient Evaluation"** concept.

Range of Expression of Feline Renal Lymphoma

Pattern Overlap

What's YOUR diagnosis?
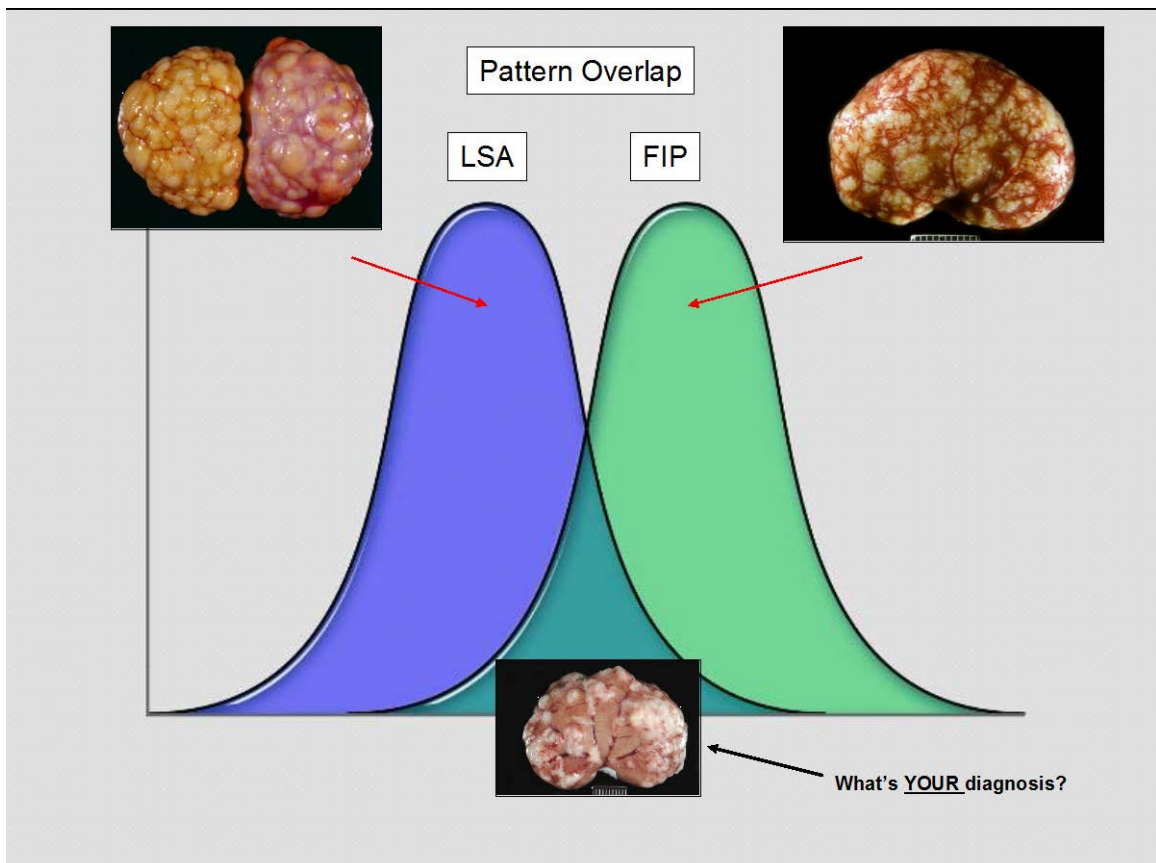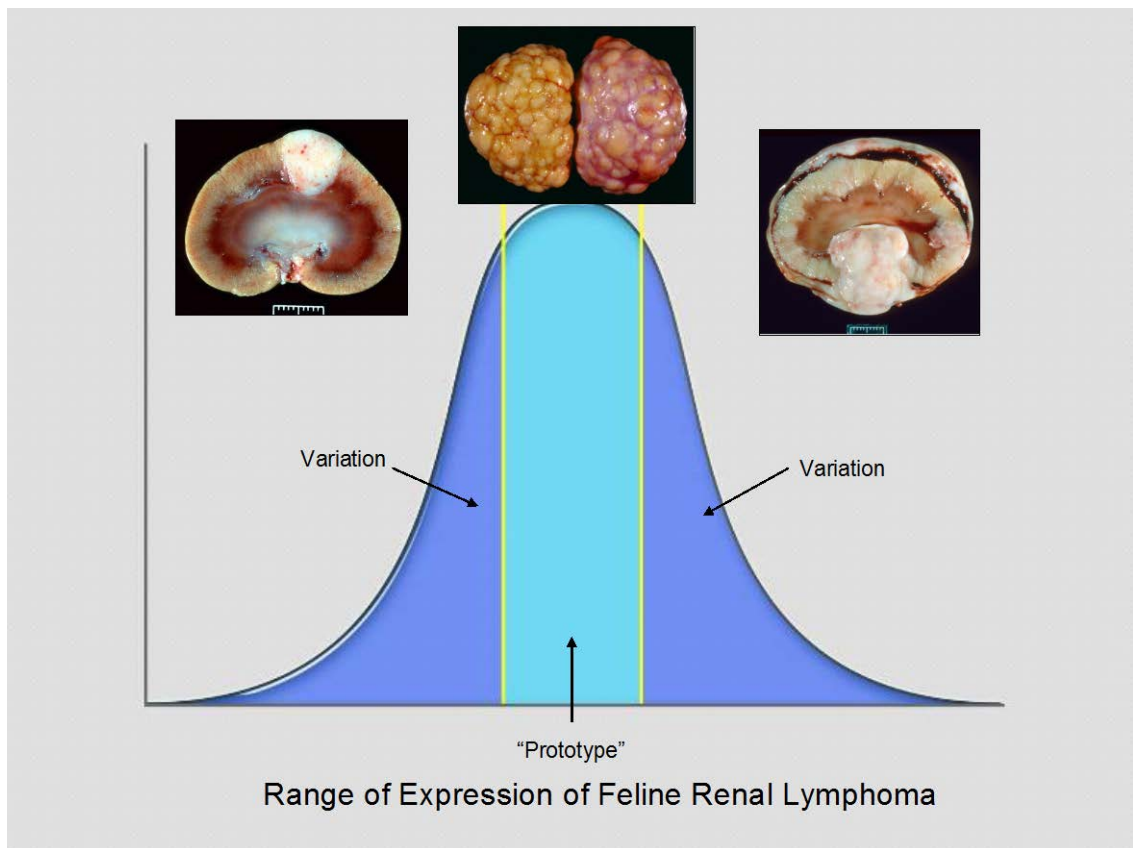
K9 WD Nasal Carcinoma
Classic or "Prototypic" pattern
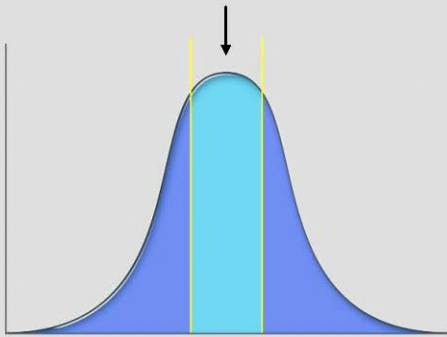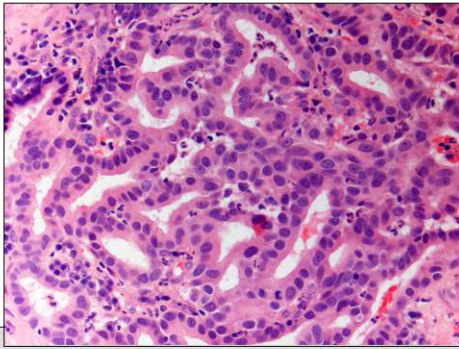
K9 WD Nasal Chondrosarcoma
Classic or "Prototypic" Pattern
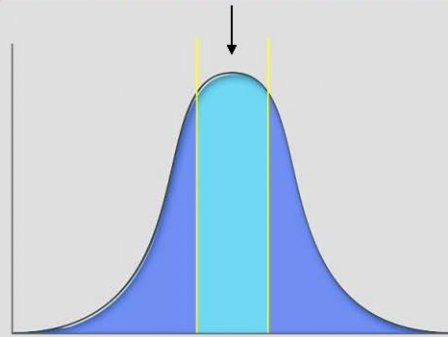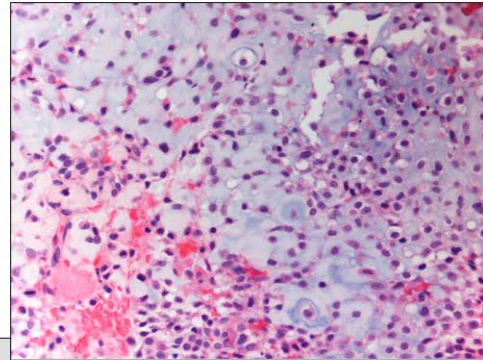
In poorly differentiated nasal neoplasia in the dog, the lesion patterns of carcinomas and sarcomas overlap and may converge.

What's <u>YOUR</u> Diagnosis?

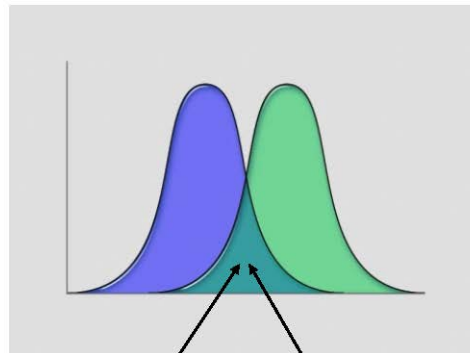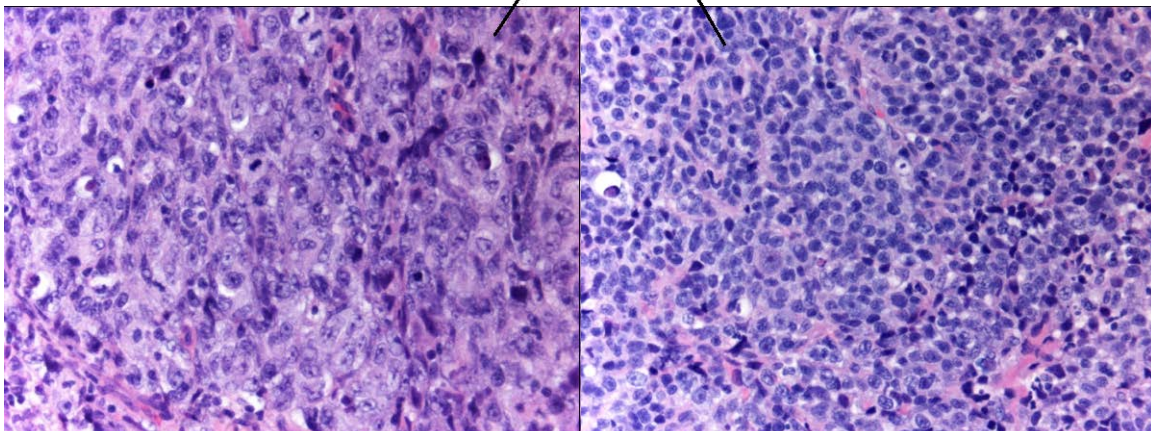# Pattern Overlap in Canine Cutaneous Spindle Cell "Tumors"

Its not always a simple "either/or" decision.

Hemangiopericytoma

Fibrosarcoma

Myxoma

Melanoma

Fibroma

Myxosarcoma

Neurofibrosarcoma

Well Differentiated K9 Maxillary Fibrosarcoma

CORPUS HIPPOCRATICUM (V)

Peripheral Nerve sheath tumor

Granulation tissue
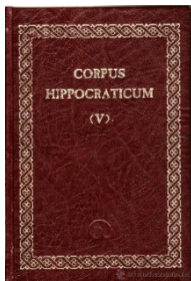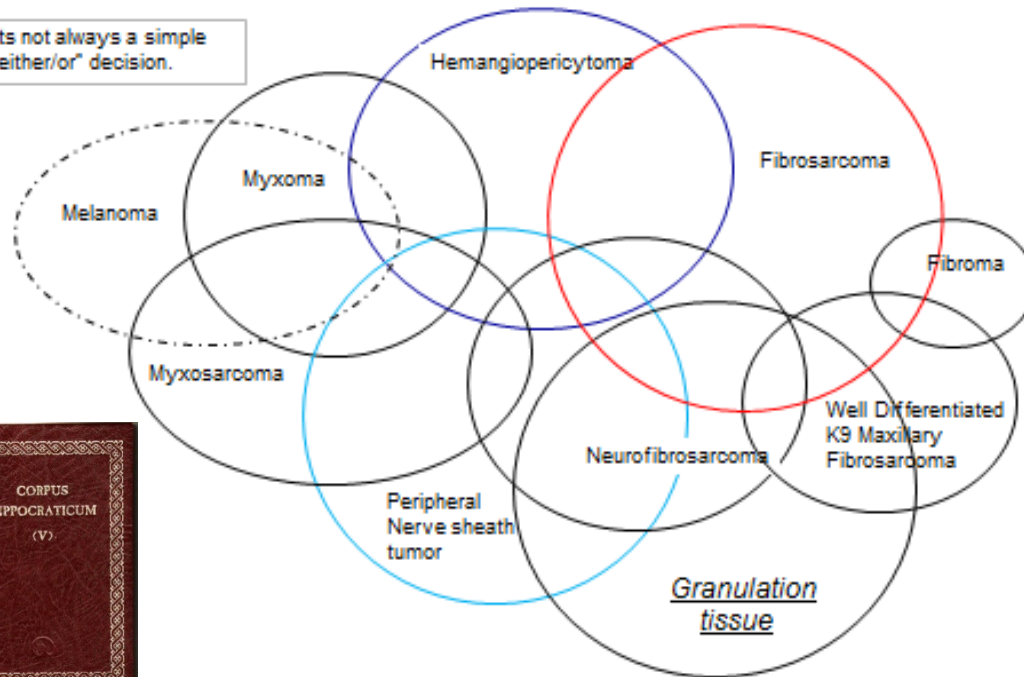
"...judgment is difficult"

Pattern Overlap in Canine Cutaneous Round Cell Tumors

Histiocytoma

Histiocytic Inflammation/ cutaneous histiocytosis

Sterile pyogranuloma

Histiocytic sarcoma

Plasmacytoma

MCT

CORPUS HIPPOCRATICUM (V)

Lymphoma

TVT
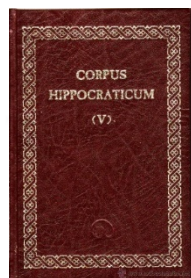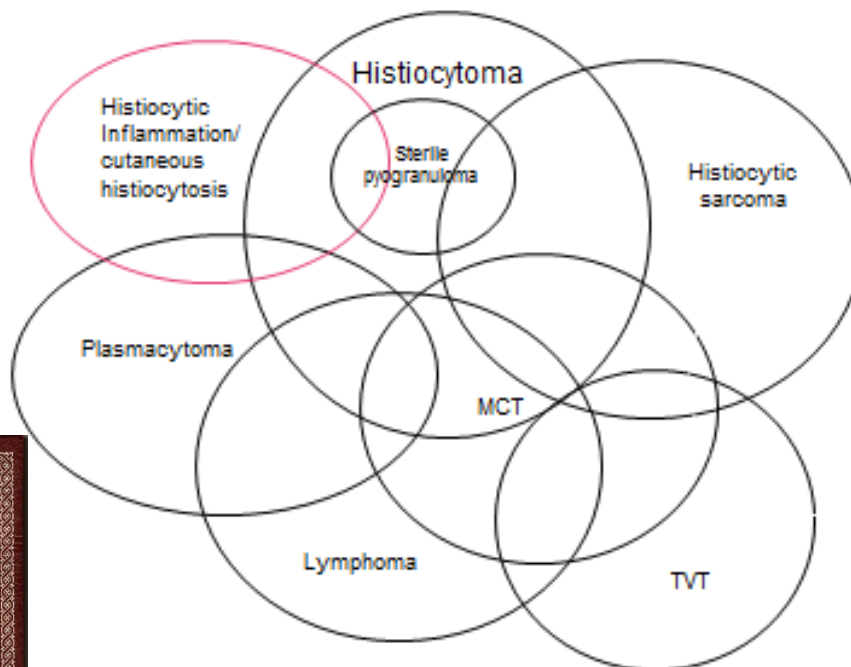
"....judgment is difficult"

Recognition is real and important and often right. It's the mark of an experienced pathologist that becomes refined over the years of practice aided by remembering when you were wrong. _Doctors (including pathologists) achieve competence by recognizing their mistakes and incorporating them into their memory._

"Identify your mistakes, analyze them, keep them accessible at all times"

The problem in surgical pathology is that we get relatively little feedback about our diagnoses. Clinicians at least see the patient again but often **WE make** a Dx and never learn if it was correct or not. This is a critical issue in the profession. Pathologists working in academic veterinary medical centers have far more opportunity for this than those in the commercial or government diagnostic labs. Labs with a single or small cadre of pathologists are too insular and have insufficient diversity of opinion necessary to keep pathologists thinking about their diagnoses. The pathology community needs to solve this problem and promote more clinician-pathologist interaction.

"....Opportunity is fleeting"
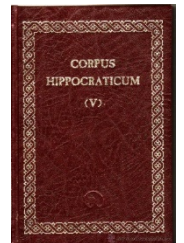
Pattern recognition while extremely useful can also be dangerous. Research shows that **most medical judgment is made within seconds after perception**. _Experts form an opinion on average in 20 seconds._ The more seasoned and experienced you are the greater is the temptation to rely on "Gestalt" alone.

"...Experience is delusive"
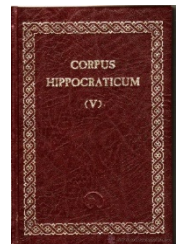
"Cogent pathologic evaluation combines the 1st impression in pattern recognition with deliberate analysis"

So its errors in thinking, not ignorance of facts.
Most of the errors we make are in "How we **think** about what we see

COGNITIVE ERRORS IN VETERINARY PATHOLOGY

ANCHORING

One of the dangers of "Gestalt". The observer does not consider the multiple possibilities but *quickly and firmly latches on to his or her "First Impression"* and ignores discrepancies that would argue to reject it. We see only the landmarks we want to see and so become "anchored" in our opinion.
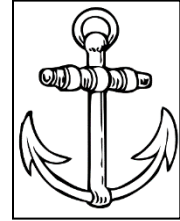
CONFIRMATION BIAS

The *tendency to search for or interpret new information in a way that confirms or reinforces your diagnosis* and avoid or ignore information that contradicts or would lead you away from prior belief. *"Cognitive Cherry Picking"*. Usually follows "anchoring" in a "Gestalt" diagnosis.
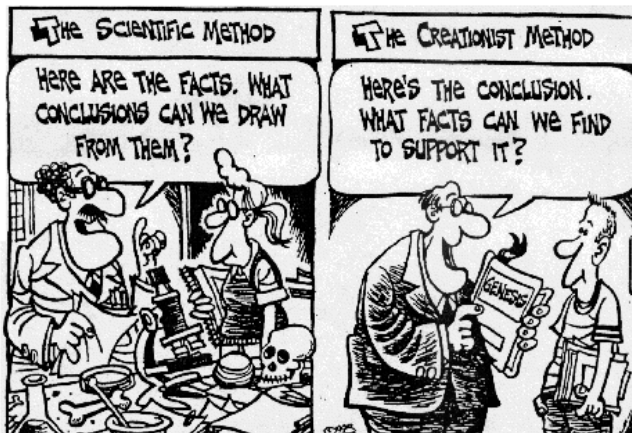
We see in the data what we want to see. We must stay uncommitted to a diagnosis until we have seen or considered all of the facts.

"Describe 1st, THEN interpret"

Ironically this is easier for students than for experienced pathologists because they lack "Gestalt"; they do not have convictions generated by the confidence of experience and so delay their Dx. This not an uncommon problem on the histopathology section of the certification examination. The candidate decides at the top of their essay what the diagnosis is, then writes a description to that entity to fit their interpretation rather than what is on their slide. That's confirmation in action.
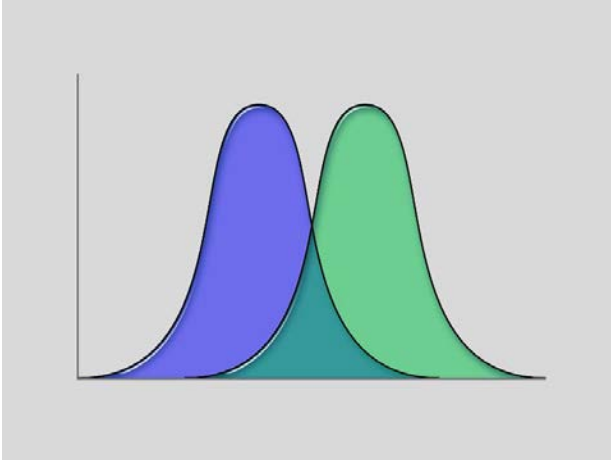
By ignoring data in the overlap that would area that would point us toward the other diagnosis, we force the Dx into our "Gestalt" diagnosis.

SEARCH SATISFACTION

The natural cognitive tendency _to stop thinking when we make a major finding_. The detection of one finding interferes with that of others. This is a well known error among human radiologists and is a major factor in false negatives. So "_Keep on truckin'_" (We test this on the ACVP exam with "Two-fors"
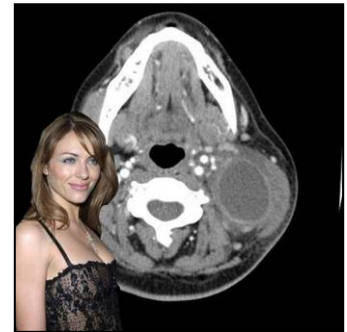
What's a **"Two-for"**?
= A question, gross image or microscopic slide, that contains **more than one diagnostic entity or lesion**.

"_Oh Thou who didst with Pitfall and with Gin,_
Beset the Road I was to wander in,
Thou wilt not with Predestined Evil round
Enmesh me, and impute my fall to sin"
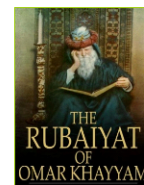
Well, I'm sorry but I'm afraid we will! Why?
   Because it happens in the real world
   Because, by testing for it, it teaches
          "The Standard"
   Because it's highly discriminating

FALSE NEGATIVES

Our minds favor the perception of "positive" data over "negative". We are more likely to see lesions that are present than lesions that result in the absence of something. Especially if the lesion is symmetrical or diffuse. Remember

---

The Paradox of Anatomic Pathology
"Sometimes the most extensive, widespread or diffuse lesion is the easiest to overlook because there is no normal for comparison

---

*Focusing on what is wrong* and the cause of the problem. Often improper or lack of framing leads to errors in thinking. Mostly for surgical pathologists the clinician or surgeon "Frames" the case. ****No or inadequate framing is a serious problem for veterinary surgical pathologists**. It is likely that concern about improper framing or leading the pathologist astray is what motivates some clinicians to say, *"Don't tell the pathologist anything, you will bias him"*. I have heard clinicians teach this to veterinary students. The reality is that without some clinical clues, perception and cognition are significantly hampered. We may be able to decrease errors in surgical pathology by at least some framing of the case by clinicians. This is one of the values of working with clinicians and providing a proper submission form that indicates what information is needed or desired.
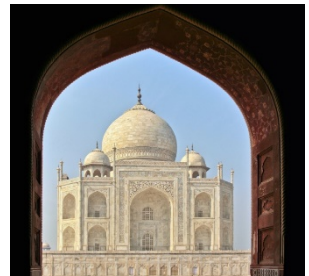
 "Accept the "Frame" but be aware that it can mislead you"

AVAILABILITY

This is the tendency *to judge the likelihood of an event (diagnosis) by the ease with which relevant and recent examples come to mind*. We teach our students to make the *"most likely diagnosis"* given the image or facts. Indeed, we test for this on the certification examination also.

 "When you hear hoof beats, think horses not zebras"

Is a good rule most of the time because **common things occur commonly.** But if you get "anchored" to the idea, you will miss some unusual diagnoses. But remember "Zebra" is a "**topographically relative**" concept. While hoof beats in the USA and Europe usually mean "Horses", in Tanzania, most of the time when you hear hoof beats, its actually zebras.

ZEBRA RETREAT

This is the shying away from a rare diagnosis. Powerful forces discourage "zebra hunting". Often "zebra hunters" are considered to be "show boats" or arrogant. To verify the occurrence of a Zebra diagnosis can cost money and time and cost containment issues blunt this activity. Mostly the lack of experience with the rare diagnosis fosters a lack of confidence so the diagnosis is not pursued aggressively.

## THE LAW OF PARSIMONY OR OCKHAM'S RAZOR

A bedrock principle of the scientific method that states that explanation of any phenomenon should make as few assumptions as possible in the explanatory hypothesis.

*"All things being equal, the simplest solution
tends to the best one"*

Ockham's Razor applies to decision making in descriptive pathology but should not override thorough cogent analysis of the images and facts. Sometimes the correct answer is complex

DIAGNOSIS MOMEMTUM

A ripple effect through a group of pathologists. A pathologist makes an initial diagnosis that is accepted by peers and subordinates without challenge. Subsequent opinions agree and soon the diagnosis is universally agreed upon. This occurs especially when the first opinion is made by an expert or senior experienced pathologist. I have seen this many times in seminars when a senior resident gives a diagnosis and all of the other residents follow suit even when the first diagnosis is wrong. Soon the diagnosis gains enough force to crush all other opinions.
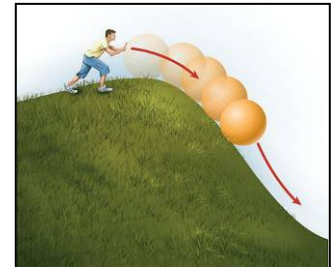
UNCERTAINTY

All observers have characteristic ways they manage uncertainty which is common in diagnostic pathology. Pathologists tend to be either **"Risk Takers"** that have more false positive diagnoses or are **"Risk Averse"** who tend to have more false negatives.

The Evolution of Uncertainty
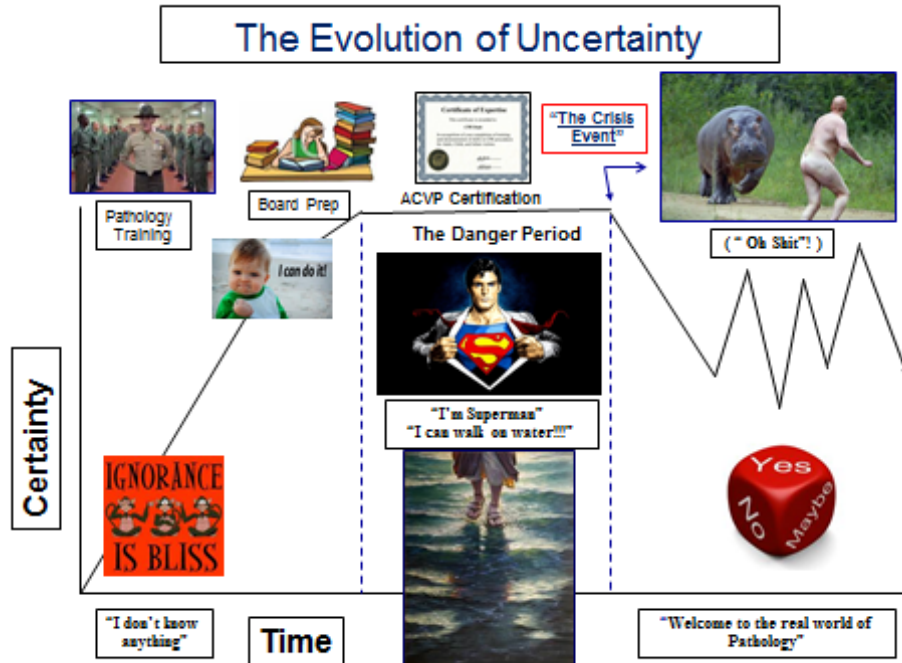
Management of Risk

You manage this risk by being aware of the ramifications of your diagnosis and what the consequences are if you are wrong.

 I try to err on the side of least damage if I am wrong and this varies from situation to situation. Remember to communicate your uncertainty to the clinician if it impacts case management. Clinicians generally do not care of you called a tricholemoma a trichoblastoma or sebaceous hyperplasia an adenoma. There is no clinical fallout. Surgeons complain about pathologists who will not consistently commit to a firm diagnosis and that is a danger as the threat of litigation becomes more frequent. Remember our job is to help as much possible. I tend toward making a diagnosis whenever possible but I am **guided by the "First Rule of Medicine" ("Above all, do no harm").** This is motivated by a desire to help clinicians, give the clinicians and pet owners their money's worth and the fact that for a long time we have been working with impunity as to the legal consequences of our diagnoses. But I manage the risk by being honest with clinicians

("Nothing competes with honesty in the pathology report")

and knowing the clinical consequences of a mistake for each diagnosis I give. Surgical pathology today is a challenge and to work in this environment you have to accept that and the risks and limitations. "*Bring your "A" game to the microscope*"

JUGGLING

The mark of the expert physician is the ability to keep seemingly contradictory bits of data simultaneously in your mind then seeking other information to make a decision one way or another
You must find a middle ground. Be aware of the cognitive errors and traps. Recognize that certain patterns may not conform to the prototype. The art of pathologic diagnosis is knowing when you are outside the prototype range of lesion expression and into which other overlapping lesion range you are in.
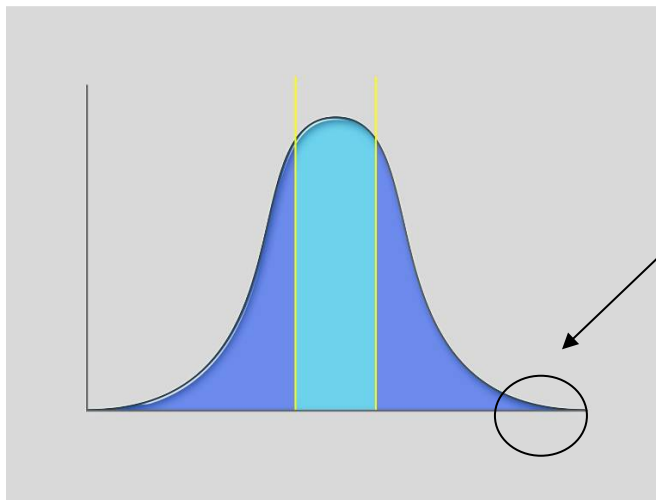
When the lesion is at the extreme limit, opinions among pathologists may differ remarkably and regardless of what they say, the certainty of each diagnosis is low. Pathologists should communicate the unusual or atypical pattern that does not easily fit into a diagnosis or that would likely elicit divergent opinions so the clinician can better manage the uncertainty of the diagnosis and therefore the risk to the patient if the diagnosis is wrong. Clinicians must understand the variable nature of disease patterns and that it is a subjective opinion. This is why two board certified pathologists can look at the same slide and render 2 often very different diagnoses

THE MANAGEMENT OF COGNITIVE ERRORS

1. **Be aware of the cognitive traps** Other experienced pathologists have similar mechanisms. "*Man up*"! You make errors. We all do. Managing your cognitive errors begins with "accepting your story"

2. **Slow the perception and analysis process**. Time opens he mind. However, *time is the most precious commodity in medicine*. None of us has the luxury of making diagnoses with unlimited time. Most difficult to do in surgical biopsy and on the certification examination. Consultation with colleagues when possible. Set the case aside and come back to it later. Often you see the lesions with a more open mind.

"Most things are better by morning"
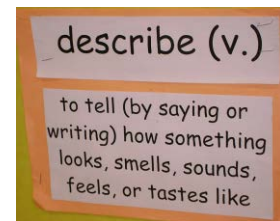…………Lewis Thomas
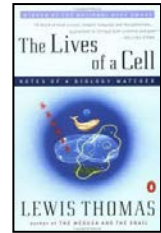
This is the origin of the old medical axiom,
"Take 2 aspirin and call me in the morning"

3. **Deconstruct the pattern recognition image** mentally or in writing just as we teach our students to do. Use your Pattern Recognition skill (*Gestalt)*, its valuable and often correct but check it with a cogent analysis of all the facts if possible ("*Corroborative testimony*") . I always ask myself before I commit to a diagnosis "*Does it all add up*" or "*What else could this be*"?

4. *"Describe uncertainty"* because it forces you to slow down and evaluate the separate parts of the "Gestalt Image".But employ a style that fits the purpose of the task. Most critical in biopsy. Control fatigue by work flow management and an efficient style that suits the biopsy reports purpose.
   *"The amount written is inversely proportional to the certainty of the diagnosis."* It's different for everybody.

5. Make a mental list of DDx's and work from that. Again, the ACVP and ECVP certification examinations test this skill for a good reason.

6. Use the Total Patient Evaluation Concept. Get all of the pieces of the puzzle together before you interpret the "picture". *"Read a slide but interpret a patient"* Properly framed cases often provide a lead or information that may set off a DDx list or even stimulate a thought or idea that you were not considering. Valuable but in some tasks either purposely denied, as on the certification examinations, or omitted by clinicians for whom you are working. Always interpret framing cautiously because if not accurate, it can lead you astray. "*To examine for yourself*"
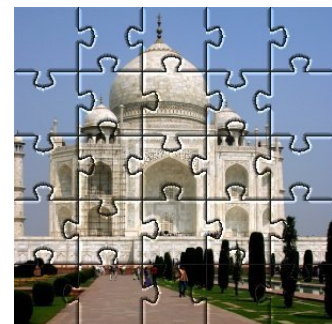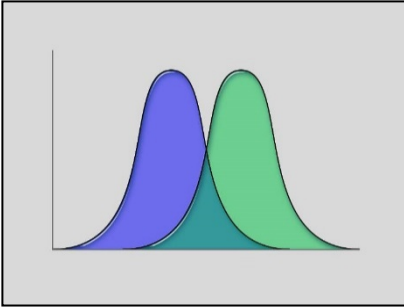
PATHOLOGICAL MYOPIA

The tendency to over weight the data immediately in front of you and ignore other information pertinent to the diagnosis. Especially common in surgical biopsy interpretation when the slide is all you have.
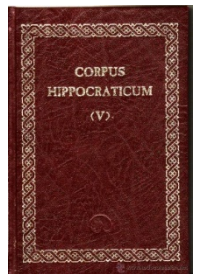
"Read a slide, but interpret a patient"

The Judgment of Competing Uncertainties

Sometimes the total patient evaluation helps to focus you and assist in the decision. If not, ***"Take two aspirin and look at it again in the morning"*** Then seek another opinion from a colleague.

"Judgment is difficult"

THE MYTH OF INFALLIBILITY

The expectation of being perfect, while appealing to us, is unreasonable. There is a long chain of events with multiple critical points before the pathologist even sees the case. There are vagaries and subjectivity in pattern recognition. There are going to be mistakes and some diagnoses cannot be reached by consensus. If this were not so, we would agree on everything but we don't. That is why the Greeks called medicine an "Art". What is an acceptable error rate? Who knows? 5%? The real rate is probably much higher. We do know from human studies that the **Interobserver variability is ~ 20% and the Intraobserver variability is ~ 5-10%.**

"And finally there is judgment. We try to teach it to our students, but we wonder if we understand it ourselves. Sometimes the course that seems right for this particular patient today is exactly the opposite of what seemed right for someone with what seemed to be exactly the same problem yesterday. If even statistics give fuzzy answers, how much more unsteady must be judgment? Were it infallible, doctors would never disagree. The problem thus distills itself down to the first aphorism of Hippocrates; judgment is difficult to learn, to apply and even to recognize; medicine has few uncertainties….the ancients correctly called it the Art.
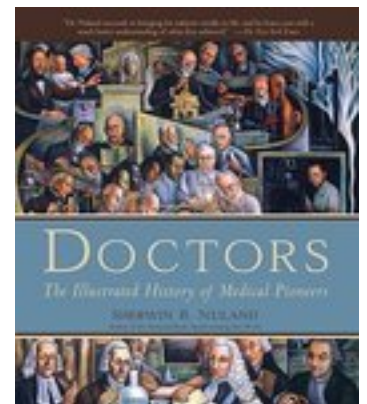
(From "Doctors. The Illustrated History of Medical Pioneers"
By Sherwin B. Nuland MD)