

Clinical reasoning and problem solving – *are they teachable and assessable skills?*

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Our students – do they all have the same experience?





What are our goals in
clinical veterinary
education?

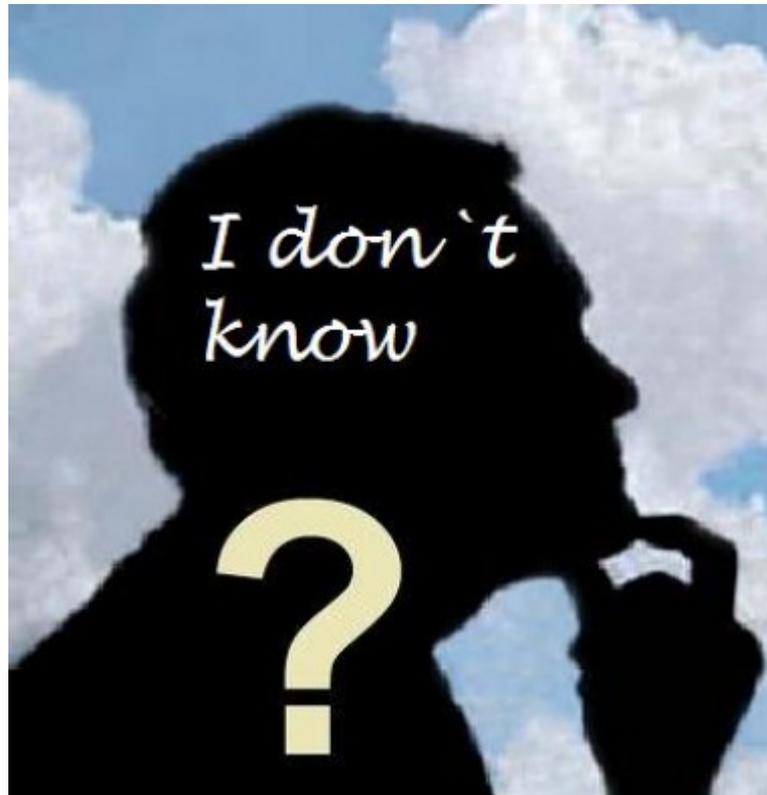


What are the challenges?

What do our graduates have to do?

- The majority will enter general practice at least initially
- They will have to deal with:
 - Primary and preventative health care
 - The worried well
 - The genuinely unwell
- Few will be able to refer all complex cases to specialists even if they want to

How does it feel not to know?



How to deconstruct what is needed to clinical reason?



Clinical teaching components

- Didactic teaching
- Practical skills learning
- Observation
 - Clinical role models on and off campus
- Doing
 - Engagement with clinical decision making on and off campus

Clinical teaching - locations

- University teaching hospitals
- Private specialist hospitals
- First opinion/general practice in the community
- Charity-based practices
- Shelter medicine
- Other

Clinical teaching – who by?

Royal Veterinary College



Specialist practice



- Sophisticated diagnostic testing usually integral to patient management
- Focus is almost exclusively on reaching an accurate diagnosis and instituting rational therapy as soon as possible
- Many cases reach a conclusion – one way or another!

General practice

- Problems may be ill defined
- Consultation times are shorter
- Access to comprehensive diagnostics often much more limited
 - Financial
 - Technical
 - Knowledge



General practice

- Owner expectations may be more focused on resolution than a specific diagnosis
- Decision making more often in an environment of uncertainty
- Sound clinical reasoning skills essential to enhance ability to influence clients
 - Diagnostic decisions
 - Treatment decisions
 - Adherence to treatment plans





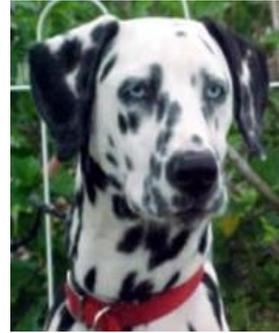
Let's look at some cases seen in 1st opinion practice



“Brutus”



“Brutus”



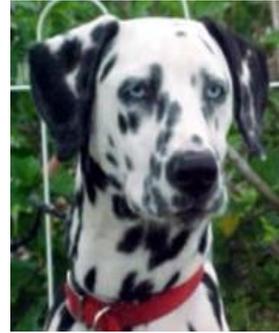
- 10 year old male neutered Dalmation
- Hx:
 - vomiting - 3 days
 - PU/PD: 10 days
 - inappetant - 10 days
- PE
 - dehydrated
 - depressed

What diseases do you know that cause both vomiting and PU/PD?



Differentials?

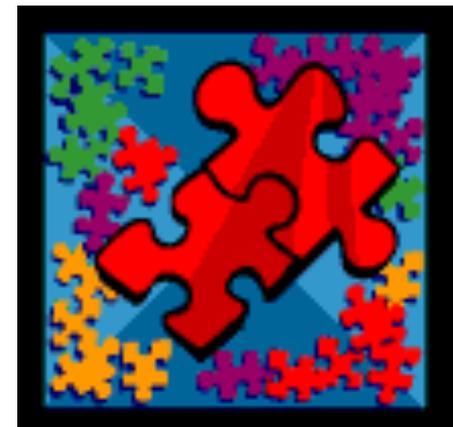
- Renal failure?
- Diabetes?
- Liver disease?
- Hypercalcaemia?
- Hypoadrenocorticism?
- ??????



“Brutus”

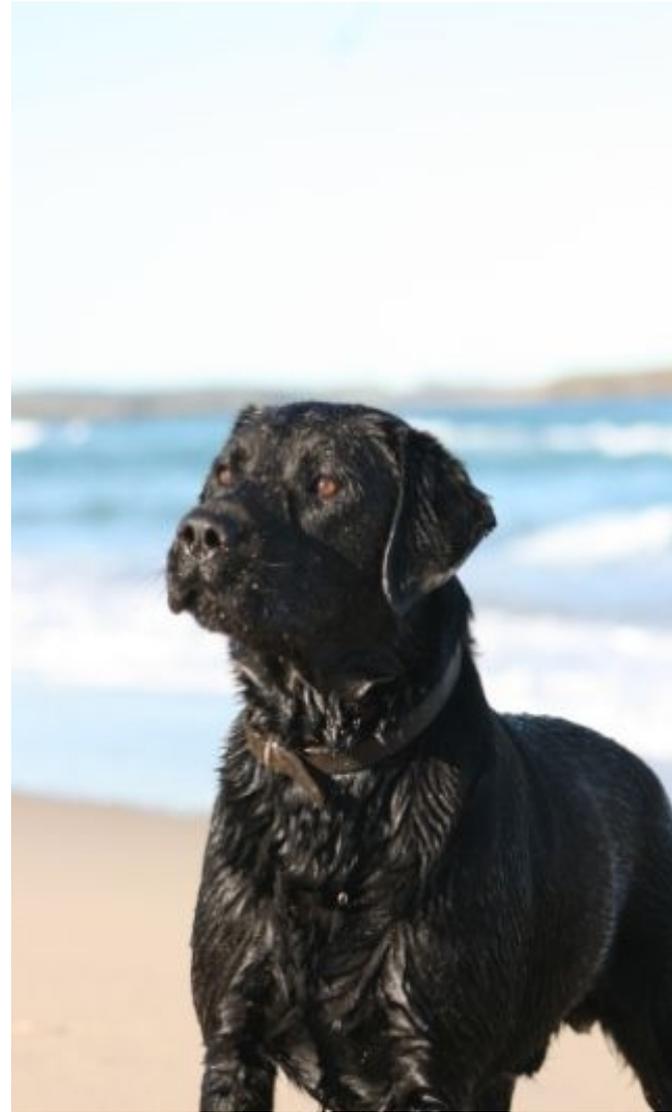


- There are a limited number of causes of this pattern of clinical signs
- Routine blood tests will probably yield a diagnosis provided they are appropriately comprehensive and.....
- You know how to interpret them

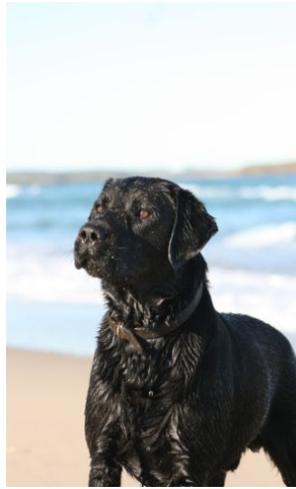


“Guinness”

8 year old
Male (N) Labrador



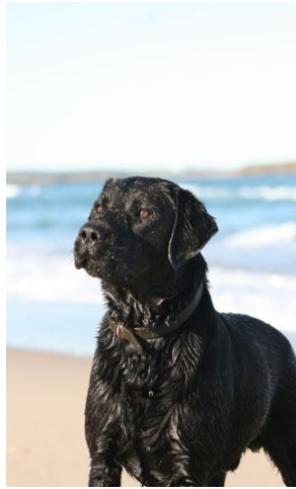
History



- Acute history of collapse several hours ago
- Passed large amount of melaenic faeces
- Vomited once
- Active and normal the preceding day
- Had eaten well the preceding afternoon

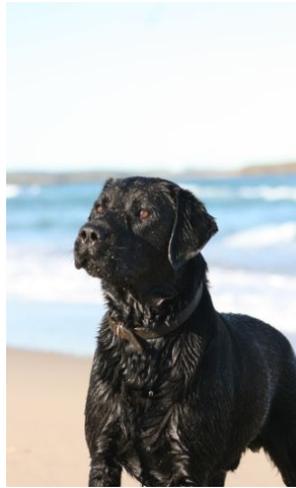
Physical examination

- Very weak
- Very pale mucous membranes
- HR = 160 = PR
- Systolic cardiac murmur on the left hand side (II/VI)
- Splenomegaly
- Rectal temperature 37.6° C



Possible differentials?

- Acute GI disaster?
- Coagulopathy?
 - Rat bait?
- Acute cardiac failure?
- Splenic torsion?
- Splenic haemangiosarcoma?
- Haemolytic anaemia?
- ?????



“Erroll”



“Erroll”



- 4 year old neutered male Burmese
- Hx:
 - 2 week history of intermittent vomiting
 - vomit is bile stained
 - last 4-5 days he has become progressively anorexic and depressed

“Erroll”



> Hx:

- 24 hours prior to presentation he had started straining to urinate and the urine was blood stained
- no diarrhoea noted
- water intake was normal until the past 24 hours when it may have been reduced

“Erroll”



> Physical examination

- very depressed
- severely dehydrated
- rectal temperature 38.1°C
- HR = 220 = PR
- mucous membrane colour was poor, CRT > 4 secs
- abdominal palpation unremarkable
- kidneys felt normal and were not painful
- bladder was full but felt normal and could be easily expressed

What diseases do you know that cause vomiting, then some time later, anorexia and depression and even later cause haematuria and dysuria?



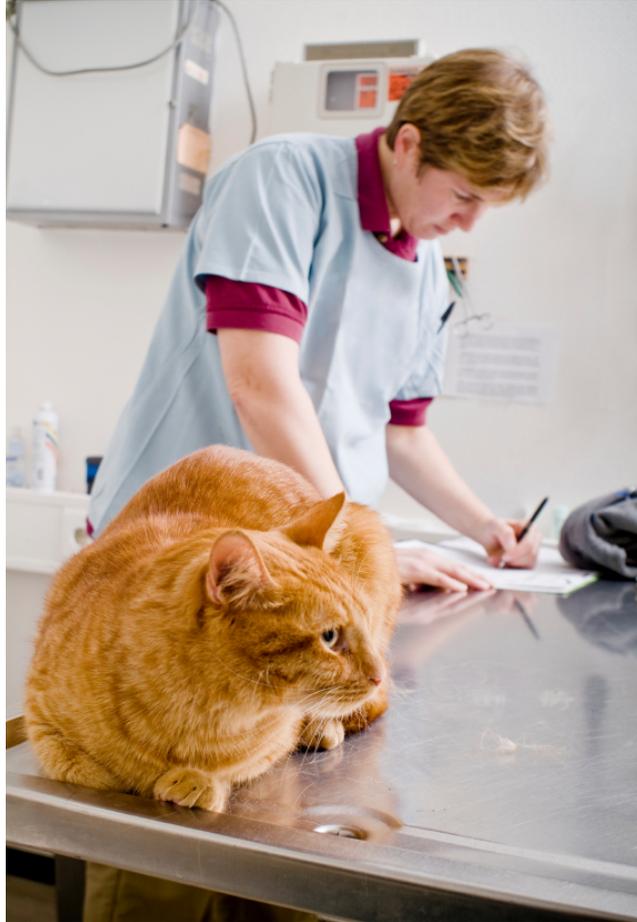
“Erroll”



- There is no easily recognizable pattern to permit a differential list
- Blood work revealed no abnormalities other than a significant inflammatory leukogram
-
- **HELP!!!!!!**



Probable diagnoses



Clinical presentation

Probable diagnoses



Clinical presentation

Probable diagnoses



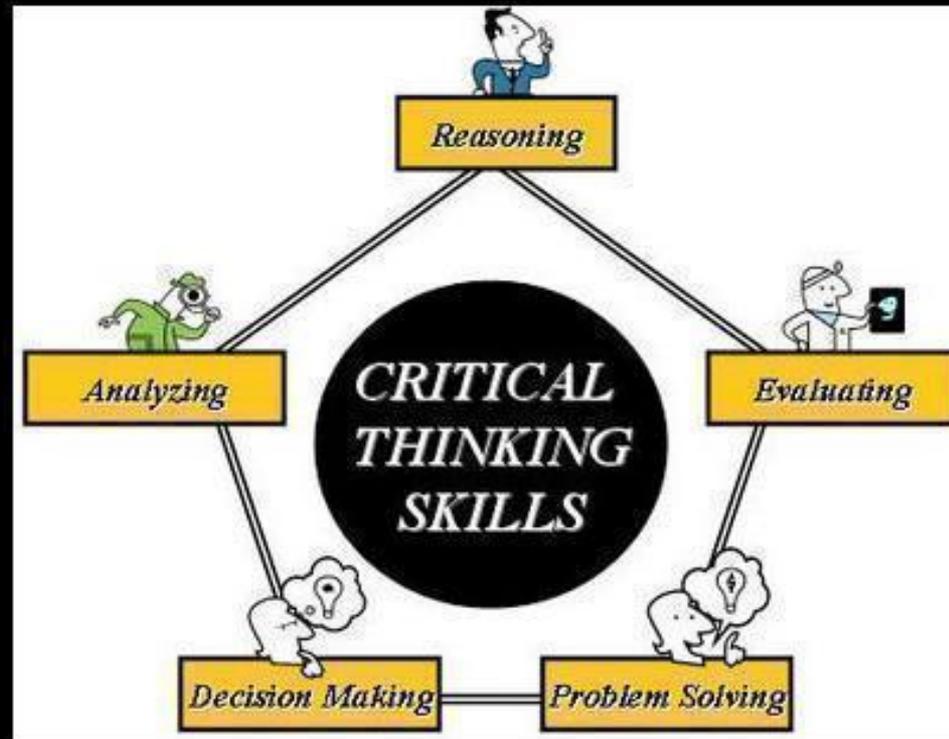
Clinical presentation

Probable diagnoses

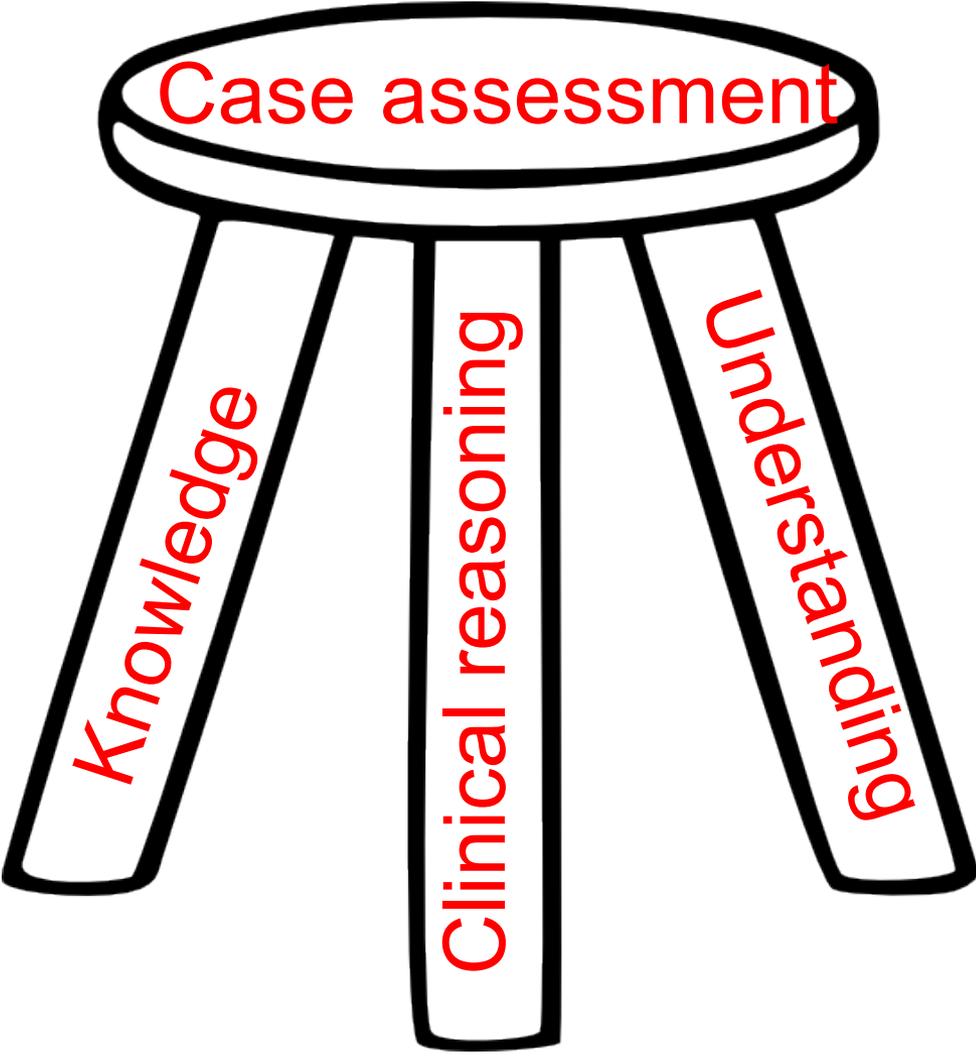


Clinical presentation

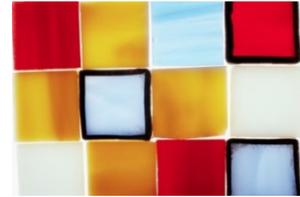
Solutions



Problems



How can the vet make a diagnosis?



➤ Non-analytical reasoning - pattern recognition:

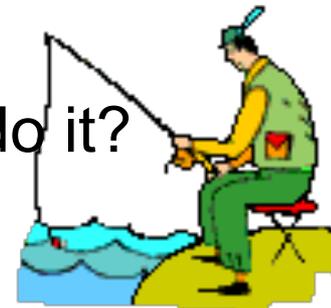
- What disorders do I know that will cause this particular pattern of clinical signs?
- What is in my illness script bank?

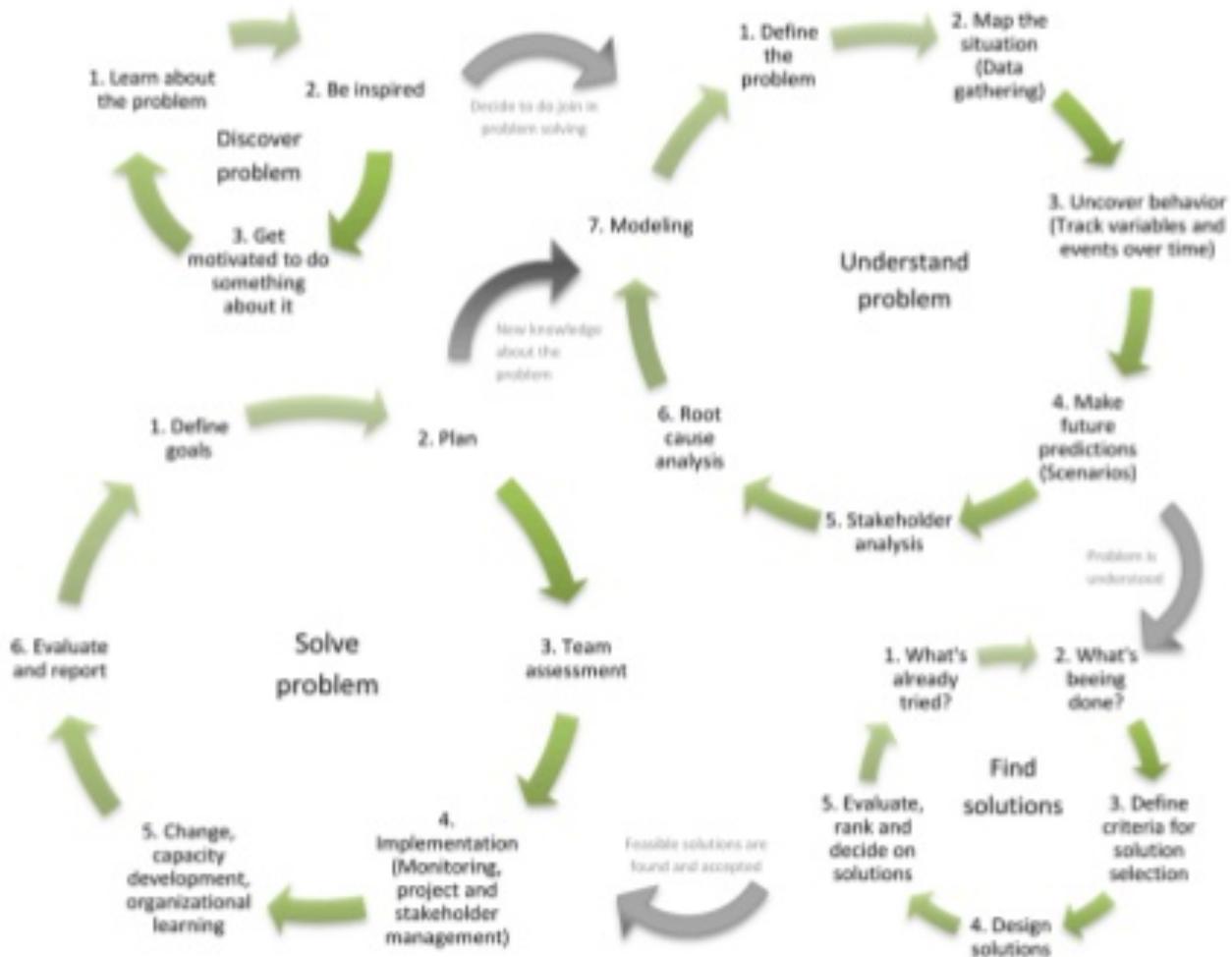
➤ Minimum database:

- Eek – all looks a bit complicated - I'll do some bloods and that will give me the answer – I'll go fishing!

➤ Analytic reasoning

- But what is this exactly and how do I learn to do it?







Non-analytic reasoning

Fishing expedition

Analytic reasoning





Non-analytic reasoning

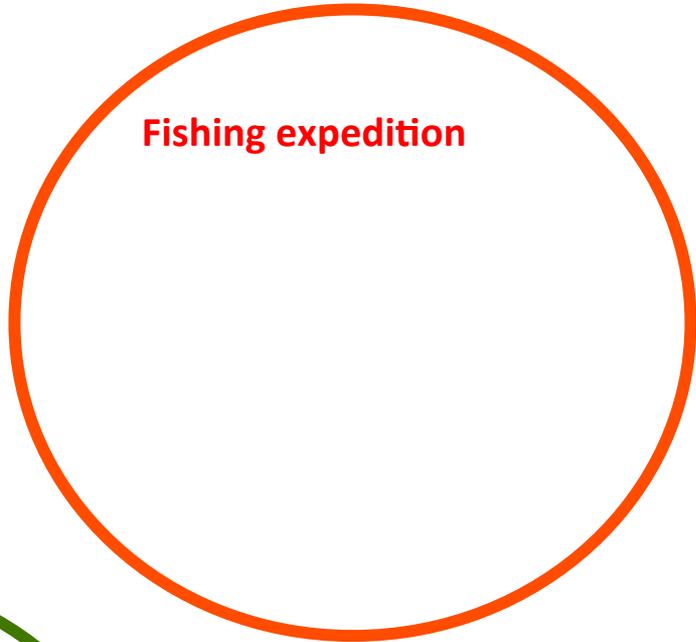
Fishing expedition



Analytic reasoning



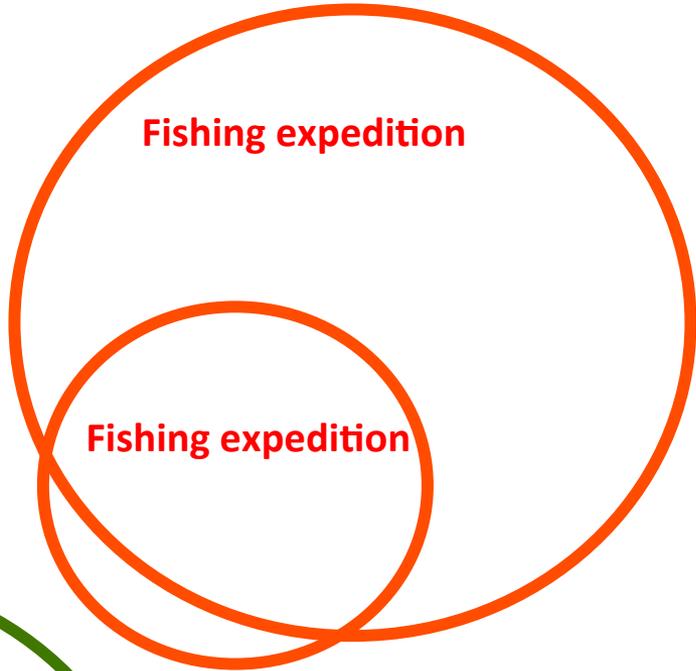
Non-analytic reasoning

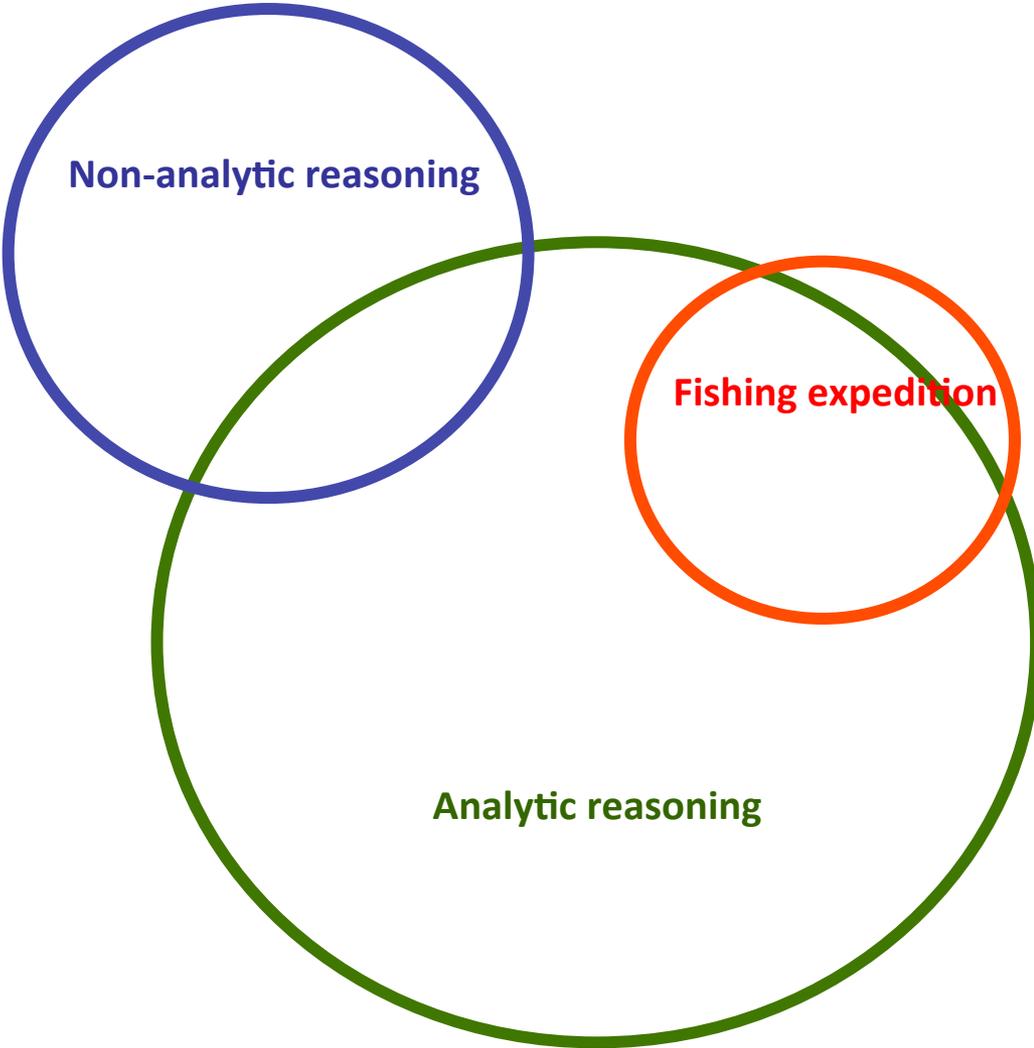


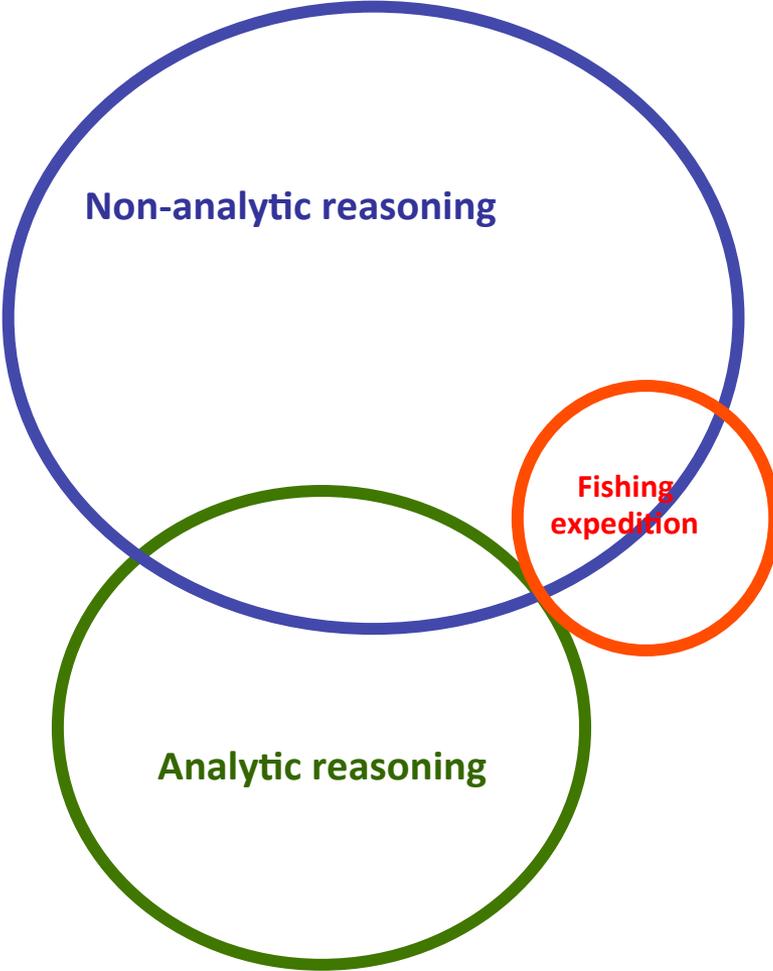
Fishing expedition



Analytic reasoning



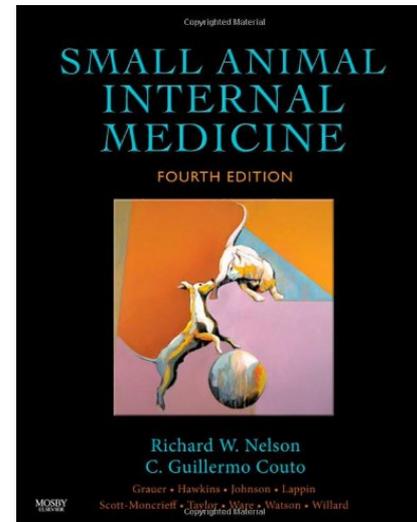
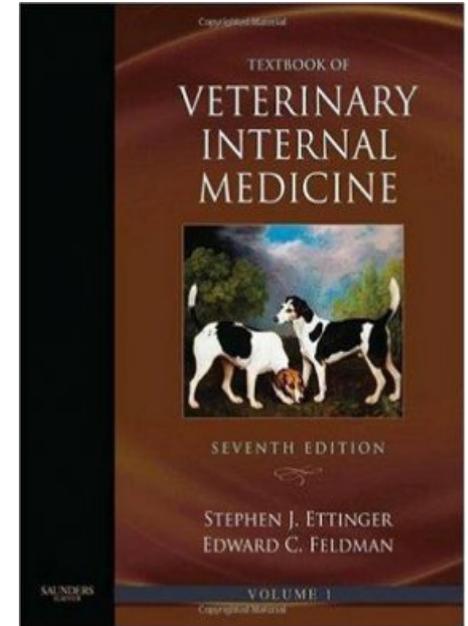




Why focus on analytic reasoning aka problem solving?



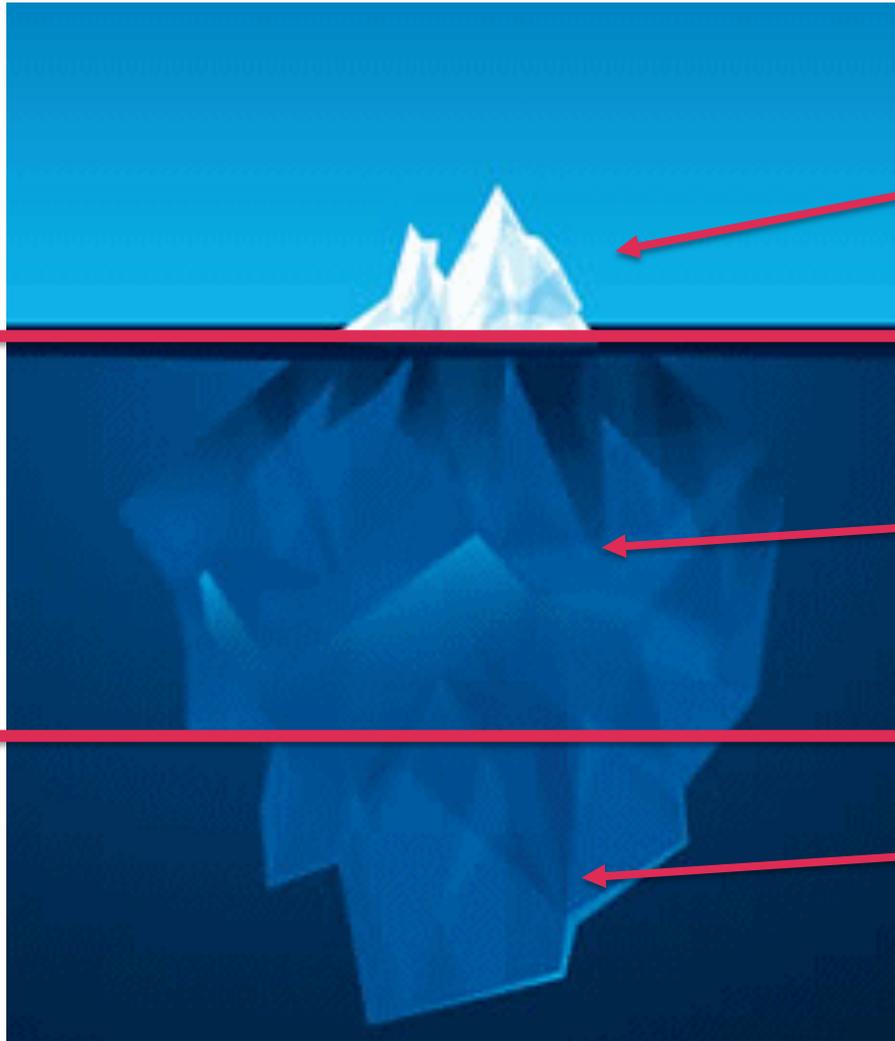
Surely facts are enough?



Plus experience?







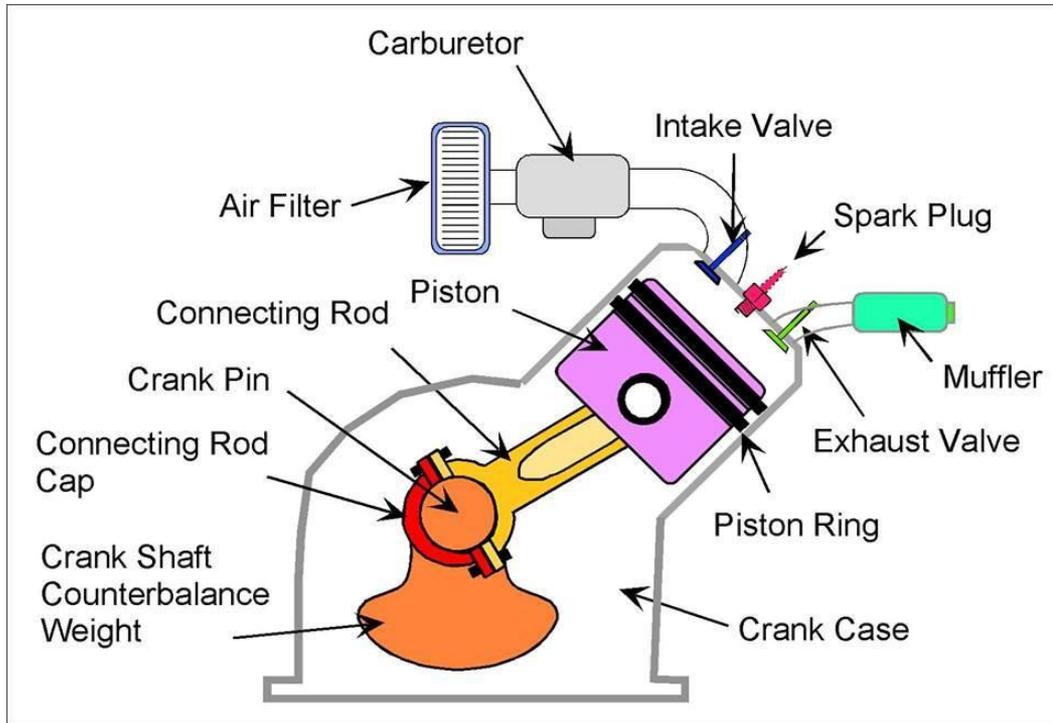
What the student currently knows

What is currently known
by experts and is in textbooks
and the veterinary literature

What no one yet knows or
what will change

Knowledge

- We can't tell them everything known now let alone what will be known in the future
- Knowing the facts is not the same as knowing what to do
- Knowledge is only useful if it can be accessed, formulated and applied to the problem at hand



Sowhy focus on problem solving?





Hi – my name is Bud
and I've got cancer of
the liver

Non-analytical reasoning aka pattern recognition

- Effective in perhaps 70% cases in general practice
- Works best when:
 - the clinical pattern is unique for a disorder or
 - there are only a few possibilities which are:
 - easily remembered or
 - can easily be ruled in or out by routine tests
 - vet has extensive experience, is well read and up to date, reviews all diagnoses critically and has excellent memory

Pattern recognition

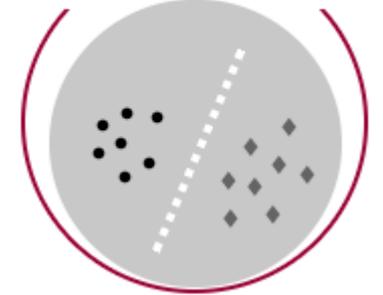
- Involves a wide variety of heuristics
 - subconscious rules of thumb or mental shortcuts to reduce the cognitive load and speed resolution of problems
- Tend to be viewed more favourably in some disciplines.....
 - emergency care
 - visual disciplines
- Than others
 - internal medicine



Pattern Recognition-Advantages

- Doesn't need to be taught
 - Thinking in patterns occurs natural
- Quick
 - When correct
- Cost effective
 - When correct
- Vet looks good and is happy
 - When correct!

Pattern Recognition



When can pattern recognition fail?



Pattern Recognition-Disadvantages

- To be effective need to have only limited number of diagnostic options
- Even for experienced clinicians it is not good for uncommon disorders or atypical presentations of common disorders
- Dependent on previous diagnosis (Dx) vs clinical signs match being correct
- Very dependent on experience, knowledge and memory



Pattern Recognition-Disadvantages

- Risk of tunnel vision
- Risk that all data will be interpreted favourably to support clinical assumptions
 - Confirmation bias
- No clear alternate diagnostic path if pattern recognition is wrong



Pattern Recognition-Disadvantages

- If no pattern obvious investigation may be
 - unfocused
 - time consuming
 - costly



Pattern Recognition

- Relies entirely on knowledge and experience



“Teaching” nonanalytic reasoning

- Pattern recognition cannot be “taught”
- It also can’t be suppressed
- A case will inevitably trigger memories and suggest possible diagnoses if similar patients have been seen previously



“Teaching” nonanalytic reasoning

- Thus to support development a large bank of illness scripts is required
- Plus a learned process for acknowledging, then double-checking, the favoured illness script



“Teaching” nonanalytic reasoning

- Formation of patterns used for illness scripts can only be constructed by each learner based on:
 - patients they have seen
 - knowledge they have accumulated





“Teaching” nonanalytic reasoning

- Needs to allow recognition of typical presentation for a problem as well as the variations and atypical presentations

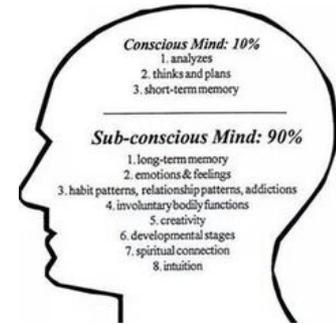


“Teaching” nonanalytic reasoning

- Thus students must have adequate exposure to pedagogically useful cases
 - Common conditions
 - More complex cases that can be decoded where learning points are:
 - transferable
 - core to good medical practice and clinical reasoning
 - teacher does not get bogged down in clinical minutia, that may be intellectually exciting for the specialist or specialist in training, but is of questionable educational relevance

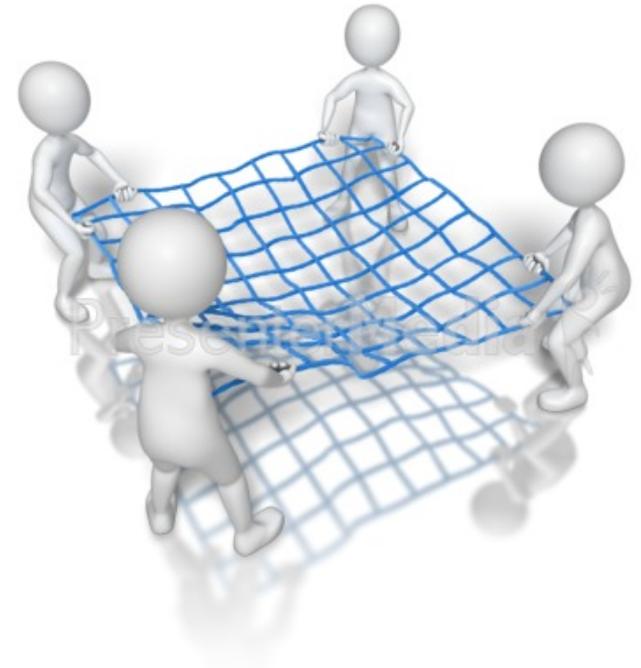
So?

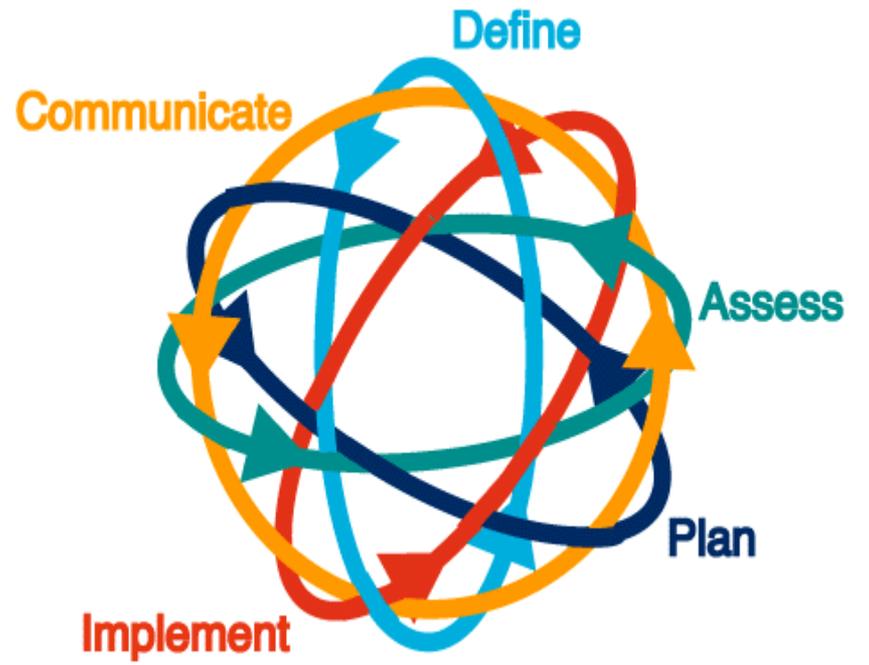
- Nonanalytic reasoning occurs rapidly and thinking in patterns occurs naturally
 - Development can be supported but not “taught”
 - Analytic reasoning can be developed and each individual will usually find a path if called upon to do it
 - But surely better to teach a structure that can be used as a base?
- Especially if that base can reinforce pathophysiological principles at the same time



What about analytic reasoning?

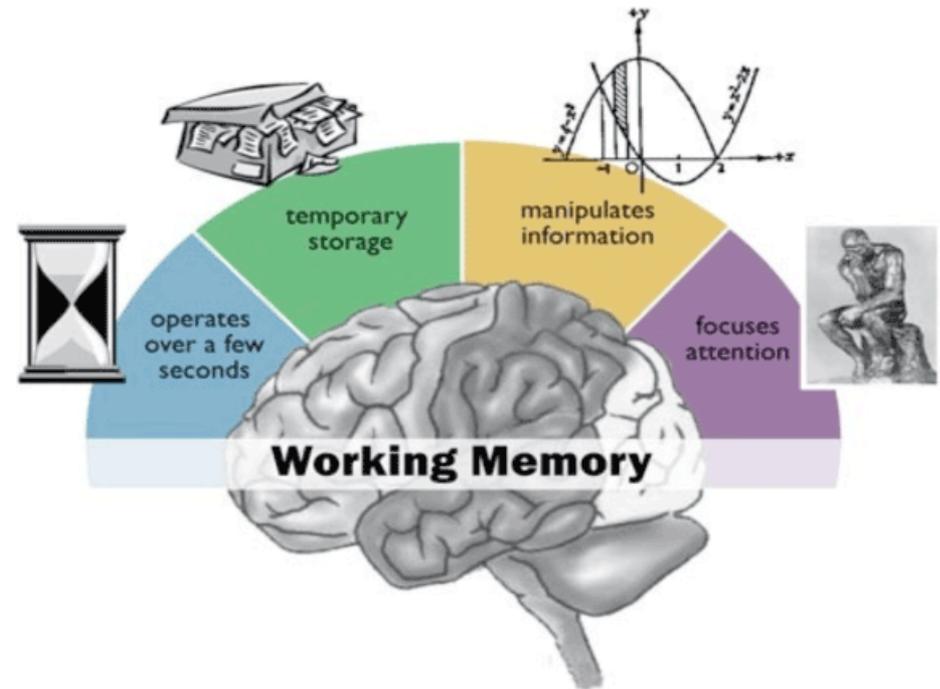
- When needed?
 - When nonanalytic reasoning not effective or available
 - Safety check even when it is
- Is it teachable?





Analytic reasoning

- May be less prone to bias than nonanalytic reasoning
- Limited by working memory capacity



Analytic reasoning

➤ Unless.....

- strategies developed to provide a logical, methodical and memorable process
- through which the clinician can problem-solve any case presentation

➤ Deductive vs inductive

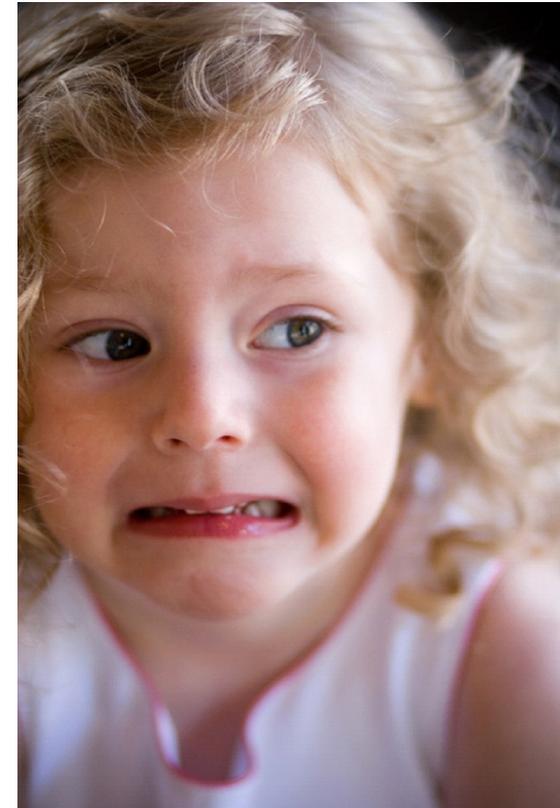
Deductive

- Generated hypotheses which the clinician then tests
- “Rule out” approach
- Can rely too much on collection of non specific diagnostic data
 - which can be challenging to interpret in the absence of an intellectual framework informed by pertinent key questions
- Can be time-consuming and laborious



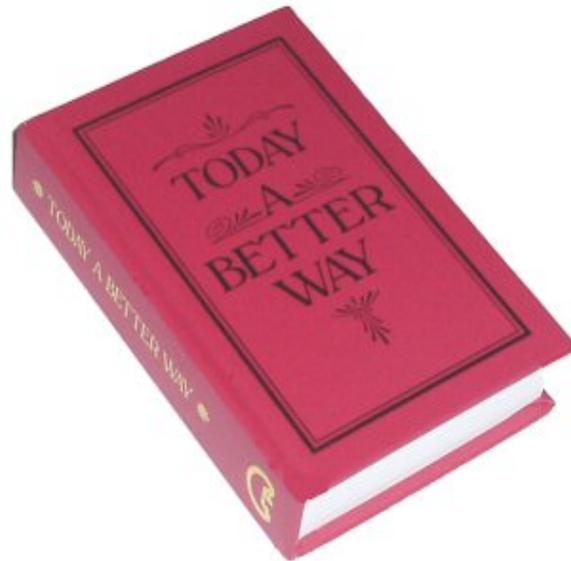
Inductive

- Develop decision trees/ “small worlds”
- Broad generalizations from specific observations
- Formulation of tentative hypotheses → general conclusions or theories
- Overwhelming without specific advice on how to do it
- So



Teaching a logical approach

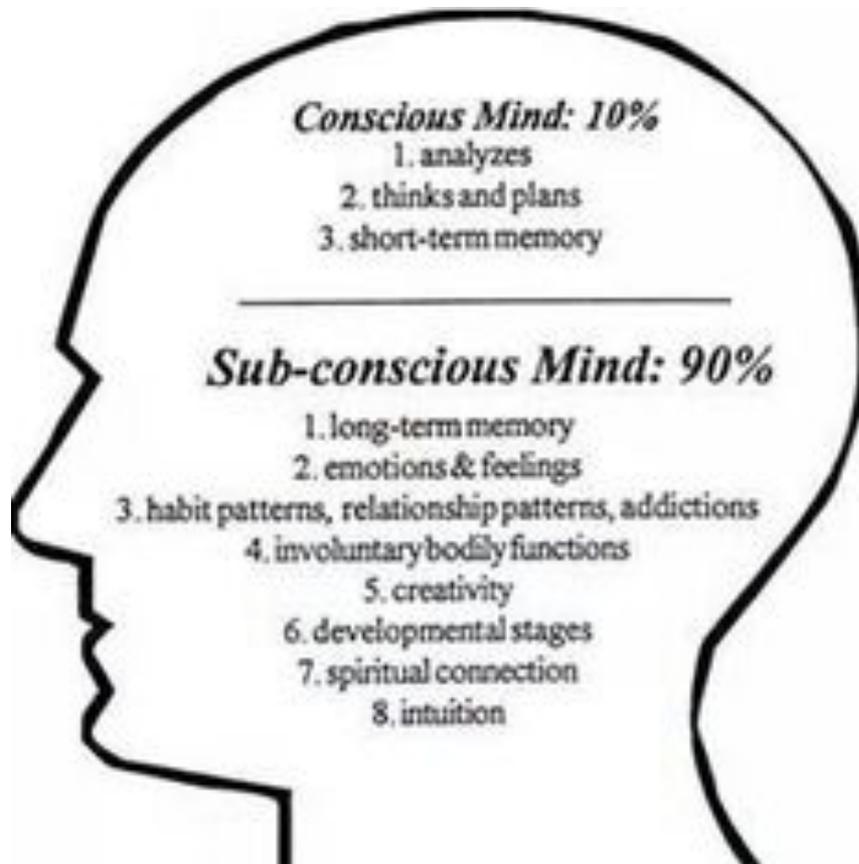
- Logical approach to clinical problem solving (LCPS) based on problem-centred inductive clinical reasoning

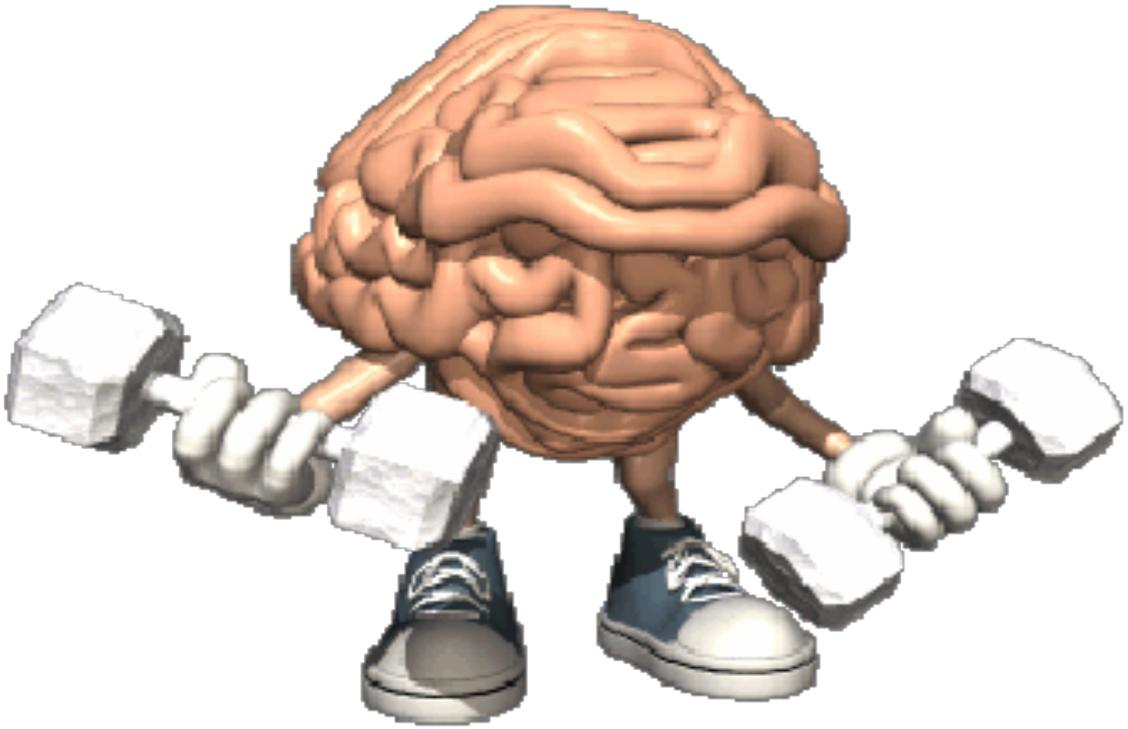




LIFE
BEGINS
AT
THE
END
OF
YOUR
COMFORT
ZONE.

-NEALE DONALD WALSCH-





Logical clinical problem solving (LCPS)

- › Construct a problem list then....
- › Define the problem
- › Define the system
 - And how it may be involved
- › Define the location within the system
- › Define the lesion



Constructing a problem list

- Helps makes explicit the clinical signs
- Transforms the vague to the more specific
- Helps prevent overlooking less obvious but nevertheless crucial clinical signs
- Helps clarify any obvious difference in chronology of clinical signs or other clues that may suggest there is more than one disorder in the patient

Spencer



Spencer

- 5 year old male Border collie
- Vomiting for 3 days
- Losing weight for 4 weeks
- Intermittent diarrhoea for 4 weeks
- Decreasing appetite for 4 weeks
- Very weak when examined in consult

Pattern recognition

- What disease do I know that will cause vomiting, diarrhoea, weight loss, weakness and reduced appetite over a period of 4 weeks?

Problem based does not mean

- Vomiting
 - All causes of vomiting
- Weight loss
 - All causes of weight loss
- Diarrhoea
 - All causes of diarrhoea
- Weakness
 - All causes of weakness
- Inappetance
 - All causes of inappetance





Problem based also does not mean only

My problem list is:

- › Vomiting
- › Weight loss
- › Diarrhoea
- › Weakness
- › Inappetance

Problem based also does not just mean....

My differentials are:

- Liver disease
- Foreign body
- Renal disease
- Hypoadrenocorticism
- Hypercalcaemia
- Gastric neoplasia
- IBD
- ????????

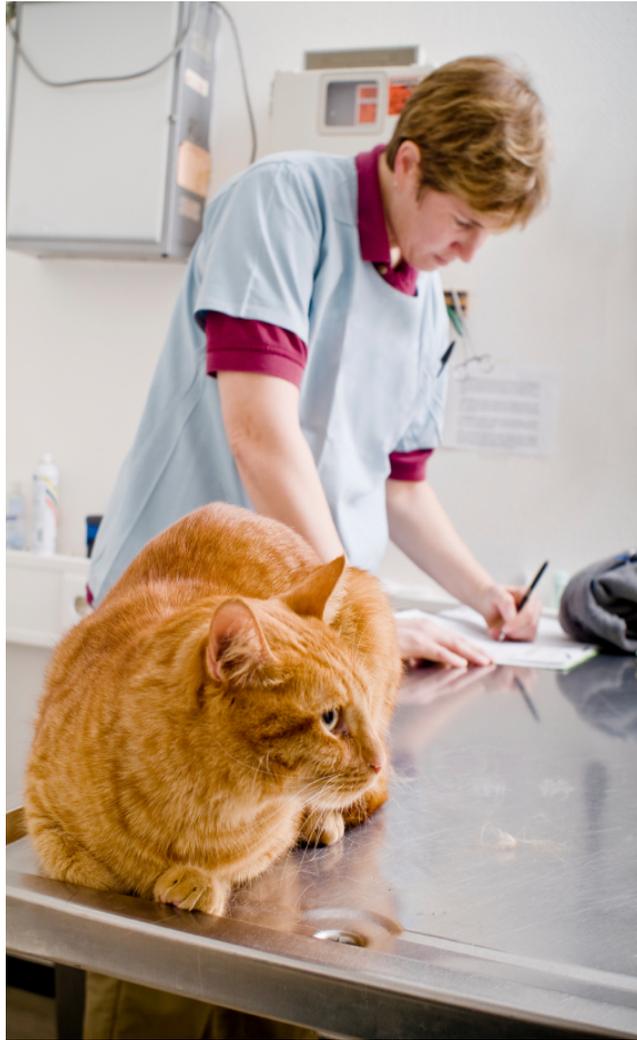


Problem based also does not just mean....

- Development of algorithms



Probable diagnoses



Problem list

Probable diagnoses



Problem list

Problem based (LCPS) does mean for each specific problem

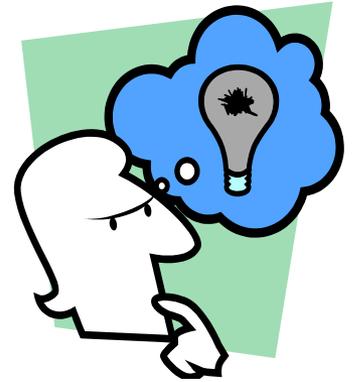
- Define the problem
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 - And how it may be involved
- Define the location within the system
- Define the lesion

**A problem well defined
is a problem half solved**



Define the problem

- Is there another clinical sign that this problem could be confused with?
- Some problems need to be further defined and refined to clarify the appropriate diagnostic path



Define the problem

- Vomiting or regurgitating?
- Diarrhoea or discharge from the genital tract or anal sacs?
- Straining to defaecate – constipation or colitis?
- Fit - seizures or fainting?
- Red urine - blood, haemoglobin or myoglobin?
- Abdominal pain or back pain?

Define and refine the problem

WHY DOES IT
MATTER?



Why does it matter?

- Diagnostic approach can be completely different for problems that seem similar to an owner or vet but are in fact completely different
- Differential diagnoses to consider can be completely different

For example –vomiting?

- Often can be treated symptomatically
- If need to investigate various tests can be useful
 - Biochemistry
 - Haematology
 - Urinalysis
 - Abdominal imaging
 - Endoscopy
 - Exploratory laparotomy



Regurgitation?

- Rarely responds to symptomatic treatment
- If persistent is usually a “bad” disease
- To investigate?
 - Imaging of the oesophagus
 - Plain radiology
 - Contrast radiology
 - Fluoroscopy
 - Endoscopy

LCPS

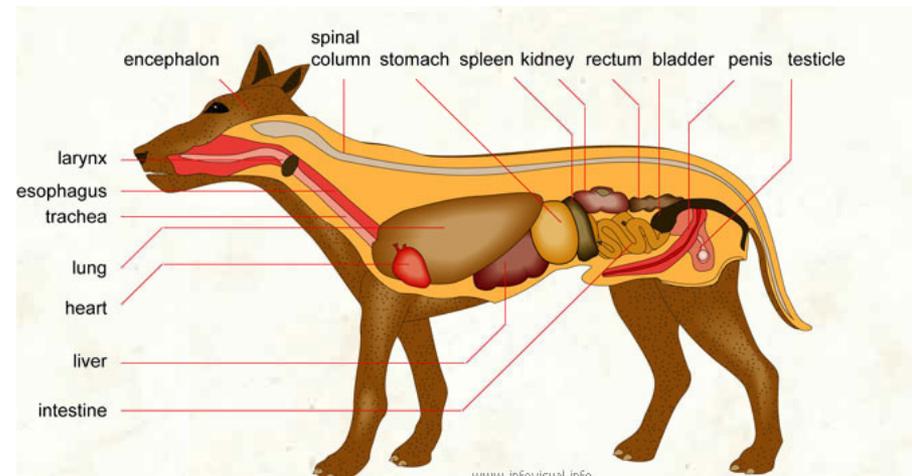
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LCPS

- Define the problem
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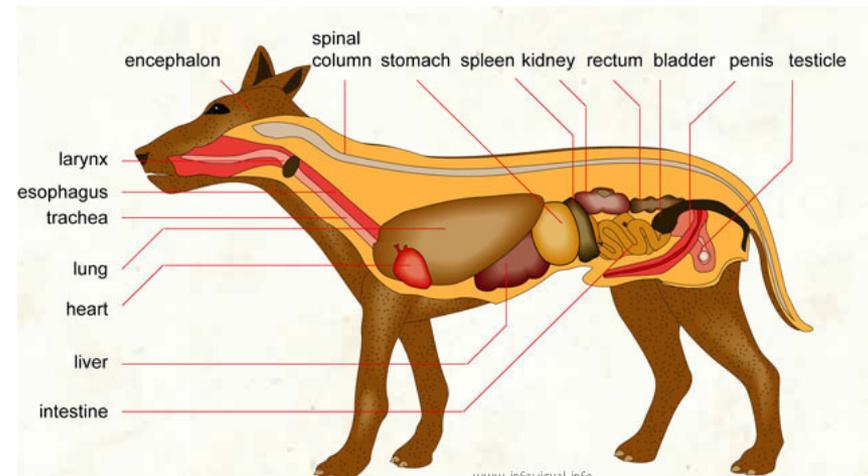
Problem based approach

- Define the system
 - And how it may be involved



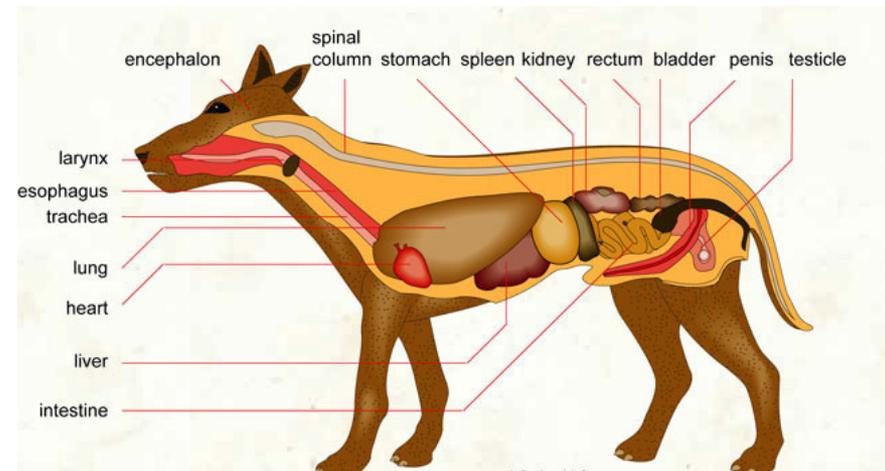
Define and refine the system

- For every clinical sign there is a system/s that must be involved i.e. it “creates” the clinical sign
 - Vomiting, diarrhoea
 - Gastrointestinal
 - Collapse
 - Neuromuscular/skeletal
 - Cough
 - Respiratory



Define and refine the system

- But the really important question is – how is it involved?
- Refine the system
 - Structural (primary) vs functional (secondary)
 - OR
 - Local vs systemic



Define and refine the system

- **Primary (structural) disease**
 - Pathology is in that system e.g.
 - Inflammation, neoplasia, infection
- **Secondary (functional) disease**
 - Pathology outside of the system is affecting the way the system is working but there is no actual pathology in the system and/or the pathology has been caused by another body system
 - e.g. effect of hypoxia, electrolyte changes, toxins on organ function

Define and refine the system

> Vomiting

- **Primary**, structural disease of the gut

Or

- **Secondary**, functional metabolic disease
 - E.g. liver disease, renal failure, electrolyte imbalance



Define and refine the problem

WHY DOES IT
MATTER?



Why does it matter?

- Diagnostic approach can be completely different for primary vs secondary system involvement
- Investigation of structural problems of a body system often involves imaging and biopsy and blood work can be completely normal
- Investigation of secondary, functional problems often involves blood work as well as other diagnostic tools

Why does it matter?

- Incorrect definition of problem or system can lead to:
 - wasted time



Why does it matter?

- Incorrect definition of problem or system can lead to:
 - wasted time
 - wasted money



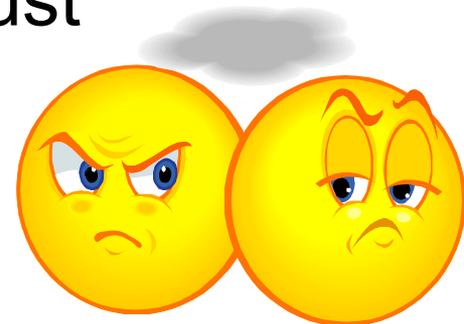
Why does it matter?

- Incorrect definition of problem or system can lead to:
 - wasted time
 - wasted money
 - potentially endanger patient by delayed or incorrect diagnosis



Why does it matter?

- Incorrect definition of problem or system can lead to:
 - wasted time
 - wasted money
 - potentially endanger patient by delayed or incorrect diagnosis
 - impair vet/client relationship and trust



Why does it matter?



LCPS

- Define the problem
- Define the system
 - And how it may be involved
- Define the location within the system
- Define the lesion

Define the location

- Problem = vomiting
- If the system = Secondary GI disease
- Location?
 - Renal
 - Liver
 - Adrenals
 - Pancreas
 - Endogenous toxins
 - Electrolyte imbalance
 - CNS

Define the location

- Problem = weakness
- If the system = neurological
- Location
 - Brain
 - Spinal cord (cervical, thoracic, lumbar)
 - Peripheral nerves
 - Multifocal



LCPS

- Define the problem
- Define the system
 - And how it may be involved
- Define the location within the system
- Define the lesion

Define the lesion

- Developmental
- Degeneration
- Infection
- Inflammation
- Neoplasia
- Nutritional
- Trauma
- Toxic

Define the lesion

- Priorities will be influenced by:
 - Age
 - Breed
 - Sex
 - Geographic location
 - History



LCPS

- Provides a structure for the student to hang their knowledge on and provides defined steps to help reach a diagnosis



LCPS

- The organised vs deep litter filing system for veterinary knowledge



LCPS

- Reduces need to remember long list of differentials



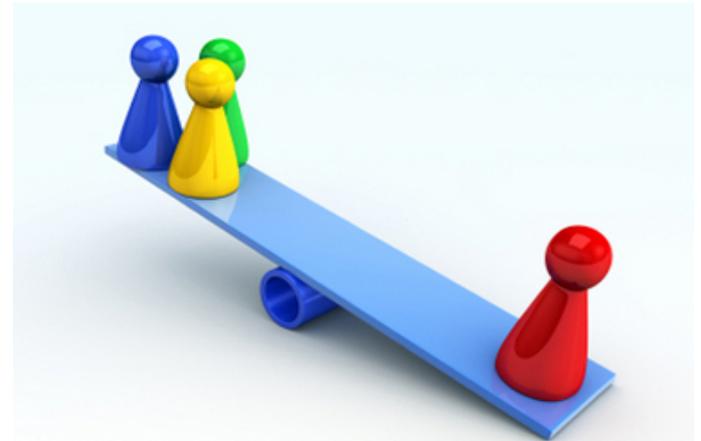
LCPS

- › Helps prevent getting trapped by a perceived “obvious” diagnosis
- › Reduces risk of tunnel vision



LCPS

- Helps avoid diagnostic bias



Diagnostic bias

Availability bias	A tendency to favour a diagnosis because of a case the clinician has been seen recently.
Anchoring bias	Where a prior diagnosis is favoured but is misleading. The clinician persists with the initial diagnosis and is unwilling to change his or her mind
Framing bias	Features that do not fit with the favoured diagnosis are ignored
Confirmation bias	When information is selectively chosen to confirm, not refute a hypothesis. The clinician only seeks or takes note of information that will confirm his or her diagnosis, and does not seek or ignore information that will challenge it.
Premature closure	Narrowing the choice of diagnostic hypotheses too early

LCPS

- Provides memory triggers to ensure an appropriate history is taken
- Structure around
 - Define the problem/problems
 - Can I define and refine the system?
 - It doesn't matter if you can't as long as you ask the question



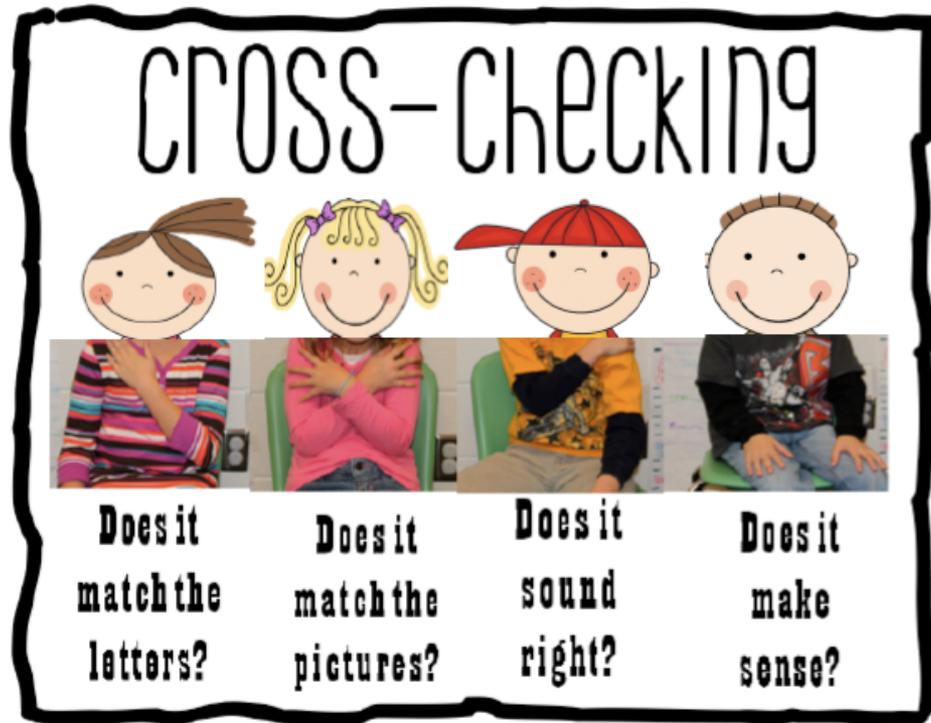
LCPS

- Helps turn a terrifying case into.....
- A manageable one!



Does pattern recognition have a place?

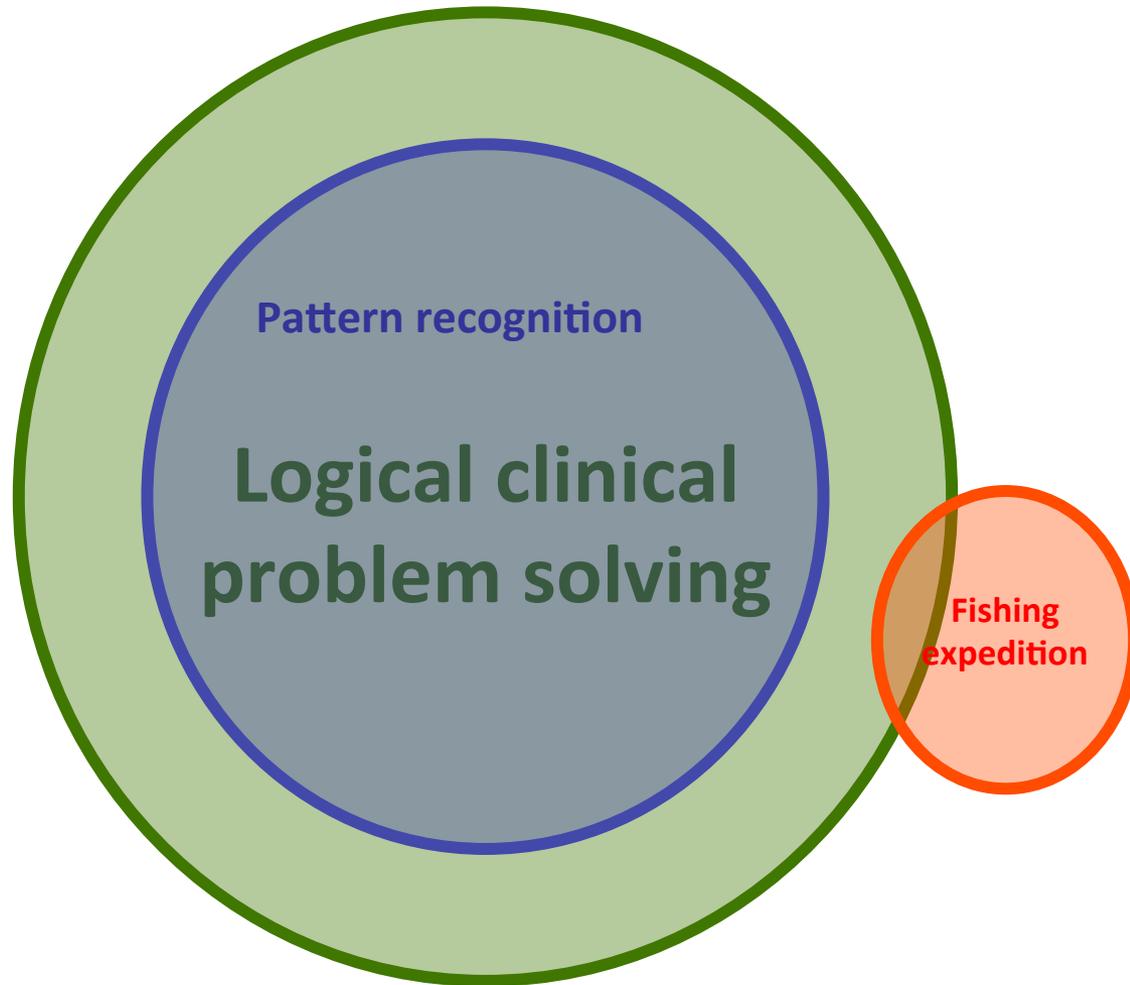
- Of course!
- It is impossible to suppress but needs to be “managed”
- If clinical signs options
- After initial clari
- Vet’s experienc but

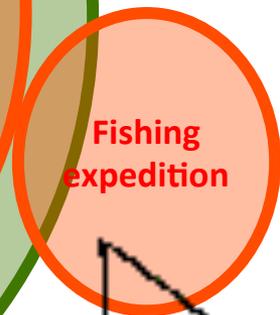
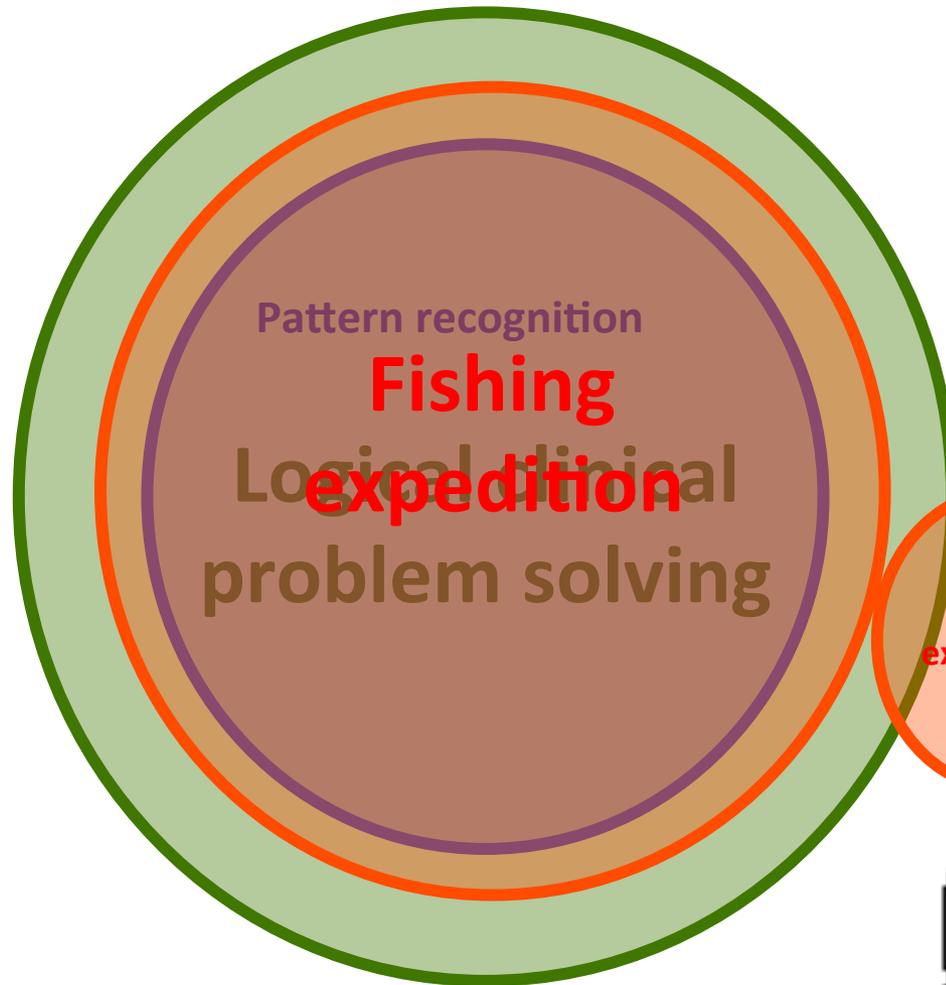


Dx

Does pattern recognition have a place?

- Development of problem based discipline enhances accuracy and strength of pattern recognition
- Better understanding of why certain patterns suggest certain disease
- Greater chance that pattern recognition will be correct
 - reduces tunnel vision and incorrect assumptions





Without a structure.....?

Alice: Would you tell me, please, which way I ought to go from here?

The Cat: That depends a good deal on where you want to get to

Alice: I don't much care where.

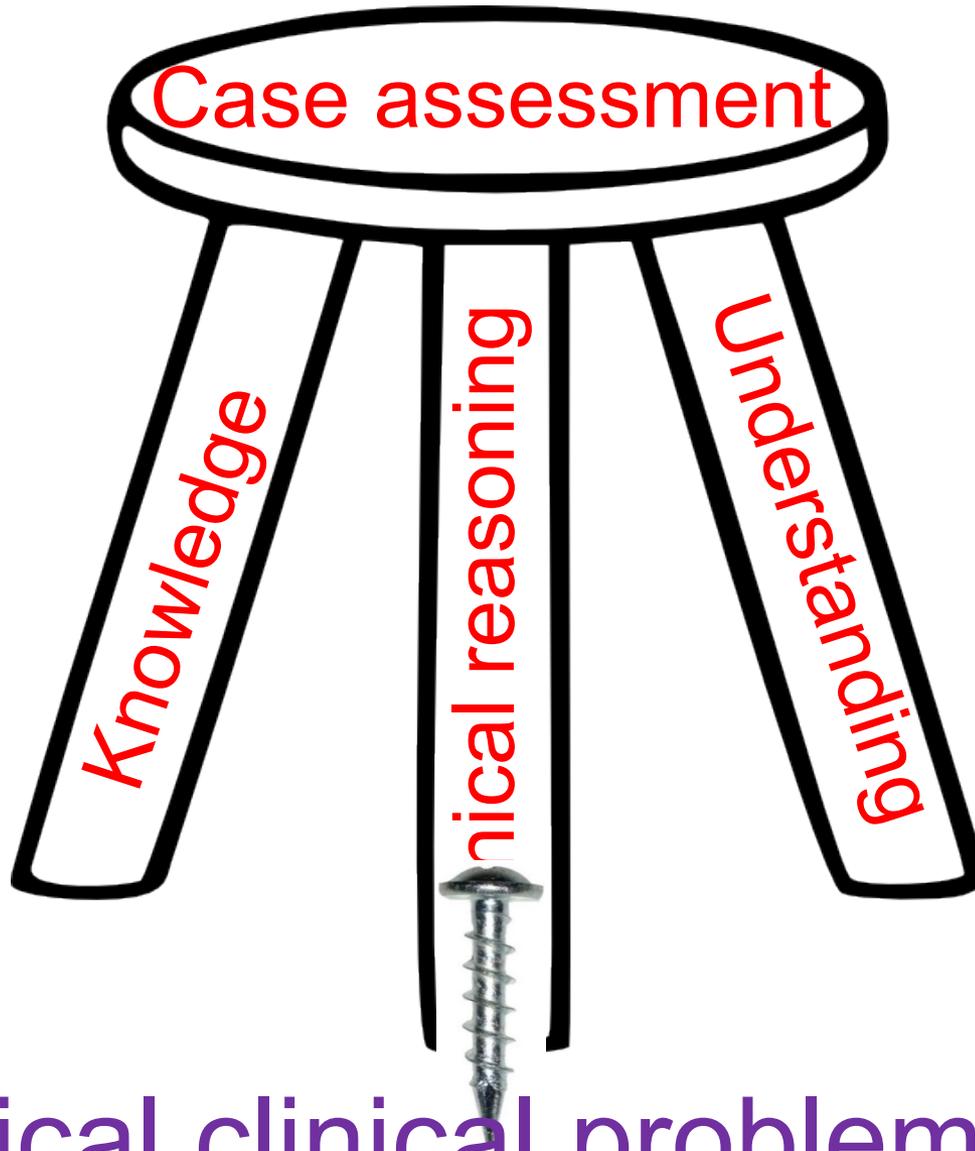
The Cat: Then it doesn't much matter which way you go.

Alice: ...so long as I get somewhere.

The Cat: Oh, you're sure to do that, if only you walk long enough.









Where we want to go?





Questions?



CLINICAL REASONING IN SMALL ANIMAL PRACTICE



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