CHAPTER 1
Introduction to problem-based inductive clinical reasoning

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The aim of this book is to assist you to develop a structured and pathophysiological sound approach to the diagnosis of common clinical problems in small animal practice. The development of a sound basis for clinical problem solving provides the veterinarian with the foundation and scaffold to allow them to potentially reach a diagnosis regardless of whether they have seen the disorder before. Furthermore, the method presented in this book will help you avoid being stuck trying to remember long differential lists and hence free your thinking skills to solve complex medical cases. The aim of the book is not to bombard you with details of different diseases – there are many excellent textbooks and other resources that can fulfil this need. What we want to provide you with is a framework by which you can solve clinical problems and place your veterinary knowledge into an appropriate problem-solving context.

We all remember our first driving lessons, which may have been quite challenging – for us and/or our instructors! We had to think actively about many factors to ensure we drove safely. The more experienced we became at driving, the more non-driving-associated tasks, such as talking to our passengers, listening to the radio and changing the radio channels, we were able to do while driving. If we had attempted any of these tasks at the beginning of our driver training, we might have had an accident. As we become more experienced at a task, we need to think less about it, as we move to what is known as unconscious competence.
We see a similar process in clinical education. During the progression from veterinary student to experienced clinician, knowledge and skills are initially learnt in a conscious and structured way. Veterinary undergraduate education in most universities is therefore based on systems teaching, species teaching or a mixture of both. These are excellent approaches to help develop a thorough knowledge base and understanding of disease processes and treatments. However, when an animal or group of animals becomes unwell, the clinical signs they exhibit can be caused by a number of disorders of a range of different body systems – the list may seem endless. They do not present to the veterinarian with labels on their heads stating the disease they have (more’s the pity!). Therefore, for the veterinarian to fully access their knowledge bank, they need to have a robust method of clinical reasoning they can rely on. This method allows them to consolidate and relate their knowledge to the clinical case and progress to a rational assessment of the likely differential diagnoses. This makes it easier to determine appropriate diagnostic and/or management options for the patient. Because you have a clear path, communication with the client becomes easier.

The next part of the journey of becoming an experienced clinician is that clinical judgement and decision-making processes become unconscious or intuitive. The rapid, unconscious process of clinical decision-making by experienced clinicians is referred to in medical literature as intuition or the ‘art’ of medicine. The conscious thinking process is often referred to as ‘science’ (evidence-based) or analytic. Intuition is context-sensitive, influenced by the level of the clinician’s experience, context-dependent and has no obvious cause-and-effect logic. Why is this important? We have all thought – ‘I just know that the animal has ...’. The unconscious mind will pretend to the conscious mind that the clinical decision was based on logical assumptions or causal relationships. This is not a problem as long the intuition or ‘pattern recognition’ has resulted in a correct diagnosis. However, when it does not, we need to understand why it failed and have a system in place to rationally progress our clinical decision-making. This book will provide you with the tools and thinking framework needed to unravel any clinical riddle, unleashing the potential of your unconscious mind rather than blocking your working memory as you try to recall all the facts you may have once known.
Introduction to problem-based inductive clinical reasoning

Why are some cases frustrating instead of fun?

Reflect on a medical case that you have recently dealt with that frustrated you or seemed difficult to diagnose and manage. Can you identify why the case was difficult?

There can be a multitude of reasons why complex medical cases are frustrating instead of fun.

- Was it due to the client (e.g. having unreal expectations that you could fix the problem at no cost to themselves? Unwilling or unable to pay for the diagnostic tests needed to reach a diagnosis? Unable to give a coherent history?)
- Was the case complex and didn’t seem to fit any recognisable pattern?
- Were you unable to recall all the facts about a disease and this biased your thinking?
- Did the signalment, especially breed and age, cloud your clinical decision-making resulting in an incorrect differential list?
- Did the case seem to fit a pattern but subsequent testing proved your initial diagnosis wrong?
- Did you seem to spend a lot of the client’s money on tests that weren’t particularly illuminating?

Can you add any other factors that have contributed to frustrations and difficulties you may have experienced with medical cases?

Apart from the client issues (and as discussed later, we may be able to help a little bit here as well), we hope that by the end of this book, we will have gone some way towards removing the common barriers to correct, quick and efficient diagnosis of medical cases and have made unravelling medical riddles fun.

Solving clinical cases

When a patient presents with one or more clinical problems, there are various methods we can use to solve the case and formulate a list of differential diagnoses. One method involves pattern recognition – looking at the pattern of clinical signs and trying to match that pattern to known diagnoses. This is also referred to as developing an illness script. Another method can involve relying on blood tests to tell us what is wrong with the patient – also referred to as the minimum
database. Or we can use problem-based clinical reasoning. Often, we may use all three methods.

**Pattern recognition**

Pattern recognition involves trying to remember all diseases that fit the ‘pattern’ of clinical signs/pathological abnormalities that the animal presents with. This may be relatively simple (but can also lead to errors of omission) and works best:

- For common disorders with typical presentations
- If a disorder has a unique pattern of clinical signs
- When all clinical signs have been recognised and considered, and the differential list is not just based on one cardinal clinical sign and the signalment of the patient presented
- If there are only a few diagnostic possibilities that are
  - easily remembered or
  - can easily be ruled in or out by routine tests
- If the vet has extensive experience, is well read and up-to-date, reflects on all of the diagnoses they make regularly and critically and has an excellent memory.

Pattern recognition works well for many common disorders and has the advantage of being quick and cost effective, provided the diagnosis is correct. The vet looks good to the client because they have acted decisively and confidently … provided the diagnosis is correct.

However, pattern recognition can be flawed and unsatisfactory when the clinician is inexperienced (and therefore has seen very few patterns) or only considers or recognises a small number of factors (and is not aware that this process is mainly driven by unconscious processes that might need to be reflected upon if they fail). Or even if the clinician is experienced, it can be flawed for uncommon diseases or common diseases presenting atypically, when the patient is exhibiting multiple clinical signs that are not immediately recognisable as a specific disease, or if the pattern of clinical signs is suggestive of certain disorders but not specific for them. In addition, for the experienced clinician, the success of pattern recognition relies on a correct diagnosis for the pattern observed previously being reached and not assuming that similar patterns must equal the same diagnosis. Pattern recognition can lead to dangerous tunnel vision where the clinician pursues his/her initial diagnostic hunch based
on pattern spotting to the exclusion of other diagnostic possibilities. They may then interpret all subsequent data as favourable to their initial diagnosis, including ignoring data that doesn’t ‘fit’ their preferred diagnosis. This phenomenon is described in psychological literature as confirmation bias – defined as a tendency for people to favour information that confirms their beliefs or hypotheses. And finally, the disadvantage of relying entirely on pattern recognition to solve clinical problems means that should the clinician realise subsequently that their pattern recognition was incorrect, they have no logical intellectual framework to help them reassess the patient. Thus, pattern-based assessment of clinical cases can result at best in a speedy, correct, ‘good value’ diagnosis but at worst in wasted time, money and, sometimes, endangers the life of the patient.

**I’ll do bloods!**

Routine diagnostic tests such as haematology, biochemistry and urinalysis can be enormously useful in progressing the understanding of a patient’s clinical condition. However, relying on blood tests (often called a minimum database) to give us more information about the patient before we form any assessment of possible diagnoses can be useful for disorders of some body systems but totally unhelpful for others. Serious, even life-threatening, disorders of the gut, brain, nerves, muscles, pancreas (in cats) and heart, for example, rarely cause significant changes in haematological and biochemical parameters that are measured on routine tests performed in practice. Over-reliance on blood tests to steer us in the right clinical direction can also be problematical when the results do not clearly confirm a diagnosis. The veterinarian can waste much time and the client’s money searching without much direction for clues as to what is wrong with the patient. And of course, the financial implications of non-discriminatory blood testing can be considerable, and many clients are unable or unwilling to pay for comprehensive testing. Using blood testing to ‘screen’ for diagnoses can be misleading, as the sensitivity and specificity of any test are very much influenced by the prevalence of a disorder in the population.

For experienced veterinarians, pattern recognition combined with ‘fishing expeditions’ (i.e. ‘I have no idea what’s going on so I’ll just do bloods and hopefully something will come up!’) can result in a
Clinical reasoning in small animal practice

successful diagnostic or therapeutic outcome in many medical cases in first opinion practice. However, there are always cases that do not yield their secrets so readily using these approaches, and it is these cases that frustrate veterinarians, prolong animal suffering, impair communication, damage the trust relationship with clients and on the whole make veterinary practice less pleasant than it should be. You also have to know about and remember lots of diagnoses for this approach to be effective. This is problematical if the veterinarian does not recognise or remember potential diagnoses or if, as discussed previously, the pattern of clinical signs doesn’t suggest a relatively limited number of differentials. It is also less useful for inexperienced veterinarians or veterinarians returning to practice after a career break or changing their area of practice.

It is for all of these reasons that we hope this book will enhance your problem-solving skills as well as build your knowledge base about key pathophysiological principles. We want to assist you to develop a framework for a structured approach to clinical problems that is easy to remember, robust and can be applied in principle to a wide range of clinical problems. The formal term for this is problem-based inductive clinical reasoning.

Problem-based inductive clinical reasoning
In problem-based inductive clinical reasoning, each significant clinicopathological problem is assessed in a structured way before being related to the other problems that the patient may present with. Using this approach, the pathophysiological basis and leading questions (see the following sections) for the most specific clinical signs the patient is exhibiting are considered before a pattern is sought. This ensures that one’s mind remains more open to other diagnostic possibilities than what might appear to be initially the most obvious and thus helps prevent pattern-based tunnel vision. If there are multiple clinical signs, for example vomiting, polydipsia and a pulse deficit, each problem is considered separately and then in relation to the other problems to determine if there is a disorder (or disorders) that could explain all the clinical signs present. In this way, the clinician should be able to easily assess the potential differentials for each problem and then relate them rather than trying to remember every disease process that could cause that pattern of
particular signs. It is important that the signalment of the patient is seen as a risk factor but should not blind the clinician to potential diagnoses beyond what is common for that age, breed and sex.

Thus, we do look for patterns but not until we have put in place an intellectual framework that helps prevent tunnel vision too early in the diagnostic process.

**Essential components of problem-based clinical reasoning**

**Step 1 – the problem list**

**Construct a problem list**

The initial step in logical clinical problem solving is to clarify and articulate the clinical problems the patient has presented with. This is best achieved by constructing a problem list – either in your head or in more complex cases, on paper or the computer.

**Why is constructing a problem list helpful?**

- It helps make the clinical signs explicit to our current level of understanding
- It transforms the vague to the more specific
- It helps the clinician determine which are the key clinical problems (‘hard findings’) and which are the ‘background noise’ (‘soft findings’)
- And most importantly, it helps prevent overlooking less obvious but nevertheless crucial clinical signs.

**Identify the problems and ‘prioritise’**

Having identified the presenting problems, you then need to assign them some sort of priority on the basis of their specific nature.

For example, anorexia, depression and lethargy are all fairly non-specific clinical problems that do not suggest involvement of any particular body system and can be clinical signs associated with a vast number of disease processes. However, clinical signs such as vomiting, polydipsia/polyuria, seizures, jaundice, diarrhoea, pale mucous membranes, weakness, bleeding, coughing and dyspnoea are more specific clinical signs that give the clinician a ‘diagnostic
hook’ they can use as a basis for the case assessment. As the clinician increases their understanding of the clinical status of the patient, the overall aim is to seek information that allows them to define each problem more specifically (i.e. narrow down the diagnostic options) until a specific diagnosis is finally arrived at.

**Specificity is relative!**

The relative specificity of a problem will, however, vary depending on the context. For example, for a dog that presents with intermittent vomiting and lethargy, vomiting is the most specific problem, as in all likelihood the cause or consequences of the vomiting will also explain the lethargy. In contrast, for the dog that presents with intermittent vomiting and lethargy and is found to be jaundiced on physical examination, jaundice is the most specific clinical problem. The majority of causes of jaundice can also cause vomiting but the reverse is not true, that is there are many causes of vomiting that do not cause jaundice. Thus, there is little value in assessing the vomiting as the ‘diagnostic hook’, as it will mean that many unlikely diagnoses are considered and time and diagnostic resources may be wasted. In this case, assessment of jaundice will lead more quickly to a diagnosis than that of vomiting, as the diagnostic options for jaundice are more limited than those for vomiting.

In other words, although you identify and consider each problem to a certain degree, you try to focus your diagnostic or therapeutic plans on the most specific problem (the ‘diagnostic hook’) if (and this is important) you are comfortable that the other clinical signs are most likely related. If you are not convinced that they are all related to a single diagnosis, then you need to keep your problems separate and assess them thoroughly as separate entities, which may or may not be related. There are reasons that might make one surmise that the clinical signs are related to more than one problem including the following:

1. The chronology of clinical signs is very different, raising the possibility that there is more than one disorder present.
2 The problems don’t fit together easily, for example different body systems appear to be involved in an unrecognizable pattern.

3 Other clues that may be relevant to the case, for example some clinical signs resolved with symptomatic treatment but others didn’t.

**How do I decide what problems are specific?**

As indicated previously, specificity is a relative term and will vary with each patient. There are a few clues that you can look for when trying to decide the most specific problems the animal has:

**Is there a clearly defined diagnostic pathway for the problem with a limited number of systems or differential diagnoses that could be involved?**

For example: vomiting vs. inappetence

- The problem of vomiting has a very clearly defined diagnostic pathway (discussed in Chapter 2), whereas there is almost an endless set of diagnostic possibilities for causes of inappetance, and there is no well-defined diagnostic approach (Chapter 4). Hence, vomiting is a more specific and appropriate ‘diagnostic hook’ than inappetance.

**Could one problem be explained by all the other problems but not vice versa or does the differential diagnosis list for one problem include many diagnoses that would explain the other problems but not vice versa?**

For example: vomiting vs. jaundice

- As mentioned earlier, jaundice is the more specific problem because most causes of jaundice could also conceivably cause vomiting, but there are many causes of vomiting that do not cause jaundice.
- Hence, the diagnostic pathway for jaundice is more clearly defined (discussed in Chapter 10), and there are a more limited number of possible diagnoses.

**But don’t forget to relate each problem to the whole animal**

Once you have narrowed down your diagnostic options for the most specific problems, you use these to direct your diagnostic
or therapeutic plans, but don’t forget to consider the less specific problems in relation to your differential diagnosis.

For example, your specific problem may be polyuria/polydipsia (PU/PD) associated with a urine specific gravity of 1.002 (hyposthenuria), and your non-specific problem may be anorexia. Hence, when considering the potential differential diagnoses for PU/PD associated with hyposthenuria, those diagnoses for which anorexia is not usually a feature, for example psychogenic polydipsia, diabetes insipidus and hyperadrenocorticism, are much less likely than those diagnoses where anorexia is common such as hypercalcaemia, pyometra and liver disease. It is not always necessary to ‘rule out’ the former diagnoses, but they have a lower priority in your investigation than the latter group.

Thus, the thinking goes: ‘the causes of hyposthenuria are … … … … … … (Chapter 12) and in this patient the most likely causes are … … … … (because of the other clinical signs or clinical pathology present).’ In other words, you use the non-specific problems to refine the assessment of the specific problems. One could claim that this is pattern recognition, and indeed it is to a certain extent. However, the step of clarifying the problem list (and thus not overlooking minor signs) and assessing the specific problems in this manner allows the clinician’s mind to be receptive to differentials other than the supposedly blindingly obvious one that uncritical pattern recognition may suggest (such as thinking every cat with PU/PD must have renal failure). And as we discuss later in this chapter, the particular steps you take in assessing the specific problems also decrease the risk of pattern-based tunnel vision and confirmation bias.

How likely is a diagnosis?
Priority is also influenced by the relative likelihood of a diagnosis. Common things occur commonly. Therefore, although you shouldn’t dismiss the possibility of an unusual diagnosis by any means, the priority for the assessment is usually to consider the most likely diagnoses first, provided they are consistent with the data available.

Step 2 – Does this make sense?
Always ask yourself, particularly when assessing clinical pathology or results of other diagnostic procedures in light of particular problems – ‘does this make sense – does this clinicopathological abnormality
explain the problem that the animal has? Good clinicians are good detectives!

Example 1
For example, a dog is depressed, anorectic, vomiting and polydipsic. Its blood glucose is 12 mmol/L (just above the reference range), it has 3+ glucosuria and no ketones in the urine. Does this mean that diabetes mellitus explains all of the dog’s clinical signs? No – usually uncomplicated diabetes does not result in depression, anorexia and vomiting. There must be another reason for these clinical signs. Diabetic ketoacidosis might be occurring, but this has been ruled out by your urinalysis. Hence, you must look further for an explanation for the vomiting, anorexia and depression.

Example 2
Another example – an unwell dog (anorectic, vomiting and depressed) is found to have clinicopathological changes consistent with hyperadrenocorticism. Does this explain all of the dog’s clinical signs? No – dogs with uncomplicated hyperadrenocorticism are not metabolically unwell, so there must be some other explanation for the dog’s malaise that you will need to identify and resolve before definitive testing for hyperadrenocorticism is possible (because concurrent disease has a significant impact on dynamic adrenal testing).

Step 3 – think pathophysiologically
Another essential element is to think pathophysiologically. I’m sure that none of us realised when we were in vet school just how important an understanding of physiology and pathophysiology is to understanding medicine.

For example, an animal has profound hypokalaemia. Rather than trying to remember all the diseases that may cause hypokalaemia, review how the body might lose potassium or fail to acquire it or even ‘use it up’. By getting into the habit of thinking in this manner, you can potentially diagnose disorders you may never have heard of (or that may never have been described before!). It will also stimulate you to seek more knowledge about the pathophysiology of disease processes, which will lead to a greater understanding of internal medicine and ultimately to a better retention of knowledge.
Clinical reasoning in small animal practice

The problem-based approach

Problem-based approach means different things to different people, and you may have already read about or been to courses where it was discussed. Some regard the problem-based approach as meaning ‘write a problem list, then list every differential possible for every problem.’ Not a feasible task unless you have an amazing factual memory and endless time! Others view the problem-based approach as meaning ‘write a problem list, then list your differentials.’ This is really just a form of pattern recognition, but at least it makes a good start by formulating a problem list.

The basis of this book is the concept of problem-based inductive clinical reasoning, which is a more accurate definition than ‘problem-based approach’. This approach provides steps to bridge the gap between the problem list and the list of differential diagnoses via a structured format. The problems should be investigated by rigorous use of the following questions:

• What is the problem?
• What system is involved and how is it involved?
• Where within the system is the problem located?
• What is the lesion?

The answers to these questions or the pursuit of the answers will determine the appropriate questions to ask in the history. They may alert you to pay particular attention to aspects of the physical examination. And/or they may indicate the most appropriate diagnostic test to use to find the answers, as well as prepare you intellectually to assess the results of diagnostic procedures.

Define the problem

Example: the owner reports that the dog is vomiting. Is the animal really vomiting or regurgitating – or perhaps even coughing?

When considering the important clinical signs the patient is exhibiting, it is essential to try to define the problem as accurately as possible. ‘A problem well defined is a problem half solved’ is a good maxim to work from. The first question to ask is ‘is there another clinical sign that this problem could be confused with?’ This is a vital step, and failure to define the problem correctly has often derailed
a clinical investigation that might otherwise have been relatively straightforward.
Other examples include the following:
• The owner says the dog is having fits – is it having seizures, episodes of syncope or vestibular attacks or other strange episodes? (Chapter 7)
• The owner says the dog has red urine – is it blood, haemoglobin or myoglobin? (Chapter 11).

Refine the problem
Some problems require further refining to clarify the best diagnostic approach.
Examples include the following:
• Weight loss – is this because of inappetance or despite a normal appetite? (Chapter 3)
• Collapse – with or without loss of consciousness? (Chapters 6 and 7).

Why is it so important to define and refine the problem?
The range of diagnoses to consider, diagnostic tools used and potential treatment or management options for clinical problems that may be perceived by the owner to be the same and present similarly to the veterinarian can be very different. Or the owner might perceive the presenting signs to be attributable to one problem, but in reality, the signs indicate another problem to the veterinarian. Failure to appropriately define and/or refine the problem can often lead to wasted time and money, as the wrong problem is investigated or treated. This can delay treatment, prolong the disease, prolong the patient’s suffering, sometimes potentially endanger the life of the patient, may increase unnecessarily the costs to the client, frustrate the veterinarian and client and potentially impair the client–veterinarian relationship.

Define and refine the system
Once the problem is defined, the next step is usually to consider the system involved. For every clinical sign, there is a system(s) that must
be involved, that is it ‘creates’ the clinical sign. However, the really important question is – how is it involved? The key questions in this case are ‘what system is involved in causing this clinical sign?’ and ‘do I have a primary i.e. structural problem of a body system or a secondary problem i.e. functional problem where the system involved is affected by other factors?’

Examples include the following:

- The body system always involved when a patient vomits is the gastrointestinal (GI) system. However, it may be directly involved due to primary pathology of the gut such as parasites, inflammation, neoplasia and foreign body. This is defined as primary (structural) GI disease. Or vomiting may be occurring due to dysfunction of non-GI organs such as the liver, kidney, adrenal glands and/or pancreas. This is defined as secondary (functional) GI disease.

- The body system that is always involved when a patient has generalised weakness is the neuromuscular system. However, it may be directly involved due to primary neuromuscular pathology (e.g. inflammation, toxins, neoplasia and infection). Or the neuromuscular system may be malfunctioning due to the effect of pathology on other organs, causing metabolic derangements that impair neurological function such as hypoglycaemia, anaemia, hypoxia and electrolyte disturbances. This is defined as secondary neuromuscular disease.

Why is it so important to define and refine the system?
The range of diagnoses to consider, diagnostic tools used and potential treatment or management options for primary, structural problems of a body system are often very different compared to those relevant to secondary, functional problems of that system. Investigation of primary, structural problems often involves imaging the system in some manner (radiology, ultrasound, advanced trans-sectional imaging, endoscopy and surgery) and/or biopsy. Routine haematology, biochemistry and urinalysis are often of little diagnostic value. For secondary, functional disorders, on the other hand, haematology and biochemistry are often critically important in progressing our understanding of the case and reaching a diagnosis.

Failure to consider what body system is involved and how it is involved can often lead to wasted time and money. This can delay treatment, prolong the disease, prolong the patient’s suffering,
sometimes potentially endanger the life of the patient, may increase unnecessarily the costs to the client, frustrate the vet and client and potentially impair the relationship between vet and client. (Notice a recurring theme here?) In fact, if you do nothing else when assessing a case before seeking the diagnostic ‘pattern’, ask yourself for each of the specific problems – ‘what system could be involved and how – primarily or secondarily?’ This simple question will immediately open your mind to diagnostic possibilities you may never have contemplated if you were just focusing on the ‘pattern’.

Other examples include the following:

- Chronic cough – cardiac or respiratory system? (Chapter 8)
- Jaundice – due to prehepatic (haemolysis) or hepatic/post hepatic disorder? (Chapter 10)
- Cardiac arrhythmia – is it due to primary (structural) cardiac disease, for example dilated cardiomyopathy or extra-cardiac disease, for example gastric dilation and volvulus, splenic pathology? (Chapter 6)
- PU/PD – is it due to primary polydipsia or primary (structural) renal disease (chronic kidney disease) or extra-renal dysfunction, for example diabetes mellitus, hypercalcaemia and hypoadrenocorticism? (Chapter 12)

An alternative, although closely related, question for some problems is ‘is the problem local or systemic?’

- Epistaxis – due to local nasal disease or systemic disease, for example coagulopathy and hyperviscosity? (Chapter 11)
- Melaena – GI bleeding due to local disease (ulceration – which in turn may be due to primary or secondary GI disease) or systemic disease, for example coagulopathy? (Chapter 11)
- Seizures – due to local brain disease, for example neoplasia, infection/inflammation or systemic disease, for example electrolyte disturbances or intoxication (Chapter 7).

**How to differentiate primary from secondary system involvement?**

There are often clues from the history and/or clinical examination that help you define and refine the body system involved. Or you may not be able to answer this question until further diagnostic tests are
performed. But just asking the question ensures that you remember that body systems can malfunction due to direct pathology of that system, for example inflammation, neoplasia, degeneration, infection or due to functional problems where factors not directly related to the body system can impact on its function.

Define the location

Example: having determined that vomiting is due to primary GI disease, where in the GI tract is the lesion located?

In this example, by asking this question, you will select the most appropriate method either to answer the question or to move on to the next step.

For example, if you believe that your history and physical examination and other ancillary data indicate a lower small intestinal lesion, endoscopy is not going to be an appropriate method of visualising the area or obtaining biopsies. However, if all the information you have suggests a gastric lesion, endoscopy may be most appropriate if available.

Other examples include the following:
- Vomiting due to secondary GI disease – liver, kidney, adrenals and pancreas? (Chapter 2)
- Hind limb weakness is due to neurological dysfunction – is the lesion in the spinal cord (and where), peripheral nerves, muscles or brain? (Chapter 6)
- Haematuria – from urethra, prostate, bladder or kidneys? (Chapter 11)

Define the lesion

Once the location of a problem within a body system is determined, usually the next key question is ‘what is it?’, that is you need to identify the pathology. It can be helpful to remember the types of pathology that can occur on broad terms – for example degeneration, anomaly, metabolic, neoplasia, nutritional, infection, inflammation, idiopathic (‘genetic’), trauma, toxic and vascular (DAMNIT-V). Which type of pathology is most likely going to depend on the body system or organ involved, the signalment of the patient (species, breed,
age, sex etc.), the clinical onset and course of the clinical signs, pain involvement, the geographic location of the patient and what disorders are common in that population.

This assessment can be influenced by whether the patient is in a general clinic or a referral hospital. Common things occur commonly or ‘the hoof beats in the night are much more likely to be due to a horse than a zebra’ (unless you are on safari of course!). This doesn’t mean that uncommon diagnoses should not be considered (and they will of course be more common in referral hospitals). It’s just that common disorders usually receive diagnostic priority at the beginning of a clinical investigation.

Example: the patient has a gastric lesion – is it a tumour, foreign body or ulcer?

This question will require visualisation and/or biopsy to answer, but it would have been a waste of time asking the question until you had arrived at the right location.

Other examples include the following:

• Spinal cord lesion visible on magnetic resonance imaging – is it inflammation, infection or a neoplasm?
• Haematuria is due to lower urinary tract disease – infection, calculi or neoplasia?
• Large bowel diarrhoea – parasites, infection, ulceration, stricture, neoplasia or diet related?

What do I need to do to define the problem, system, location or lesion?

The diagnostic methods used to define the problem, then the system, then, where appropriate, the anatomical location and then the lesion will vary depending on the problem.

For example, clinical pathology may be needed in some cases to define the problem, but in many cases, the problem will be definable on the basis of history (onset and course of the disease) and clinical examination findings. Similarly, diagnostic tests or procedures may be required to define and refine the body system involved in some cases, and for other problems, the system involved will be evident from clues from the history and/or the clinical examination. In some cases, once the problem is defined, for example regurgitation, the
body system is immediately apparent and the anatomical location identified (upper GIT – oesophagus or pharynx). For neurological problems, clinical and neurological examination will often define the problem, system and location, leaving only the lesion needing to be defined by diagnostic testing.

**Putting it all together**
Defining the problem, system, location and then the lesion does not always follow this exact order. For some problems, for example coughing and diarrhoea, identifying the location occurs before identifying the system, as location identification helps identify the system (discussed in more detail in Chapters 3 and 8). For some problems, for example pruritus (Chapter 14), you might go straight from problem definition to seeking to define the lesion. However, for almost all clinical problems, answering some or all of the four questions – ‘what is the problem? what system is involved and how? what is the location of the lesion? and what is the lesion?’ will provide a framework to guide your clinical reasoning and diagnostic and therapeutic decisions. Thus, instead of thinking when faced with a vomiting patient, ‘I wonder if it has a gastric foreign body or renal failure or a liver tumour?’, your initial energies are directed at defining the problem and system, which will help make your list of differentials (which are usually the location and/or lesion) logical, appropriate and given appropriate priority. In this way, the diagnosis is made thoughtfully, and during the process, all diagnostic options can be considered as the need arises.

**But does pattern recognition have a place?**
It is important to reiterate that pattern recognition for many cases is appropriate and justified – depending on your level of experience, knowledge, skill base and mindset. For example, if a pot-bellied elderly terrier with bilaterally symmetrical alopecia, seborrhoea, hyperpigmentation and comedones walked into your consulting room and the owner reported that the dog was drinking lots of water, was ravenously hungry and appeared to be panting excessively, then hyperadrenocorticism is the most obvious diagnosis, and going through the motions of assessing each specific problem would be ridiculous (but not if you had never seen a dog with hyperadrenocorticism before!).
However, it is important to be aware that pattern recognition is only foolproof if the pattern is virtually unique to the disease, you consider a sufficient number of factors in your pattern or there are a very limited number of diagnostic options. Its value is very dependent on the clinician’s experience, depth of knowledge and ability to sort data quickly and efficiently.

Of course, once you have considered each individual problem, you do in fact look for a pattern in the clinical signs. However, the insertion of that initial step of considering each specific problem individually and then relating it to the other problems present should ensure that you don’t miss the less obvious possible diagnoses.

In addition, the process of developing a sound problem-based approach can enhance your ability to pattern recognise because you have a greater understanding of the reasons why you believe certain patterns are suggestive of some disorders more than the others.

**Combinations of clinical signs**

There are some combinations/patterns of clinical signs that make the diagnostic options very limited, and it is entirely appropriate to consider them together; for example, the patient with PU/PD who is also polyphagic. If the PU/PD and polyphagia have been present for the same duration, then they are almost certainly due to the same disorder, and it is quite appropriate to assess them together. There are very few conditions that will cause this pattern of clinical signs (e.g. diabetes mellitus, hyperthyroidism and hyperadrenocorticism), so it is quite appropriate to concentrate on these first.

**It may appear tedious at times!**

You may feel at times that being asked to assess each individual’s specific problem is a tedious exercise when the diagnosis is obvious, because you think you recognise the pattern of clinical signs. In some cases, this will be true, whereas in other cases, you will be misled. However, the most important point that we will try to get across is that if you don’t ‘practise’ this structured problem-based approach on relatively simple clinical cases, when you are faced with the complex cases, which probably most of you feel frustrated about at present, you will not be able to apply problem-based principles and as such will be still left floundering as pattern recognition and/or going fishing.
fail you. It is also important to recognise that pattern recognition is a process of thinking that doesn’t require explicit teaching – it happens naturally, whereas developing a robust structured inductive approach does require explicit articulation and practise of the steps involved.

Finding the right balance
It is also useful to remember that medical diagnoses are often based on the ‘balance of probabilities’ rather than having to be proved ‘beyond reasonable doubt’. Striking the right balance between the diagnostic possibilities and judging what is important or likely and what is less important or less likely can be challenging and, of course, is very influenced by experience, but also understanding and knowledge.

Ancillary benefits
The aim of a structured and thorough approach to diagnosis is to reach the answer as quickly as possible and to get the best value from your ‘diagnostic dollar/pathology pound/enabling euro’ – that is not to waste the client’s money on unnecessary tests and procedures. An additional advantage of following this approach is that you should have a very good idea why you are advising doing blood tests or taking radiographs or prescribing a particular medication. And because you know why, you can explain your reasons to the client clearly, and they are much more likely to agree to follow your suggestions. Client compliance is positively influenced by the degree to which they understand the reasons for diagnostic or treatment recommendations.

You are also in a much better position to explain the implications of ‘normal results’ rather than being sent into a panic because you were hoping the blood tests would show something (‘because the dog looks really sick, so it must have an abnormal blood test! – but its blood results are absolutely normal! – HELP! – what do I do now?’).

In conclusion

Problem-based inductive clinical reasoning:
- Is much more than just listing problem, then listing differentials for each problem (a common misconception about problem-based medicine).
• Has ‘rules’ that are easy to remember and can be applied to most clinical problems animals present with.
• Has a structured approach centred on three to four main steps as follows:
  • Define and refine the problem
  • Define and refine the system
  • Define the location (where appropriate)
  • Define the lesion
• Provides a framework to hang your knowledge on allowing you to recognise and retrieve more easily the information you need.
• Reduces the need to remember long list of differentials (see the first point).
• Helps prevent getting trapped by a perceived ‘obvious’ diagnosis – it helps avoid confirmation bias.
• Provides memory triggers to ensure an appropriate history is taken and a thorough clinical examination performed.
• Provides a clear rationale for choosing diagnostic tests or treatments that can be communicated to the owner.
• Helps turn a terrifying case into a manageable one!

**Time waster or time saver?**
It is common when first faced with the process of problem-based inductive clinical reasoning to feel that it is an academic exercise that there simply isn’t time to apply in the context of a busy clinic, 10–15 min consultation slots and the many conflicting demands on your time. However, if you are able to put in the hard yards initially and if you discipline yourself to think in this manner, it will become second nature, subconscious (unconscious competence) and certainly not as laborious as it may appear at the beginning. In fact, acquisition of these problem-solving skills will ultimately save time, as it will help you quickly eliminate extraneous background noise and focus on what is important for the patient and client. An analogy is the process of learning a new language. To do so, you initially need to learn some vocabulary and grammar (framework), but once you have a basic understanding and if you use the new language on a daily basis, further progression to fluency comes naturally. But without the basic framework and constant practice, fluency is an unfulfilled dream.
Comments from participants in courses based on this approach include that they developed ‘a more systemic approach to medicine, which saved a lot of time in a busy practice’; ‘it made me think more efficiently in a busy practice’. Hopefully, this will be your experience too. As with all skills, it takes time to develop the knowledge base and mental discipline required for this form of clinical reasoning, but once developed, it will provide a firm base for the future and, most importantly, will not ‘go out of date’, no matter how many new diseases/disorders are discovered.