Assignments with Specimens in order to learn Clinical Reasoning in Veterinary Medicine

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A 3D insight in the building plan of different animal species is essential for a veterinarian when applying clinical reasoning (CR), one of the key competencies in veterinary clinical practice. Retrieving information from clinical examination is based on 3D insight, something Master students need during their internships in the clinic. However, CR is taught in the Bachelor with paper-based cases. This transition leads for beginning Master students to a lack of 3D insight and practice in decision-making based on 3D objects.

One possible way to bridge this gap is the use of specimens, 3D visual aids. Therefore, three self-study assignments were designed and validated. Participants were 47 students from the Companion Animal track of the Master Veterinary Medicine, working in pairs. Think aloud protocols were recorded and analyzed for the occurrence of the different steps of CR. After each assignment, students filled out a brief questionnaire on their experiences with the assignment.

The analysis revealed that all three assignments evoked CR, however, they all showed a slightly different reasoning pattern. This is due to the influence of characteristics in the assignments, which include questions and phrasing. The way in which the specimens are addressed greatly influences their usage; as information source or as tool for decision making.

Concluding, this study is the first to provide a format for CR self-study assignments with specimens. It provides insight in the influence of characteristics of these assignments, important in helping students gain a 3D insight and confidence in decision-making based on specimens.

Key words: *3D insight; Clinical reasoning; Self-study assignments; Specimens; Specimen-based decision-making*

Introduction

Clinical reasoning (CR), the reasoning process starting at first entrance of a patient in the clinic, leading to a diagnosis and, if necessary, treatment, is one of the major learning outcomes of the veterinary curriculum (Turnwald et al., 2008). In order to apply CR based on information retrieved from clinical examination of patients and radiographs, a three-dimensional (3D) insight in the building plan of different animal species is essential. Gaining a 3D insight from two-dimensional textbook images is challenging. Models can support the learning process leading to a 3D insight (Lipson, 2007; Ward, 2011), especially when this takes place in situations as realistic as possible (Dolmans, Snellen-Balendong, & van der Vleuten, 1997; Mayer, 1998; Ramaekers, 2011).

In the Master, students practice CR during their internships in the clinic, in the Bachelor they learn how to perform it with cases that resemble experiences in the work field of a veterinarian (Ramaekers, 2011). Most often these cases are paper-based and do not contain visual information to help understand and solve the case. Many models are available at the Faculty of Veterinary Medicine in Utrecht to make CR assignments more realistic; specimens (in jar or plastinated), skeletal materials and artificial models are supplied to the students. At the moment students only use these models to memorize structures in anatomy, whereas they can improve the 3D insight of the students and make them more confident taking decisions based on 3D information.

Hence, this situation is calling for newly developed assignments that combine 3D objects, specimens, and a clinical case on paper. However, the available literature provides little specific guidelines for the design of such assignments. This research fills this gap by investigating the effects of characteristics of CR self-study assignments with specimens.

General Aim

The aim of this study is to gain insight into what an effective CR self-study assignment with specimens is, in order to improve 3D insight and confidence in decision making of students. Three different assignments are designed. The effects of characteristics in these assignments will be translated into a format for self-study assignments, in order to encourage teachers to create their own assignments. Therein, specimens make the transition from paper-based cases into real cases (internships) more gradually, force students to make decisions based on 3D visuals and improve 3D insight.

Theoretical Background

Different aspects need to be taken into account concerning CR self-study assignments with specimens for the development of a 3D insight and confidence in decision making with 3D models. Since realistic learning with these models is of great importance for the assignments, this is first discussed. These models are implemented in self-study assignments. Therefore features of this type of assignments are discussed secondly. These self-study assignments become part of the educational track for CR in the veterinary curriculum. Therefore the components of CR as well as how students learn this type of reasoning are discussed last.

Realistic learning with models

Studying with models helps students develop a 3D insight. This was reported for geoscience for models that converted a two-dimensional image, for example a map, in 3D models. This helped students with spatial thinking; they performed better on skills such as localization and orientation (Ward, 2011). Learning with a concrete experience in the form of a model instead of an abstract concept also increases the amount of information remembered from about 20% to 90%. The more experience is gained with models, the better the 3D insight becomes

(Lipson, 2007). In veterinary medicine, these models are specimens. They can take multiple forms such as prosections, plastinates or moulages. Moulages are wax models used since the 17th century by medical students to learn anatomy and pathology (Cooke, 2010), prosections are dissected body parts demonstrated in jars with formaldehyde. Nowadays, plastinates are more frequently used. Plastinates are bodies or body parts in which the tissue fluid is replaced by silicones (Von Hagens & Whalley, 2011). Plastinates and prosections are preferred because they show the variability in anatomy existing in all species, in real material (Fruhstorfer, Palmer, Brydges, & Abrahams, 2011; Jones & Whitaker, 2007). Thereby, the specimens can be used as substitutes for real, but also rare, cases.

The use of specimens can create a better understanding by students. This was proven for plastinates in a study in which students had to solve a problem with the use of those plastinates and books. This way of working resulted in a better understanding than when students only remembered anatomical names (Stuart & Henry, 2002).

Use of specimens makes assignments more realistic. Studying the internal structures of animals by holding and turning these specimens adds to the acquisition of 3D insight. A relevant context, which contains science and clinical knowledge, also makes an assignment more realistic (Dolmans et al., 1997). Such a context links to a future as veterinarian, a meaningful context for the students that contributes to their learning (Mayer, 1998; Ramaekers, 2011). To relate to the context of a veterinarian even more, case-based learning can be used with cases resembling experiences in veterinary practice (Ramaekers, 2011).

Specimens establish a better 3D insight and understanding of the subject. Furthermore, specimens make the cases used more realistic, approaching the reality in clinical practice which is important since high fidelity cases evoke cognitive processes similar to reasoning in clinical veterinary practice (Ramaekers, 2011). These reasons prove the design guideline to include specimens in the assignments useful (1).

Self-Study Assignments

The specimens are integrated in self-study assignments. Those assignments have an immediate benefit on learning and on development of academic skills (Cooper, Robinson, & Patall, 2006). In designing self-study assignments, two important features should be considered. The assignment has to encourage the students to regulate their own learning process. They need the possibility to reflect on their own performance and knowledge in order to take further actions (McLoughlin, 2002). The second important aspect contains the level of difficulty of the assignments. This must fit within the zone of proximal development of the students, otherwise they will not learn from the assignment (McLoughlin, 2002). This relates to the prior knowledge the students have (Dolmans et al., 1997), including their level of CR.

Elaborating on the available information and one's own thoughts while making the assignments helps students in their learning process. Cues such as questions or discussion points stimulate this (Dolmans et al., 1997; Ramaekers, 2011). If discussions are raised, time spent on the case will increase, thereby increasing performance (Dolmans et al., 1997). Discussion can be stimulated by promoting small group work. Students add to each other's knowledge while working to an answer (Johnson & Johnson, 1999) and during discussion of the answer, students have to explain their thoughts, leading to better understanding of the problem (Packer & Ballantyne, 2005).

Another factor of influence is motivation, which is connected to the learning outcome of the self-study assignments (Cooper et al., 2006; Dolmans et al., 1997). The Arabian Gulf University has a museum that students use for self-study with self-directed learning modules. When the layout of the museum changed, students' attendance increased with over a third. This new layout was arranged according to the curriculum of the University (Ganguly, Chakravarty, Latif, Osman, & Abu-Hijleh, 2003). The students were motivated to make the

self-directed learning modules of the museum because they considered it a valuable contribution to their learning process.

In order to make the addition of specimens to assignments worthwhile, students should be motivated to learn from such assignments (Cooper et al., 2006). It turns out that students appreciate the use of plastinated specimens because they give detailed information and help with gaining a 3D insight (Fruhstorfer et al., 2011).

The first design guideline that can be taken from this, is that the assignments should fit with the prior knowledge of the students regarding the process of CR and the content of the cases (2). The second design guideline is that the assignments should elicit discussion, which leads to a better understanding (3). To achieve this, students make the assignment in couples and there need to be cues or questions that initiate discussion.

Clinical Reasoning

In order to design self-study assignments for CR, it is necessary to understand the general process of CR. Basically, this process consists of six components (Ramaekers, 2011). When a veterinarian sees a new patient, the veterinarian collects information, cues (Charlin, Boshuizen, Custers, & Feltovich, 2007). This is the first component of CR.

Cues activate existing frameworks (Charlin et al., 2007; Elstein, Shulman, & Sprafka, 1979; Kassirer & Kopelman, 1991) needed for interpreting new information (Kassirer & Kopelman, 1991). Frameworks are based on information gained during earlier experiences (Charlin et al., 2007) during the students' study and in their first years of practice (Kassirer & Kopelman, 1991). Activated frameworks help relating cues to each other (Kassirer & Kopelman, 1991), the second component.

The relationship between cues helps in interpreting the information, which leads together with selection of the most important information to the formation of diagnostic

hypotheses (Charlin et al., 2007; Elstein et al., 1979; Eva, 2005; Kassirer & Kopelman, 1991), the third component of CR.

The formulated hypotheses form a new, narrower, context for the problem. It gives a focus for the continuing of the investigation and it helps in formulating questions for further examination (Elstein et al., 1979; Kassirer & Kopelman, 1991). This leads to the collection of new information, component four of CR.

The gathered new information provides new cues. This ideally encourages comparison between the different hypotheses, leading to refining of the hypotheses or new hypotheses (Elstein et al., 1979; Kassirer & Kopelman, 1991). These are tested with the new information and judgments are made, the fifth component.

Making judgments leads to a few final hypotheses that need one last check. This check can be done with causal reasoning, which helps revealing discrepancies between cause and effect (Kassirer & Kopelman, 1991). Eventually, causal reasoning and discriminating information will lead to a final hypothesis which should be checked one last time with the patient's problem before becoming the diagnosis (Charlin et al., 2007; Kassirer & Kopelman, 1991). Formulating this diagnosis is the sixth and last component of CR.

Sometimes a seventh component of CR is mentioned, namely making a decision on treatment modalities (Ramaekers, 2011). Since this seventh step does not concern the specimens, it is not addressed in the assignments of this study.

Based on the information above, clinical reasoning can be defined as: the reasoning process in which information is collected and organized in order to form hypotheses, which are refined based on new information in order to establish a diagnosis.

The description above of CR should be taken into account when designing the assignments. All steps of CR should be present, either explicitly or implicitly, in the assignments (4), which does not imply that all students will address each step of CR.

Learning Clinical Reasoning

Becoming an expert in CR takes time, many case experiences are needed to gain knowledge for insertion in extended knowledge frameworks (Bowen, 2006; Charlin et al., 2007; Kassirer & Kopelman, 1991). Novices generate more hypotheses compared to experts (Bowen, 2006). When prioritizing these hypotheses, novices build up their own knowledge frameworks (Bowen, 2006). Building these frameworks through training in CR improves performance on clinical problems (Farnsworth et al., 2008). The design guideline that can be taken from this, is that it is beneficial for students to go through the process of prioritizing their hypotheses, therefore this needs be guided, for example by questions (5).

At Utrecht University, CR is taught to Veterinary Medicine students during six years of education. In the Bachelor, students study organ systems in a variety of animals. Each organ system is taught in a different course. Besides these courses, students participate in the longitudinal course on CR. This course starts in the second half of the first year and lasts until the end of the Bachelor. The specific cases in this course change according to the currently taught organ system. Students combine learned symptoms with the steps of CR in the longitudinal course, thereby learning how to apply CR. To do this, they receive a specially designed paper-based case each week, which they solve in small groups, guided by a teacher. These cases are purely descriptive; there are no photographs or specimens used. Therefore, students sometimes lack important information that would be taken into account if they had photographs or specimens. They are also not trained to make decisions based on 3D visuals. In the Master curriculum, students learn to combine the different organ systems of the animals belonging to their study track. This combining also requires the combination of different disciplines such as anatomy, pathology, parasitology and diagnostic imaging. For this combining, students need the CR learned during their Bachelor´s. They apply it during

internships. With this applying of CR in the clinic, students need a 3D insight to solve the cases and enough confidence to make decisions based on their findings in the animals.

Research Question

The specimens that are available in the study area of Veterinary Medicine can be of good use for gaining a 3D insight and confidence to make decisions, while practicing CR. The gaining of this insight and confidence through CR self-study assignments with specimens provides an opportunity to bridge the gap between the practice of CR in the Bachelor and the Master. Since the available literature did not contain such assignments, the research question is:

What influence do characteristics of self-study assignments with specimens have on clinical reasoning?

In order to answer this research question, three assignments are designed. These assignments will be made by first year Master students in order to find out how many times they address the different components of CR. Next, it will be studied whether these findings are correlated with specific characteristics of the assignments.

Methods

This study belongs to the category of design-based research. In this study, the first step in a design-based research study was performed, aiming at 'proof of concept' (Masterman, 2011).

Participants

The participants were forty-seven first year students in the Companion Animal track of the Master Veterinary Medicine. These students all have their Bachelor Degree in Veterinary

Medicine. In this Bachelor's curriculum, CR has an essential role.

The target group of the assignments are third year Bachelor and first year Master students. Since the data collection took place in the fall, the third year students were not the best choice since they did not yet gather all prior knowledge required. The Master students do provide a representative sample for the time of the year at which they had been assessed.

Materials

The developer, who is both a veterinarian and teacher and thereby has experience with both clinical situations and educational insight, developed three assignments based on the design guidelines which were established by the first researcher (TW) and described previously (Theoretical Background).

The developer determined three promising contexts for the assignments in which all steps of CR were expected to evoke, but also a context for which specimens or radiographs were available. These contexts were discussed with another expert in clinical situations and education in order to check whether they really were promising contexts.

The developer brought together the gathered information and the contexts. Also specimens were integrated in the design, by providing an information source other than written text. In the assignments references were made to the specimens. The first assignment concerned a dog with an enlarged esophagus, caused by a persistent right aorta arch (appendix 1), the second assignment concerned a dog with an osteosarcoma in the distal part of the femur (appendix 2) and the third assignment concerned a dog with an extrahepatic portosystemic shunt (appendix 3).

The assignments should be at the right level of difficulty (McLoughlin, 2002). Apart from asking the students how they perceived the difficulty, the difficulty was also analyzed by five staff members at the division of anatomy and physiology. There were multiple

Table 1
Example of two dimensions from the scoring table

	Degree of complexity		
Dimensions	Simple (1)	Average (2)	Difficult (3)
Problem demarcation	Problem is given with clear demarcations	All parts of the problem can be found in the assignment	Problem is diffuse and contains multiple sub problems
Cues for analysis and solution	Assignment contains many cues for analysis and solution	Assignment contains limited number of cues	Assignment contains (almost) no cues

Note. The dimensions are scored on a three-point scale, in which 1 = Simple, 2 = Average, 3 = Difficult.

dimensions that influence difficulty, which all were scored for each of the assignments. This was done with a scoring table (appendix 5) in which each dimension was divided into three categories; 1 was simple, 2 was average and 3 was difficult (Ramaekers, 2011). An example for two dimensions can be seen in table 1.

Data collection

The developed assignments were tested with students in their first year of the Master track Companion Animals. The self-study time scheduled for Anatomy in these courses was allocated to this study.

In a proof of principle study, there is no set number to decide how many cases are needed. However, it is important to collect a well-saturated amount of data. In order to achieve this, approximately 15 to 30 observations were needed for each assignment (Creswell, 2007; Miles & Huberman, 1994). The Master track Companion Animals divided the students into four groups; each group consisted of twelve students. The students solved the assignments in pairs, leading to 6 observations per group for each assignment. The assignments could be made by all students from three of the four groups, which led ideally to 18 observations per assignment. For logistic reasons, only six students could make each

assignment in the fourth group, leading to 3 observations per assignment. Therefore, a maximum of 21 observations could be collected for each assignment. However, due to practical issues, a total of 51 observations were collected. Of these observations, 41 concerned assignments made by pairs of students while 10 assignments were made by students on their own. Assignment 1 was made seventeen times, assignment 2 eighteen times and assignment 3 sixteen times.

Students made the assignments in an artificial setting, consisting of a table with all the specimens at which the students work, since the study area was not completely refurbished at the start of the data gathering. Besides that, students retrieving information within the study area will provide problems in data gathering for this study. Microphones and extra light should be used to optimize the recordings.

Before the students made the first assignment, it was explained what the purpose of the study was and it was asked if the students gave permission to be filmed. It was also explained what they were supposed to do, including the technique of thinking aloud, which implies that the subjects speak out every thought that comes to mind (Van Someren, Barnard, & Sandberg, 1994). By using this technique, reasoning patterns of students became more explicit, giving more insight in the different steps of CR the students went through. The fact that the students worked in pairs contributed to the ease with which students spoke out their thoughts (Packer & Ballantyne, 2005). Once the students made the assignment, they were asked to fill out a questionnaire on how they perceived the assignment.

While the students made the assignments, they were recorded with two film cameras. These cameras were placed on the left and right side of the students in order to film in detail what the students did with the specimens. The cameras were located behind the students to minimize the effect of distraction by the notion of being filmed since this can make them more self-conscious of themselves (Denscombe, 2010).

Table 2
Questionnaire for student perception

Statement	Perceived assignment quality	Based on
This assignment is a useful self-study assignment	Usefulness	Design guideline 1
This assignment is comparable with other self-study assignments	Comparable	Goal
This is a relevant assignment for becoming a veterinary practitioner	Relevance	Design guideline 1
This assignment is a good exercise for the application of clinical reasoning	Clinical reasoning	Design guideline 4
This assignment is explicitly different than other self-study assignments	Different	Goal
I would have preferred to make this assignment alone instead of with a partner	Alone	Design guideline 3
The level of this assignment was	Difficulty	Design guideline 2

After they finished the assignment, students were asked to fill out a questionnaire on how they perceived the assignment. This questionnaire (appendix 4) was made by the researcher based on the design guidelines and the goal we had with the assignments (table 2). It contained seven items, which the students answered on a five-point Likert Scale.

Data analysis

All film fragments in which students express a step of CR were coded. Therefore, a coding scheme was used which was based on the different steps of clinical reasoning (appendix 6). In order to check whether the coding happened in a consistent and clear way, three fragments, one from each assignment, were also coded by another researcher. In order to assess the interrater reliability, the intra-class correlation coefficient (ICC) was calculated (Hallgren, 2012). The two-way consistency single-measures ICC was .481, indicating a moderate agreement. To check for coding consistency, part of the fragments were coded twice by the first researcher. In order to determine the part of the fragments that needed recoding, Cicchetti's guideline was used, 2n2, in which 'n' stands for the number of categories used

while coding. This formula indicated the maximum amount of data needed to recode in order to check the consistency of the coding. This formula is a guideline because the richness of the data influences the amount of recoding; richer data require less data recoding (Cicchetti, 1976; Cicchetti & Sparrow, 1981).

The students made the assignments ideally in pairs. However, it turned out that from the students making the assignments in pairs, only 7 pairs made all three assignments with the same fellow student. Therefore it was decided to consider the data independent instead of dependent.

The total number of codes for each assignment differed between the student pairs, ranging from 28 to 102. To make the assignments comparable, the absolute number of codes for each coding category within the different observations was converted into the relative number of codes. Since the duration of the assignments also differed, from 12 to 42 minutes, a regression analysis was performed to find out if the variation in the number of codes was caused by the duration of the assignment. This resulted in R^2 = .501, indicating that 50,1% of variation in the number of codes could be explained by the duration of the assignment.

Results

Clinical reasoning

The filmed material of the 51 observations was coded with a unique code for each step of clinical reasoning. The mean number of times students address a specific step of CR was determined for each assignment (table 3). Since there are differences between the different observations, for example regarding making judgments (M = 6.00, SD = 5.16) in the first assignment, that are for 50,1% due to differences in the duration of the assignment, this data was transformed to relative frequencies in order to compare those observations. The mean relative number of times students address a specific step of CR is given in table 4. On the

relative frequencies, an ANOVA was performed with Gabriel's pairwise test procedure as post hoc to suit the slightly different number of cases (Field, 2009). The results were considered statistically significant at the level of $p < .05$.

Collecting information.

Regarding the first step of clinical reasoning, information collection, there is no difference between collecting information in general, $F(2, 48) = 1.70$, $p = .193$, and collecting

Table 3
The frequency of each code in the three assignments

	Ass. 1 (n = 17)		Ass. 2 (n = 18)		Ass. 3 (n = 16)	
Code	*M*	*SD*	*M*	*SD*	*M*	*SD*
1. Collecting information from text	6.24	2.33	7.11	3.14	8.69	5.53
2. Collecting information from specimens	6.24	3.27	2.50	3.00	9.25	2.67
3. Organizing information	6.94	3.38	1.56	1.76	7.75	5.47
4. Generating diagnostic hypotheses	5.00	3.06	7.67	3.13	7.56	4.03
5. Collecting additional information from text	1.88	0.99	6.11	3.71	7.13	4.79
6. Collecting additional information from specimens	4.53	1.88	6.22	2.49	3.50	3.12
7. Making judgments	6.00	5.16	10.17	4.97	11.13	6.60
8. State definitive diagnosis	0.59	0.71	1.56	0.98	1.63	1.03
9. Answer question	13.76	4.86	6.17	2.55	12.13	3.94
10. Answer reflective question	4.29	2.02	0.00	0.00	0.00	0.00

Table 4
The relative frequency of each code in the three assignments

	Ass. 1 (n = 17)		Ass. 2 (n = 18)		Ass. 3 (n = 16)	
Code	*M*	*SD*	*M*	*SD*	*M*	*SD*
1. Collecting information from text	.12	.05	.15	.06	.12	.06
2. Collecting information from specimens	.12	.10	.05	.06	.14	.05
3. Organizing information	.12	.05	.03	.03	.11	.06
4. Generating diagnostic hypotheses	.09	.05	.15	.04	.11	.05
5. Collecting additional information from text	.03	.01	.12	.05	.11	.07
6. Collecting additional information from specimens	.09	.04	.13	.06	.05	.05
7. Making judgments	.10	.08	.20	.05	.15	.07
8. State definitive diagnosis	.01	.01	.03	.02	.03	.02
9. Answer question	.24	.05	.13	.05	.18	.05
10. Answer reflective question	.08	.04	.00	.00	.00	.00

Note. The given numbers are all relative frequencies, indicating how many times a code was assigned to a fragment regarding the total number of codes.

information from text, $F(2, 48) = 1.62$, $p = .209$, between the three assignments. The assignments all had the same structure starting with an history of the visits to the veterinarian, the first impression and the clinical examination of the patient.

However, regarding the collection of information from specimens there is a difference, since in assignment 2, a smaller fraction of the fragments is devoted to this, $F(2, 48) = 7.88$, $p = .001$. This can be due to the fact that the number of specimens is lower in this assignment than in the other two (3 vs 8 and 9). However, after correction for this, no difference in number can be established. This correction was performed by dividing the absolute number of times students look at specimens by the number of specimens available for each assignment. In assignment 1, students collect information from the specimens on average 6.24 times ($SD = 3.27$) in nine specimens, which results in 0.69 times for each specimen; in assignment 2, on average 2.50 times ($SD = 3.00$) in three specimens results in 0.83 times for each specimen; in assignment 3, on average 9.25 times ($SD = 2.67$) in eight specimens results in 1.16 times for each specimen (table 3). As the number of specimens is not likely to be the cause of the difference in the number of times they are used to collect information, the way they are addressed in the assignments has to be compared.

In assignment 2 information is given in text after which the statement is made ‘See specimens for further information’. In assignment 1 and 3 students are asked to name organ systems that they want to examine and are asked to ‘Look in the specimens whether the organ systems contain abnormalities’. This is a specific question they need to answer.

Organizing information.

The second step in CR, organization of information, concerns less fragments in assignment 2 compared to assignment 1 and 3, $F(2, 48) = 17.85$, $p < .001$. Comparing the assignments, it turned out that in assignment 1 and 3 there are questions stimulating the students to organize their information. These questions are:

- Which organ systems do you want to examine based on the information above, and why? (assignment 1)
- Make a list of the most important problems [and make a DDx [a list of all Differential Diagnoses] based on the most distinctive problem]. (assignment 1)
- Which organ systems are you going to examine? (assignment 3)
- What are the most important problems? (assignment 3)
- Choose the two most important problems [and make a DDx]. (assignment 3)

An example of organizing information can be seen in assignment 3, when students answer the question "Which organ systems are you going to examine?". One of their answers is the digestive tract, and they come to this answer by organizing their information: "He does not eat well, he vomits and the feces varies [in consistency]" (case 3.20130813-1). Questions eliciting organization of information are absent in assignment 2. In this assignment, students are asked to make a DDx right after information gathering. Most students directly come up with hypotheses without explicit signs of organizing information.

Generating diagnostic hypotheses.

Regarding the third step of CR, the statement of hypotheses, assignment 2 has a larger fraction of the fragments devoted to this step than assignment 1 and 3, $F(2, 48) = 10.44$, $p < .001$. The difference between assignment 2 and, 1 and 3 is again the phrasing of the question. Whereas in assignment 1 and 3 is asked for a DDx of the most important problems, the question in assignment 2 is "Which problems match with the symptoms above? Make a DDx as complete as possible.". This question asks to list hypotheses that fit with ALL symptoms.

Collecting additional information.

The fourth step of CR is the collection of additional information, which is the information collected after stating hypotheses. When considering this collection of information in general,

assignment 2 differs from assignment 1 and 3, $F(2, 48) = 13.42$, $p < .001$, since there are more fragments assigned to collection of additional information in this assignment.

Collecting additional information from specimens ($F(2, 48) = 10.84$, $p < .001$) is also higher in this assignment. In assignment 2, students need to look at the specimens in order to state a definitive diagnosis, leading to discussions about findings and going back and forth between the different specimens to confirm their diagnosis. However, in assignment 1, students are only asked to compare their findings on the X-ray with the specimens to state their diagnosis. The film fragments show that students at this point only look at the one or two specimens in which they found abnormalities before. They do not compare all specimens with their findings on the X-ray, leading to fewer times collection of information from specimens. Also in assignment 3 the information on paper leads, guided by questions, to the diagnosis. The question to state the diagnosis only suggests to students that they can look at the specimens.

Collecting additional information from the text is done less times in assignment 1, $F(2, 48) = 14.36$, $p < .001$. The length of the text referring to retrieval of additional information is comparable in all three assignments. The main difference is that assignment 1 contains the results of a blood test in which all values were within the reference values. The students read this information and go on. There is no need for the students to go back to this part of the text later in the assignment. Assignment 3 also contains a blood test, but with abnormal values. These values stimulate discussion, after which students go back to the test information. In assignment 2 abnormalities were given in writing, rather than summarized in a table. This also stimulated discussion and alternation between collecting information and discussing this information.

Making judgments.

Regarding the fifth step of CR, 'making judgments' ($F(2, 48) = 9.11$, $p < .001$), there is a statistically significant difference between assignment 1 and assignment 2 ($p < .001$). In assignment 2 more fragments are devoted to the making of judgments. There are multiple questions in the assignments that elicit judging. Those questions are:

- What is the order of your DDx now (which problems still fit and which do not fit anymore)? (assignment 2)
- How can you discriminate between the possible problems? (assignment 2)
- Which problem from your DDx seems most likely? (assignment 1)
- View the X-rays again, how can you discriminate between the possible problems? [This question continues on a previous question in which it was asked to name three possible congenital problems] (assignment 1)
- Look whether your findings on the X-ray correspond with the specimens. What is the cause of the mega esophagus? (assignment 1)

The difference between these questions is that the questions in assignment 2 ask for a broad answer, which depends on earlier answers of the students, whereas the questions in assignment 1 are more specific. The questions of assignment 2 can be answered with multiple problems. An example of judgments made, in order to answer the question "What is the order of your DDx now (which problems still fit and which do not fit anymore)?" is (case 2.20130819-3):

- Student 1: "I would think about, maybe, a fissure or something since the femur appears painful but the swelling decreases"
- Student 1: "Eh, problems with the patella seems less, eh, since the drawer phenomenon and all is negative"
- Student 1: "Thereby, a problem with the cruciate ligaments becomes less probable"

- Student 1: “So, you could have a bone problem and even a problem in the joint”

However, the questions in assignment 1 guide students more, leading to a lower number of topics to judge. An example of an answer on the question “Which problem from your DDx seems most likely?” is (1.20131105-11):

Student 1: “Which problem from your DDx seems most likely? Mega-esophagus”

Student 2: “Yes”

Student 1: “At least, that picture does it [Student 1 points at picture showing a mega-esophagus]”

State definitive diagnosis.

The sixth step of CR, stating a diagnosis, differs between assignment 1 and assignment 2 and 3, $F(2, 48) = 7.92$, $p = .001$. In assignment 2 and 3, a direct question is asked: “What is the definitive diagnosis?”, whereas this is an indirect and two-fold question in assignment 1: “Look whether your findings on the X-ray correspond with the specimens. What is the cause of the mega esophagus?”.

Answer question.

In all assignments questions are asked. Some questions evoke steps of CR, others stimulate students to recall knowledge learned earlier in their study. Also reflective questions are asked and questions regarding the process of examining the patient. How many times these types of questions were present in the assignments can be seen in table 5 (appendix 7). With regard to answering questions, all assignments differ significantly, $F(2, 48) = 20.99$, $p < .001$.

In assignment 1 eight questions are asked that do not directly concern CR. In this assignment, students give an average of 13.76 ($SD = 4.86$) answers to those eight questions (table 3). This leads to a mean of 1.72 answers given to each question. In assignment 2, three circumstantial questions are asked. Students give an average of 6.17 answers in total ($SD = 2.55$), leading to 2.06 answers per question. In assignment 3, two questions are asked that do

Table 5
Number of times the different types of questions are asked in the three assignments

Type of question	Assignment 1	Assignment 2	Assignment 3
Clinical Reasoning	7	3	7
Knowledge	3	0	0
Process	2	3	2
Reflective	3	0	0
Total	15	6	9

not directly concern CR. In this case, students give an average of 12.13 answers (*SD* = 3.94), leading to 6.07 answers per question. The circumstantial questions in assignment 2 and assignment 3 all concern the process. No indications can be found either in those questions or surrounding information to explain the difference in the number of times students answer a question in those two assignments.

Answer reflective question.

Reflective questions were asked only in assignment 1, after finishing the statement of a diagnosis. The three questions asked concerned important aspects of the case, which might be unaddressed, such as ‘How could the breeder have missed the regurgitation of the pup?’.

Difficulty of the assignments

Since students only learn from self-study assignments when they are at the right level of difficulty (McLoughlin, 2002), the difficulty level was determined by five staff members of the division of anatomy and physiology. They did this by filling out a scoring table (appendix 5) that concerned different dimensions that influence the difficulty of an assignment (Ramaekers, 2011).

In table 6 the results are shown, indicating that there are differences in dimensions in the assignments. For example in the dimension of problem demarcation in which assignment 3 (*M* = 2.6; *SD* = 0.89) scores more difficult than assignment 2 (*M* = 1.8; *SD* =0.45). When looking at the description of the categories of problem demarcation (table 1), this result

Table 6
Mean values of the dimensions for each of the three assignments

	Assignment 1		Assignment 2		Assignment 3	
Dimensions	*M*	*SD*	*M*	*SD*	*M*	*SD*
Problem demarcation	2.2	0.84	1.8	0.45	2.6	0.89
Cues for analysis and solution	1.4	0.55	1.5	0.50	1.2	0.45
Available information	2.1	0.55	2.2	0.84	1.8	0.84
Realistic	2.4	0.42	2.2	0.84	2.0	0.71
Representative	2.4	0.55	1.8	0.45	2.4	0.55
Within range of prior knowledge	1.7	0.45	1.4	0.55	1.5	0.50
Integration	1.6	0.89	1.4	0.55	2.2	0.84
Time available	1.4	0.55	1.4	0.55	1.8	0.45
Mean	1.9	0.30	1.7	0.27	1.9	0.28

Note. The dimensions are scored on a three-point scale, in which 1 = Simple, 2 = Average, 3 = Difficult. n = 5 for all values.

means that in assignment 2 all parts of the problem are available for the students in the assignment, while in assignment 3 also all parts of the problem are given but the problem itself is diffuse.

The Mann-Whitney U test was performed to check whether the assignments differed significantly. Results show that assignment 1 and 2 do not differ in difficulty, $U = 7.00$, $z = -1.16$, $p = .245$, and neither do assignments 1 and 3, $U = 11.00$, $z = -0.32$, $p = .753$, and assignments 2 and 3, $U = 7.00$, $z = -1.16$, $p = .245$.

Questionnaire

Since student motivation is a requirement in order to learn from self-study assignments (Cooper et al., 2006; Dolmans et al., 1997), students' opinion on the assignments was measured with a questionnaire (appendix 4). This questionnaire contained seven items, answered on a Likert scale. Data retrieved from a Likert scale is conceptually ordinal, but is here treated as interval (Carifio & Perla, 2007; Norman, 2010).

Items.

Beforehand, it was expected that there would be a relationship between student answers on the items 'alone' and 'difficulty'. The hypothesis was that the more difficult students rate the

Table 7
Category descriptions of the questionnaire

Category	Items	Cronbach's *alpha*	Description
1	Usefulness Relevance Clinical reasoning	.77	Perception of students on educational benefits of the assignment
2	Comparable Different	.82	Perception of students regarding the assignment in comparison with other assignments in the study
3	Alone Difficulty	.44	Perception of students regarding preconditions

assignment, the more likely they prefer to make the assignment in couples instead of alone. Spearman's correlation coefficient $r = -.34$ ($p < .01$) indicates that there is a small relationship between the difficulty and making the assignment alone.

There was also a correlation expected between the items 'usefulness', 'relevance' and 'clinical reasoning'. Spearman's correlation coefficient shows that this is a moderate correlation, with $r = .58$ for 'usefulness' and 'relevance', $r = .62$ for 'usefulness' and 'clinical reasoning' and $r = .64$ for 'relevance' and 'clinical reasoning' (all p values $< .001$).

To validate the instrument and to see whether the above mentioned items can be grouped together, a Principle Component Analysis with Varimax rotation was performed, after conversion of the items 'comparable' and 'difficulty'. This analysis extracted three categories (table 7), the first and second category had high reliabilities, with a Cronbach's *alpha* of respectively .77 and .82.

Student perception.

Every participant filled out up to three questionnaires (table 8). To verify whether students rate the assignments differently, a repeated measures ANOVA was used. Between the three assignments, there is a statistically significant difference on how students perceive the usefulness of the self-study assignments, $F(2, 42) = 3.54$, $p = .038$, and the relevance for their future as veterinary practitioners, $F(2, 42) = 3.32$, $p = .046$.

Table 8
Questionnaire results

	Assignment 1			Assignment 2			Assignment 3		
Statement abbreviation	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
Usefulness	3.76	0.82	34	3.40	0.86	30	3.93	0.77	28
Comparable	2.88	0.99	33	2.71	1.13	31	2.71	1.12	28
Relevance	3.94	0.78	34	4.00	0.68	31	4.25	0.93	28
Clinical reasoning	3.88	0.77	34	3.81	0.91	31	4.25	0.65	28
Different	3.09	1.16	34	3.32	1.05	31	3.50	1.04	28
Alone	2.09	0.82	32	1.70	0.67	27	1.96	0.96	26
Difficulty	2.91	0.53	32	3.07	0.72	28	3.19	0.68	27

Note. The items of the questionnaire are scored on a five-point scale, in which, for the first six statements, 1 = Strongly disagree, 3 = Neutral, 5 = Strongly agree. For the last statement, 1 = Too easy, 2 = Easy, 3 = Exactly Right, 4 = Difficult, 5 = Too difficult.

To test the difference between the three assignments on ‘usefulness’ and ‘relevance’, the Bonferroni post hoc test was used. The rating of ‘usefulness’ of the assignments differs significantly between assignment 2 and assignment 3, $p = .036$, 95% CI [-1.15, -.03]. Students rate all the assignments useful as self-study assignments (table 8).

Relevance for a future profession as veterinary practitioner shows a statistically significant difference between assignment 1 and assignment 3, $p = .011$, 95% CI [0.082, 0.736]. However, students agree with the stand “This is a relevant assignment for becoming a veterinary practitioner” for all three assignments (table 8).

The students were also asked in the questionnaire what they thought of the difficulty level of the assignments. The results show that students rated all three assignments at approximately the right level; assignment 1 ($M = 2.95$, $SD = .51$), assignment 2 ($M = 3.05$, $SD = .76$) and assignment 3 ($M = 3.25$, $SD = .72$). There is no statistical significant difference between the assignments, $F(2, 38) = 0.90$, $p = .42$. Furthermore, students agree that all three assignments are good exercises for CR.

Besides answering the statements, students were asked for additional comments on the assignments. Within these comments, three themes were mentioned repeatedly. The first theme is the use of books. While students were not allowed to use them, they rather prefer to

use them while making the assignments. They want to search for answers on questions about prior knowledge, look for information they were not sure of, or use their DDx book. Secondly, the assignments stop when a diagnosis is stated. Students think the assignments could be even more valuable if there were follow up questions about a plan for treatment. The third theme concerns the specimens. Some students found them confusing, missed specimens or found it hard to see whether something was an abnormality or an artifact, as someone states: “I did not think that a clear abnormality was visible in all specimens, I found it hard to judge”. However, there are also students who appreciate this type of assignments: “This seems a good way to do self-studies, since it gives you a better idea of the cases”.

Conclusion

The research question for this study is ‘*What influence do characteristics of self-study assignments with specimens have on clinical reasoning?’*. All three assignments designed for this study evoked clinical reasoning. However, there are multiple characteristics that influence the effectiveness of the assignments; difficulty, educational benefits and specific characteristics within the assignments. In the next paragraphs this will be dealt with in detail.

A possible way to address these characteristics can be found in the format for new assignments (appendix 8), which concerns all steps of CR (guideline 4). This guideline was well implemented in the design of the assignments since all assignments contained and evoked all steps of CR. The format also includes guidelines for optimal use of the specimens in order to gain a 3D insight and enhance decision making based on the 3D visuals.

Specific characteristics within the assignments

Each assignment contained written information (both facts and conclusions) and specimens (both normal and abnormal, without legends or conclusions). The number of times students

collect information from the written information only differs when it concerns information collected after stating hypotheses. When this information contains abnormalities, these abnormalities are cues for discussion (guideline 3).

Posing explicit questions within the assignments has an important directional influence, they can lay emphasis on, or distract from four different steps of CR, namely organizing, hypothesizing, judging and stating a diagnosis. First, if the main learning outcome of the assignment is on the step ‘organizing’, it is useful to include a question in the assignment that initiates organization of information. An example of such a question is asking for the most important problems instead of asking no question at all. Second, the amount of hypotheses stated can be influenced by the question. When the question requires a DDx of only the most important problem, less hypotheses are generated compared to when students state a DDx for multiple problems. Third, the number of times students judge depends on the question. If the question is asked while covering a broad area, more judgments are made than compared to a question asking to compare, for example, three different possible diagnoses. An example of a broad question concerns prioritizing hypotheses (guideline 5), which is important for gaining extended knowledge frameworks. The results indicate that such a question must be present in an assignment in order to stimulate students to prioritize their hypotheses. Fourth, the question for the diagnosis can be made direct or indirect. When asked directly, more students state a diagnosis than asked indirectly, when the word ‘diagnosis’ is avoided and the question asking for a diagnosis is two-fold.

If we regard the specimens, the number of specimens has no influence on the number of times students look at each of them. Comparing findings in specimens with each other is a possible cue to stimulate discussion (guideline 3).

Also the way specimens are addressed in the assignments is important. When the specimens are really needed to state a definitive diagnosis, students use them for that,

whereas they can also be used earlier in the assignment for collecting information. The first guideline stated that, according to literature, specimens add value to the assignments. This study shows that specimens can be integrated in self-study assignments with at least two different goals, either the collection of information or the statement of a diagnosis. In both ways, the specimens can add to the students' 3D insight. They also add to students' decision making based on visual aids, since the specimens require that students make decisions based on them.

Difficulty

Difficulty was a characteristic identified based on literature research. It was assessed by inquiry of both students and faculty. The analysis by staff members showed no statistical differences, indicating that the assignments are equally difficult. This is the right difficulty level according to the students. Since guideline 2 was that the assignments should fit with the prior knowledge of the students, the developer estimated the prior knowledge of the students correctly.

Educational benefits

The questionnaire was made in order to find out whether the students saw the educational benefits of the assignments for their own learning process. Based on the results, it can be concluded that the students find the assignments useful as self-study assignments, a good exercise to apply CR and a good practice for their future as veterinary practitioner.

Discussion

In this study, three assignments were designed based on literature review, which number proved enough for a first impression of the effects of assignment characteristics on the CR of

students. To check whether the reasoning pattern found in this study is representative of the general reasoning pattern students go through when they use CR, the data of this study was compared with the data of Ramaekers (2008). In that study, fourth-year Veterinary Medicine students were recorded while solving a case in pairs. This case involved a written assignment and a simulation patient. A total of 49 cases was included in this study. Since there were only small differences between the number of times students address a step of CR either in the present study or the study of Ramaekers (2008) (table 9), both studies show the same reasoning pattern in students. Since CR was induced with a representative reasoning pattern and since the specimens provided an addition to the three assignments, the assignments can be seen as examples of good practice for first year Master students of Veterinary Medicine.

The most important feature of the assignments was the stimulation of CR through the use of specimens. Specimens were most important when students collect (additional) information. In collecting additional information, the role of specimens clearly differed between the assignments regarding the statement of the diagnosis. The developer can, regarding the goal of the particular self-study assignment, guide students to use the specimens

Table 9
Frequency (in %) of steps of clinical reasoning in two studies

	TW		SR	
Step of clinical reasoning	*M*	*SD*	*M*	*SD*
Collecting information	41.2	11.1	49.0	16.1
Organizing information	8.6	6.5	7.4	3.4
Generating diagnostic hypotheses	11.7	5.3	7.4	3.3
Making judgments[a]	15.2	7.9	8.9	3.9
			5.3	2.6
State definitive diagnosis[b]	2.3	2.1	5.5	2.3

Note. TW = Thessa Wolfswinkel, indicating the current study; SR = Stephan Ramaekers, indicating the study used for comparison (Ramaekers, 2008). Steps of clinical reasoning are based on the TW study, SR results are from codes comparable to TW steps of clinical reasoning.
[a]Since the SR study differentiated between making judgments on information or hypotheses and judgments on the process of the examining of the patient, values of both codes are given.
[b]The SR study combined stating a diagnosis and the determining of a treatment in one code, whereas the TW study only included the stating of a diagnosis.

in a way as optimal as possible (format, appendix 8). For example regarding the collection of information, students can be guided in making decisions based on the different organ systems they examine. The specimens can also be used to state the definitive diagnosis, encouraging students to make the final decision based on the specimens. In both examples, students are practicing in making decisions based on the specimens, thereby they will become more confident making these decisions. When using the specimens for the collection of information and while making decisions, the 3D insight of students will increase (Lipson, 2007). This is not directly tested in this study, but it appeared that students sometimes found it difficult to interpret the specimens. This indicates that their 3D insight is not optimal yet and therefore it is preferable that students make more assignments with specimens in order to improve their 3D insight. It might be that the students also found it difficult because the specimens were not from the same breed, which is inevitable. However, it does give students a better insight in the variety between different dog breeds (Fruhstorfer et al., 2011; Jones & Whitaker, 2007).

Specimens also make assignments more realistic, an important characteristic since assignments should be as realistic as possible. This was achieved with case-based designs that resemble veterinary practice (Dolmans et al., 1997; Ramaekers, 2011). Thereby, the developer should also be aware of how well- or ill-structured the problem is. Ill-structured problems are more realistic, since not everything is well-structured in real life (Jonassen, 2000). There should be some structure in the self-study assignments since one of the goals is that students practice with the different steps of CR. Therefore, balance is important. However, by asking general questions for example about which organ systems to investigate, the content of the problem is more ill-structured whereas the process to come to a diagnosis is more well-structured, which might be the balance needed regarding the goal of the assignments.

Students need to make the assignment as intended. Therefore it is first and most important that students see the educational benefits of why they need to make the assignments (Cooper et al., 2006; Dolmans et al., 1997). As shown by the results of the questionnaire, students understand the usefulness of the assignments. However, during the assignment, students were not allowed to use other resources to search for information. After the assignment, many students indicated that they rather had used books. Therefore it is the question what students would do if they had books available to search for answers. The problem with using books is that it can disturb the reasoning process and students can become convinced that answers can be found in the books, while actually they can only be found in the specimens. Therefore it is important to stress to students not to use books while making the assignment and also explain why, since understanding can influence students' choice (Finley, 2012).

Based on the literature it was decided that the assignments had to be made in pairs to elicit the reasoning process. It evokes discussion, and use of internal frameworks of both students. At the end of their studies the students have to be so familiar with the process that they can do it by themselves, since that is normal practice when working as a veterinarian. It is possible that some students prefer to do it alone, when they perceive a gap in knowledge between themselves and their working partner. However, the majority of the students indicated that they would rather make the assignment in couples than alone, indicating that with this working together, which elicits discussion and a better understanding (Dolmans et al., 1997), everything will go as planned.

To be able to analyze the reasoning process of the students, they used the technique of thinking aloud while making the assignments. It is, however, uncertain whether this technique led to the capturing of ALL steps of CR students went through. Regarding the step

‘stating a diagnosis’ in the first assignment, an analysis of the written answers showed that in six of the seventeen assignments a diagnosis was written down by either one or both of the students, while this diagnosis was not spoken out loud. However, this check is not possible for all steps of CR. For example, when students only write down the outcome of a judgment process, it is not possible to follow their reasoning. Therefore, despite the fact that some steps of CR were missed, usage of the technique of thinking aloud is still the best method.

Since it was for the researcher the first time to perform a study in which the students need stimulation to speak out their thoughts, it was a search for balance between enough spoken thoughts by the students and interrupting their natural process of solving the assignments to stimulate them to speak more. Encouragements for students to speak out their thoughts might have been done earlier in (almost) all times that the students were silent.

Some findings were difficult to explain, for example why students only state a diagnosis when this is literally asked in the question, and not when this is asked indirectly. They should be used to indirect questions since they are also used in other assignments during the study of Veterinary Medicine. Therefore, the statement that this difference is caused by phrasing is a possibility. Phrasing of a question can be important for the received answer, as proven in a study investigating how patients informed their doctor of their pain level, regarding the question the doctor asked (McDonald, Shea, Rose, & Fedo, 2009). Since the question asking for the diagnosis in assignment 1 is two-fold, it could also be that this is the cause for the low number of diagnoses. However, it is also possible that other factors play a role, such as the questions asked before stating the diagnosis. They ask for knowledge and judgments of this knowledge regarding the case; thereby creating a difference with the other two assignments. Therefore, in order to give a solid answer to what the trigger is for students to state a diagnosis, further research is needed, in which at least above mentioned possibilities are

tested. For the format, the choice was made to advice the developer to use the word ‘diagnosis’ in a separate question, in order to (almost) guarantee that the students state a diagnosis.

Also in making judgments there is a difference between assignment 1 and 2 that can have multiple causes. There is a subtle difference in whether the questions require broad answers or not. However, it is also possible that this is due to something else such as the clarity of the given cues in the different assignments. Therefore, further research is needed to find out whether the specificity of the questions really has such an impact on the number of times students make judgments, or that there are other factors involved, leading to insight in the different ways in which making judgments can be stimulated. For the format, no choice was made for advising either type question. The difference between both types was indicated, including the student responses to the question types. Thereby the developer can make an informed decision on the strategy he applies.

Last, there was no cause found in assignment 2 or 3 for the difference in the number of times an answer to a question was stated; neither in the questions about the process, nor in the surrounding parts of the assignment. Therefore, more research is needed. The advice in the format is to keep two or three questions about the process in the assignments. Although answering process questions such as ‘What is your advice to the owner of the dog’ (assignment 2) interrupt the reasoning process, the questions make the assignments more realistic regarding the future profession of veterinary practitioner.

This study focused on the influence of assignments with specimens on student CR patterns. Where it showed insight in, and delivered a format for, this type of assignments, it did not test whether these assignments contribute to a better preparation for Bachelor students that are about to begin their Master. An interesting follow-up research would be to see if Bachelor students practicing CR with assignments, in which they also train their 3D insight

and decision making based on 3D objects, are better prepared for their Master compared to students who do not make such assignments.

This study is the first – to our knowledge – to investigate the combination of CR and specimens for self-study assignments. In the format (appendix 8), made as frame-work for new assignments, the influence of the different specific characteristics are taken into account. Although this study was focusing on first year Master students of Veterinary Medicine, the characteristics are not specific for this discipline, but can also be used in medical and paramedical studies including Medicine and Physiotherapy. The examples given in the format are specific for Veterinary Medicine, however, they can still be used as a starting point and can be easily changed for the given discipline. It will be beneficial for students to use this type of assignments more, since self-study assignments for CR help students practice with the different reasoning steps needed to solve cases and the addition of specimens includes the obtainment of a 3D insight and confidence in taking decisions based on 3D objects.

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Appendices

Appendix 1 – Assignment 1: Persistent right aorta arch

Algemene opmerkingen voordat je met de casus begint:

- Vanwege praktische redenen komt het ras van de preparaten niet altijd overeen met de casus
- Bij alles wat je niet aan de preparaten kunt zien mag je er vanuit gaan dat het niet afwijkend is
- De kleur van de preparaten is niet betrouwbaar en kun je dus niet meenemen in je beoordeling

Casus 1

Eigenaar:	Mevr. Van den Broek Burg. Van der Wielstraat 27 2245 AL Dieren
Roepnaam:	Juul
Ras:	Duitse herder
Geslacht:	Vrouwelijk, niet gecastreerd
Geb. datum:	22-02-12
Gewicht:	8 kg (07-05-12)

26-04-12	Komt voor enting, eerste pup voor eigenaar. Gekocht bij broodfokker (5 dagen geleden). Heeft nu drie dagen op rij braaksel gevonden, maar heeft de hond niet zien braken. Verder geen bijzonderheden, levendige hond. In paspoort staat dat ze wat achtergebleven is ten opzichte van de rest van het nest. In het paspoort staat dat hij ontwormd en gevaccineerd is volgens het schema van uw praktijk. AI: pup is wat aan de kleine kant en voedingstoestand is te mager, verder g.b. AO: g.b. Advies: in de gaten houden hoe en wanneer de hond braakt. Bij aanhoudende klachten terugkomen en verder onderzoek doen. 1x lepto + parvo 1x kennelhoest
07-05-12	Het gaat niet zo goed met Juul, ze is een beetje sloom en hoest regelmatig. Ook vindt mevrouw nog dagelijks braaksel, wat bij uitvragen eerder lijkt op regurgiteren.

VRAAG: Hoe maak je onderscheid tussen braken en regurgiteren?

VRAAG: Welke specifieke informatie over het regurgiteren zou je willen weten om onderscheid te kunnen maken tussen de verschillende oorzaken van regurgiteren?

AI: pup is wat sloom, groeit matig en voedingstoestand is niet verbeterd.
Verder g.b.

AO: A 52/min, abdominale ademhaling
P 130/min, KRESS
T 39,0° C
Vacht en huid geen bijzonderheden
SV geen bijzonderheden
Lnn: mandibulaire lymfeknopen zijn beiderzijds vergroot, verder g.b.

VRAAG: Welke orgaansystemen gaat u aan de hand van bovenstaande gegevens onderzoeken en waarom?

Bekijk de preparaten om te zien of bij deze orgaansystemen afwijkingen aanwezig zijn. Aanvullende informatie vindt u hieronder.

Respiratie:
Bij druk op de larynx hoest Juul, verder g.b.

Circulatie:
Verder g.b.

Digestie:
Geen aanvullende afwijkingen.

VRAAG: Stel uw probleemlijst op en een DDx op basis van het meest kenmerkende probleem.

VRAAG: Wat is uw verdere plan van aanpak?

VRAAG: Wat valt u op aan de röntgenfoto's?

VRAAG: Wat valt u op aan het bloedonderzoek?

	Bloeduitslag	Referentiewaarde
Hematocriet	0.32 L/L	0.27 – 0.61 L/L
Leucocyten	13.9 x 10^9/L	4.5 – 14.6 x 10^9/L
Lymfocyten	4.4 x 10^9/L	0.8 – 4.7 x 10^9/L
Monocyten	0.0 x 10^9/L	0.0 – 0.9 x 10^9/L
Neutrofiele granulocyt	8.0 x 10^9/L	2.9 – 11.0 x 10^9/L
Eosinofiele granulocyt	0.1 x 10^9/L	0.0 – 1.6 x 10^9/L
Basofiele granulocyt	0.0 x 10^9/L	0.0 – 0.1 x 10^9/L
Totaal Eiwit	57 g/L	55 – 72 g/L
Albumine	27 g/L	26 – 37 g/L
Natrium	146 mmol/L	141 – 150 mmol/L
Kalium	4.1 mmol/L	3.6 – 5.6 mmol/L
Chloride	111 mmol/L	111 – 120 mmol/L
Glucose	4.2 mmol/L	4.2 – 5.8 mmol/L
Ureum	7.2 mmol/L	3.0 – 12.5 mmol/L
Creatinine	112 µmol/L	50 – 129 µmol/L

VRAAG: Welke aandoening uit uw DDx acht u waarschijnlijk?

VRAAG: hoe ontstaat een megaoesophagus?

VRAAG: bedenk drie congenitale aandoeningen die ten grondslag kunnen liggen aan een megaoesophagus.

VRAAG: Bekijk de röntgenfoto's nogmaals en bedenk hoe je onderscheid maakt tussen deze oorzaken?

VRAAG: Bekijk de preparaten om te zien of ze overeenkomen met uw bevindingen op de röntgenfoto. Wat is hier de oorzaak van de megaoesophagus?

Reflectieve vragen:

Hoe kan het dat de fokker het regurgiteren gemist heeft?

Waarom blijft de pup achter in groei en waarom is ze aan de magere kant?

Waarom is de larynx drukgevoelig?

Appendix 2 – Assignment 2: Osteosarcoma

Algemene opmerkingen voordat je met de casus begint:

- Vanwege praktische redenen komt het ras van de preparaten niet altijd overeen met de casus
- Bij alles wat je niet aan de preparaten kunt zien mag je er vanuit gaan dat het niet afwijkend is
- De kleur van de preparaten is niet betrouwbaar en kun je dus niet meenemen in je beoordeling

Casus 2

Eigenaar:	Dhr. Fientjes Lokven 14 6485 KS Dieren
Roepnaam:	Bobby
Ras:	Briard
Geslacht:	Mannelijk, gecastreerd
Geb. datum:	05-10-06
Gewicht:	33 kg

20-11-09	Eigenaar is een aantal maanden geleden verhuisd en nu nieuwe klant bij ons. Komt voor vaccinatie. Hond heeft tot nu toe weinig problemen gehad, alleen af en toe problemen met zijn huid. AI + AO: g.b. 1x lepto 1x kennelhoest 1x ontworming groot
03-03-10	Braakt sinds twee dagen en heeft ook diarree. Eet slecht en is ook wat minder actief dan normaal. Braakt enige tijd na het eten. Diarree is niet waterdun, geen bloed erbij en niet afwijkend van kleur. Onbekend of hij rare dingen heeft gegeten. AI: wat sloom, verder g.b. AO: AH=24/min, P=116/min, T= 39.0, slijmvliezen plakkerig, verder g.b. DIG: defense musculaire bij buikpalpatie, bij auscultatie beiderzijds veel hoogtonige borborygmi, verder g.b. Advies: antibraakmiddel en middel tegen diarree, belangrijk dat hij komende 24 uur niet braakt, dan gelijk terugkomen. Als het na enkele dagen niet verbeterd, dan terugkomen. 3,3 ml injectie maropitant (Cerenia)

	4 tabletten maropitant (Cerenia) 1x daags ingeven in de bek, morgen beginnen 23 tabletten sulfasalazine (Salazosulfa) 3x daags 1,5 tablet gedurende 5 dagen, direct beginnen
22-11-10	Geen bijzonderheden, hond ziet er goed uit. 1x lepto + distemper hepatitis parvo 1x kennelhoest
18-11-11	Geen bijzonderheden, probeer wel op gewicht te letten want hond is aan de zware kant (weegt nu 37 kg). 1x lepto 1x kennelhoest
21-11-12	Hond is weer keurig op gewicht, eigenaar wil in het voorjaar hond meenemen op vakantie naar Duitsland en vraagt zich af of daar nog extra vaccinaties voor nodig zijn. 1x lepto 1x rabies 1x kennelhoest Advies: bekijk op de website van het LICG de eisen waaraan je moet voldoen (bijvoorbeeld muilkorf mee), want eisen veranderen regelmatig.
24-06-13	Waren gisteren grote wandeling aan het maken. Daarbij kwamen ze een jonge Rottweiler tegen, waarmee hij ging spelen. Ineens piepte Bobby heel erg en liep daarna kreupel. Gaat nu (een dag later) nog steeds niet goed. AI: belast linker achterpoot bijna niet. AO: AH niet telbaar, hijgt alleen maar. P = 80/min, T=38.8°C, verder g.b.

VRAAG: Wat gaat u nu doen?

Locomotie: Kreupelheid is eigenlijk heel de dag door hetzelfde geweest, geen verbetering of verslechtering. In stand belast hij de poot matig, hij staat eigenlijk alleen op zijn teen. Bij het monsteren valt op dat hij duidelijk belastingkreupel is linksachter (graad II). Bij inspectie vallen u geen bijzonderheden op, beoordeling is lastig door het vele haar. Bij palpatie vindt u zwelling van en rond het kniegewricht. Bij passieve bewegingen van de knie verzet de hond zich en spant zijn spieren aan. Schuifladefenomeen en tibia-compressietest zijn niet betrouwbaar omdat de hond zich verzet. Ook bij palpatie van de distale femur reageert de hond pijnlijk.
Voor verdere informatie zie de preparaten

VRAAG: Welke aandoeningen vindt u passend bij bovenstaande klachten? Stel een zo volledig mogelijke DDx op.

VRAAG: Wat is uw advies aan de eigenaar?

Vanwege het acute ontstaan van de klachten en een duidelijk moment waarop de klachten zijn ontstaan kun je de hond NSAIDS meegeven en het een aantal dagen aan laten kijken. Er is een klein risico aanwezig dat er een fissuur/fractuur is die kan verergeren zonder adequate therapie. Belangrijk is om dit goed met de eigenaar te communiceren en uit te leggen welke diagnostische mogelijkheden er verder zijn en indien de eigenaar dat wil, dan kan dat natuurlijk ook direct. Er zit alleen een kostenplaatje aan vast. In dit geval kiest de eigenaar ervoor om met rust en NSAIDS het een week aan te kijken.

01-07-13 Eigenaar heeft de hond goed rust gegeven en medicijnen gingen er goed in. Het leek de eerste dagen beter te gaan, maar de laatste dagen gaat het toch weer minder.
AI: belast linksachter nu wel in stand
AO: AH niet telbaar, hijgt veel, P=60/min T=39.0 verder g.b.
LOC: kreupelheid is iets minder geworden, maar nog steeds duidelijk aanwezig, zwelling is aan de distale zijde van de knie afgenomen, maar boven de knie nog steeds duidelijk voelbaar. Schuifladefenomeen en tibia-compressietest zijn nu negatief, maar de hond verzet zich hevig bij het uitvoeren van deze testen. Palpatie van de distale femur levert een pijnreactie op. Passieve bewegingen van de heup leveren geen afwijkingen op. Verder geen bijzonderheden.

VRAAG: Hoe is de volgorde van uw DDx nu (welke aandoeningen worden minder waarschijnlijk en welke aandoeningen passen nog steeds goed)?

VRAAG: Hoe kunt u onderscheid maken tussen deze aandoeningen?

Helaas is uw röntgenapparaat kapot en is het onmogelijk om op dit moment een foto te maken. Toch is het mogelijk om aan de hand van de preparaten uw diagnose te stellen.

VRAAG: Wat is uw definitieve diagnose?

Appendix 3 – Assignment 3: Extrahepatic portosystemic shunt

Algemene opmerkingen voordat je met de casus begint:

- Vanwege praktische redenen komt het ras van de preparaten niet altijd overeen met de casus
- Bij alles wat je niet aan de preparaten kunt zien mag je er vanuit gaan dat het niet afwijkend is
- De kleur van de preparaten is niet betrouwbaar en kun je dus niet meenemen in je beoordeling

Casus 3

Eigenaar:	Mevr. Janssen Weegstraat 3 3675 JV Cadzand
Roepnaam:	Balou
Ras:	Yorkshire terrier
Geslacht:	Mannelijk, gecastreerd
Geb. datum:	05-01-13
Gewicht:	3.5 kg

08-02-13	Rustige pup, geen bijzonderheden. 1x lepto + parvo 1x kennelhoest 1x ontworming (volgende week geven)
01-03-13	Geen bijzonderheden 1x lepto + distemper hepatitis parvo 1x ontworming
05-08-13	Tijdens de afgelopen dagen heeft mevrouw een paar keer een plasje water in de gang gevonden en tijdens het uitlaten lijkt het of hij vaker moet plassen. Vanochtend zat er zelfs een beetje bloed bij de urine. Mevrouw vraagt zich af of het vaker plassen door zijn hormonen komt, want hij tilt zijn poot eigenlijk nog niet echt op. Volgens zijn baasje is hij ook wat slomer en als ze hem optilt piept hij soms. Ook moet mevrouw vaak zijn bek afvegen omdat er anders kwijl uitloopt. Hij eet niet zo goed, maar dat heeft hij eigenlijk nooit echt gedaan. Toch lijkt het of hij wel honger heeft, want hij staat vaak met zijn hoofd tegen de koelkast aan. Daarnaast heeft hij een periode gehad waarin hij regelmatig braakte. De ontlasting is wisselend van consistentie. De kleur is normaal.

U onderzoekt de hond en vind het volgende:

Algemene indruk: De hond is sloom bij binnenkomst. Hij is wat klein voor zijn leeftijd en heeft een beetje een wollige vacht. Ook vindt u hem aan de magere kant. Zodra hij op de behandeltafel staat plast hij. Verder vindt u bij de algemene indruk geen afwijkende dingen.

Algemeen onderzoek:
A: 40 /minuut, regelmatig, costo-abdominaal en de hond hijgt veel
P: 130/ minuut, krachtig, regelmatig, geen uitval, equaal, symmetrisch
T: 39.2 °C, verder geen bijzonderheden
Huid en beharing: de vacht is dof en dun, verder geen bijzonderheden
Slijmvliezen: rood, verder geen bijzonderheden
Lymfeknopen: geen bijzonderheden

VRAAG: Welke orgaansystemen gaat u verder onderzoeken?

Bekijk de preparaten om te zien of bovengenoemde orgaansystemen afwijkingen vertonen.

Aanvullende informatie orgaansystemen
Digestie:
Er loopt speeksel uit de bek en er is sprake van een fetor ex oro. De speekselklieren zien er normaal uit. Bij buikinspectie valt op dat de buik ingevallen is. Bij palpatie is er een defense musculaire en bij het palperen van het hypogastrium vertoont de hond een pijnreactie. Bij auscultatie hoort u beiderzijds veel, hoogtonige borborygmi. Verder zijn er geen bijzonderheden, anders dan te zien in de preparaten.

Nieren en urinewegen:
Pijnlijke buikpalpatie (zie digestie). Verder geen bijzonderheden bij het lichamelijk onderzoek van de nieren en urinewegen.

Zenuwstelsel:
Geen aanvullende afwijkingen, anders dan te zien in de preparaten.

Respiratie:
Geen aanvullende afwijkingen, anders dan te zien in de preparaten.

Circulatie:
Geen aanvullende afwijkingen, anders dan te zien in de preparaten.

VRAAG: Wat zijn de belangrijkste problemen?

Kies de twee belangrijkste problemen en stel daarvan een DDx op.

VRAAG: Welk aanvullend onderzoek zou u willen doen?

Urineonderzoek:

Macroscopisch:

De urine is rood-bruin van kleur en troebel. Bij schudden ontstaat er schuim, wat enige tijd blijft staan.

	Urinemonster Balou	Referentiewaarde
Glucose	Negatief	Negatief
Eiwit	++ 1 g/L	Maximaal +
Bilirubine	Negatief	Negatief
Urobiligeen	Normaal	Normaal
pH	8.0	6.0 – 7.0
s.g.	1.045	1.015 – 1.045
Bloed	+++ 10 mg/L	negatief
Leucocyten	500 leu/microliter	Negatief

Sediment: Bevat veel leukocyten en een enkele erytrocyt. Zie ook de foto gemaakt op 05-08-2013.

VRAAG: Wat valt op aan het urineonderzoek?

VRAAG: Wat zie je op de foto, gemaakt op 05-08-2013 (specifiek)?

Bloedonderzoek:

	Bloeduitslag	Referentiewaarde
Hematocriet	0.30 L/L	0.27 – 0.61 L/L
Erythrocyten	7.4 x 10^{12}/L	6.2 – 8.9 x 10^{12}/L
Trombocyten	422 x 10^{9}/L	144 – 603 x 10^{9}/L
Leucocyten	20.1 x 10^{9}/L	4.5 – 14.6 x 10^{9}/L
Lymfocyten	4.5 x 10^{9}/L	0.8 – 4.7 x 10^{9}/L
Monocyten	0.7 x 10^{9}/L	0.0 – 0.9 x 10^{9}/L
Neutrofiele granulocyt	16 x 10^{9}/L	2.9 – 11.0 x 10^{9}/L
Eosinofiele granulocyt	0.5 x 10^{9}/L	0.0 – 1.6 x 10^{9}/L
Basofiele granulocyt	0.0 x 10^{9}/L	0.0 – 0.1 x 10^{9}/L
Totaal Eiwit	62 g/L	55 – 72 g/L
Albumine	30 g/L	26 – 37 g/L
Natrium	147 mmol/L	141 – 150 mmol/L
Kalium	3.8 mmol/L	3.6 – 5.6 mmol/L
Chloride	116 mmol/L	111 – 120 mmol/L
Glucose	3.9 mmol/L	4.2 – 5.8 mmol/L
Ureum	3.0 mmol/L	3.0 – 12.5 mmol/L
Ammoniak	200 µmol/L	24 – 45 µmol/L
Creatinine	76 µmol/L	50 – 129 µmol/L
Bilirubine totaal	8 µmol/L	< 3.4 µmol/L
Galzuren	22 µmol/L	< 10 µmol/L
AF	51 U/L	<73 U/L
ALAT	22 U/L	<54 U/L
AST	14 U/L	<34 U/L
GGT	6 U/L	<11 U/L
CK	186 U/L	<249 U/L

VRAAG: Wat valt op aan het bloedonderzoek?

VRAAG: Hoe verandert deze informatie uw DDx (welke aandoeningen worden minder waarschijnlijk en welke aandoeningen passen nog steeds goed)?

VRAAG: Wat is uw definitieve diagnose? Bekijk hiervoor zo nodig nogmaals de preparaten

Appendix 4 - Questionnaire

Je hebt net een opdracht gemaakt waarin je klinisch redeneren hebt toegepast. Voor mijn onderzoek is het belangrijk wat je van deze opdracht vond. Daarom vraag ik je bij onderstaande stellingen aan te geven in hoeverre je het ermee eens bent.

		Helemaal niet mee eens		Neutraal		Helemaal mee eens
1.	Deze opdracht is een nuttige zelfstudie opdracht	1	2	3	4	5
2.	Deze opdracht is vergelijkbaar met andere zelfstudieopdrachten	1	2	3	4	5
3.	Deze opdracht is relevant voor de beroepsuitoefening van dierenarts	1	2	3	4	5
4.	Deze opdracht is een goede oefening voor het toepassen van klinisch redeneren	1	2	3	4	5
5.	Deze opdracht is duidelijk anders dan andere zelfstudie opdrachten	1	2	3	4	5
6.	Ik had deze opdracht beter alleen kunnen maken in plaats van samen met iemand anders	1	2	3	4	5

		Te moeilijk	Moeilijk	Precies goed	Gemakkelijk	Te gemakkelijk
7.	Het niveau van deze opdracht was	1	2	3	4	5

<u>Opmerkingen bij de stellingen of overige opmerkingen:</u>

Appendix 5 – Table for determining characteristics (Ramaekers, 2011)

Dimensie van taak/casus	Niveau / moeilijkheidsgraad Eenvoudig (1)	Gemiddeld (2)	Moeilijk (3)	index
Probleemafbakening	Probleem is gegeven en helder afgebakend	Alle ingrediënten van probleem in casus te vinden	Probleem in casus is diffuus, omvat meerdere deelproblemen	
Oplossingsrichtingen	Casus bevat veel cues* voor analyse en oplossing	Casus bevat beperkt aantal cues	Casusbeschrijving bevat weinig tot geen cues	
Beschikbare informatie	Bevat alle relevante informatie en weinig ruis**	Bevat deel van alle benodigde informatie en enige ruis	Bevat veel informatie, waarvan groter deel niet relevant	
Realistisch	Probleemsituatie is vereenvoudigd, en context onafhankelijk	Situatieschets is realistisch, maar gestileerd	Situatieschets is levensecht, bevat authentieke materialen	
Representativiteit	Veel voorkomend probleem, behorend tot kerncurriculum	Regelmatig voorkomend probleem	Weinig voorkomend probleem, specifiek voor studiepad	
Aansluiting bij voorkennis (kern)	Direct aansluitend op voorkennis en beleving studenten	Bevat enkele nieuwe ingrediënten	Geringe aansluiting bij voorkennis en beleving studenten	
Integratie, grenzen eigen deskundigheid	Monodisciplinair, valt binnen routines van alg. bevoegdheid	Vergt combinatie van vakken / disciplines, binnen	Multidisciplinair, vergt doorverwijzing naar specialist	
Tijdsdruk	Kan ruim binnen beschikbare tijd worden opgelost	Kan in beschikbare tijd net worden opgelost	Kan niet volledig worden opgelost binnen beschikbare tijd	
Index totaal				

*cues = aanwijzingen, sturende vragen
**ruis = overbodige of verstorende informatie

Appendix 6 – Coding scheme for film fragments

1. Collecting information from text
2. Collecting information from specimens
3. Organizing information
4. Generating diagnostic hypotheses
5. Collecting additional information from text
6. Collecting additional information from specimens
7. Making judgments
8. State definitive diagnosis
9. Answer question
10. Answer reflective question
11. Other

Appendix 7 – Characterization of questions

Assignment	Question		Characterization - CR - Knowledge - Process - Reflective
1	1	Hoe maak je onderscheid tussen braken en regurgiteren?	Knowledge
	2	Welke specifieke informatie over het regurgiteren zou je willen weten om onderscheid te kunnen maken tussen de verschillende oorzaken van regurgiteren?	Process
	3	Welke orgaansystemen gaat u aan de hand van bovenstaande gegevens onderzoeken en waarom?	CR – organizing
	4	Stel uw probleemlijst op en een DDx op basis van het meest kenmerkende probleem.	CR – hypothesis
	5	Wat is uw verdere plan van aanpak?	Process
	6	Wat valt u op aan de röntgenfoto's?	CR – extra info
	7	Wat valt u op aan het bloedonderzoek?	CR – extra info
	8	Welke aandoening uit uw DDx acht u waarschijnlijk?	CR – judging
	9	hoe ontstaat een megaoesophagus?	Knowledge
	10	bedenk drie congenitale aandoeningen die ten grondslag kunnen liggen aan een megaoesophagus.	Knowledge
	11	Bekijk de röntgenfoto's nogmaals en bedenk hoe je onderscheid maakt tussen deze oorzaken?	CR – judging
	12	Bekijk de preparaten om te zien of ze overeenkomen met uw bevindingen op de röntgenfoto. Wat is hier de oorzaak van de megaoesophagus?	CR – judging CR – diagnosis
	13	Hoe kan het dat de fokker het regurgiteren gemist heeft?	Reflective
	14	Waarom blijft de pup achter in groei en waarom is ze aan de magere kant?	Reflective
	15	Waarom is de larynx drukgevoelig?	Reflective
2	1	Wat gaat u nu doen?	Process
	2	Welke aandoeningen vindt u passend bij bovenstaande klachten? Stel een zo volledig mogelijke DDx op.	CR – hypothesis
	3	Wat is uw advies aan de eigenaar?	Process
	4	Hoe is de volgorde van uw DDx nu (welke	CR – judging

		aandoeningen worden minder waarschijnlijk en welke aandoeningen passen nog steeds goed)?	
	5	Hoe kunt u onderscheid maken tussen deze aandoeningen?	Process
	6	Wat is uw definitieve diagnose?	CR – diagnosis
3	1	Welke orgaansystemen gaat u verder onderzoeken?	Process
	2	Wat zijn de belangrijkste problemen?	CR – organizing
	3	Kies de twee belangrijkste problemen en stel daarvan een DDx op.	CR – hypothesis
	4	Welk aanvullend onderzoek zou u willen doen?	Process
	5	Wat valt op aan het urineonderzoek?	CR – extra info
	6	Wat zie je op de foto, gemaakt op 05-08-2013 (specifiek)?	CR – extra info
	7	Wat valt op aan het bloedonderzoek?	CR – extra info
	8	Hoe verandert deze informatie uw DDx (welke aandoeningen worden minder waarschijnlijk en welke aandoeningen passen nog steeds goed)?	CR – judging
	9	Wat is uw definitieve diagnose? Bekijk hiervoor zo nodig nogmaals de preparaten	CR - diagnosis

Appendix 8 – Format

Format

U kunt dit bestand gebruiken voor het maken van uw eigen zelfstudie opdrachten voor klinisch redeneren, welke ook preparaten bevatten. Je kunt zo'n opdracht opbouwen met behulp van negen onderdelen. Deze onderdelen staan eerst beschreven in een tabel. Ook het type vragen dat u kunt stellen, en het effect dat deze hebben op de studenten tijdens het maken van een opdracht staan benoemd. Zo kunt u bewust een bepaald type vragen in de opdracht zetten.
Vervolgens is een invul-format toegevoegd, dat u kunt gebruiken om uw eigen opdracht te maken. Als laatste zijn nog drie voorbeeldopgaven bijgevoegd. In deze opdrachten kunt u uitwerkingen van de verschillende onderdelen zien.

	Inhoud	Omschrijving	Stap van KR	Opmerkingen
1	Algemene opmerkingen	Soms is het niet mogelijk om de opdracht perfect te maken, benoem dit.		
2	Start van de opdracht	Geef in dossiervorm de geschiedenis aan	Informatie verzamelen uit tekst	
3	Informatie	Omschrijf eerste lichamelijk onderzoek	Informatie verzamelen uit tekst	
4	Verwijzing naar de preparaten	Dit kan zowel als opdracht (bv. "bekijk de preparaten om te zien of…") als in een vraag (bv. "wat valt u op aan preparaat X")	Informatie verzamelen uit preparaten	Afhankelijk van de hoeveelheid preparaten verzamelen de studenten meer of minder informatie. Ook de vragen spelen hier een sturende vraag in. Een vraag als 'welke orgaansystemen wil je onderzoeken' vervolgen met 'bekijk de genoemde orgaansystemen in de preparaten om te zien of ze afwijkingen vertonen' zorgt voor meer verzameling van informatie uit de preparaten (voorbeeld: opdracht 1 en 3)
5	Hypotheses		Informatie organiseren Hypotheses stellen	<u>Informatie organiseren</u>: Afhankelijk van de gestelde vragen doen studenten dit meer of minder. Om studenten te stimuleren hun informatie te organiseren kun je vragen (opdracht 1 en 3): Welke orgaansystemen wil je onderzoeken en waarom? Welk(e) proble(e)m(en) zijn het belangrijkst?

				Hypotheses stellen: Afhankelijk van de vraag stellen studenten vaker of minder vaak hypotheses. Het gebeurt vaker als je vraagt 'welke problemen passen bij bovenstaande symptomen' (opdracht 2), terwijl het minder gebeurt als je om een DDx vraagt van de één of twee belangrijkste problemen (opdracht 1 en 3).
6	Aanvullende informatie	Geef aanvullende informatie die nodig is om de hypotheses mee te testen	Extra informatie verzamelen uit tekst/preparaten Oordelen	Extra informatie verzamelen uit tekst: De inhoud van de informatie bepaalt hoe vaak studenten informatie verzamelen. Als de informatie alleen normaalwaarden bevat (bv in een bloedtest; opdracht 1) kijken ze er één keer naar. Als er echter abnormale waarden/symptomen beschreven worden (opdracht 2 en 3) verzamelen ze informatie, discussiëren hierover en gaan daarna verder met informatie verzamelen Extra informatie verzamelen uit preparaten: Dit is afhankelijk van hoe er naar de preparaten verwezen wordt. Studenten bekijken de preparaten vaker als ze gevraagd worden een diagnose te stellen aan de hand van de preparaten (opdracht 2), dan een verwijzing naar de preparaten zoals 'bekijk de preparaten zo nodig nogmaals' (opdracht 1 en 3). Oordelen: Studenten oordelen op basis van gestelde vragen. Deze vragen kunnen breed gesteld worden, wat leidt tot vaker oordelen. Een voorbeeld is: 'wat is de volgorde van uw DDx nu' (opdracht 2), wat leidt tot een beoordeling van alle hypotheses die in de DDx staan. Terwijl de smalle vraag 'welke aandoening in de DDx acht u het meest waarschijnlijk' (opdracht 1) alleen leidt tot benoemen waarom een bepaald probleem het meest waarschijnlijk is, ondanks dat de

				vraag doet vermoeden dat studenten ook in dit geval alle aandoeningen zouden moeten beoordelen.
7	Diagnose	Vraag een diagnose te stellen	Diagnose stellen	Studenten stellen vaker een diagnose als de vraag hier direct om vraagt met gebruik van het woord 'diagnose' (opdracht 2 en 3). Ze stellen minder vaak een diagnose als de vraag tweezijdig is en vraag naar een 'oorzaak', zoals: 'Bekijk de preparaten om te zien of ze overeenkomen met uw bevindingen op de röntgenfoto. Wat is hier de oorzaak van de megaoesophagus?' (opdracht 1).
8	Behandelplan	Vraag naar een behandelplan		
9	Reflectievragen	Deze vragen zetten studenten aan om nog eens na te denken over elementen van de casus die ze tijdens het oplossen ervan mogelijk niet besproken hebben		

Type vraag	Omschrijving	Voorbeeld
Klinisch redeneren	Een vraag die specifiek gericht is op een stap van klinisch redeneren	Stel een DDx op Wat is uw diagnose?
Kennisvraag	Een vraag die zorgt voor het ophalen van voorkennis	Hoe maak je onderscheid tussen braken en regurgiteren?
Proces	Een vraag die belangrijk is om verder te komen in het onderzoek	Wat is uw verdere plan van aanpak?
Reflectieve vraag	Een vraag die studenten aan zet om nog eens na te denken over elementen van de casus die ze tijdens het oplossen ervan mogelijk niet besproken hebben	Hoe kan het dat de fokker het regurgiteren gemist heeft?

In te vullen opdrachtformat

Haal de blauwe kop hierboven weg, en de blauwe tussenkopjes. Vul alle tekst in het rood aan. Voel je vrij om meer/minder vragen te stellen en zelf te kiezen in de hoeveelheid proces- en kennisvragen. Voor mogelijke effecten van deze vragen op het klinisch redeneren, zie de uitleg bij het schema over de vraagtypen

1. Algemene opmerkingen

Algemene opmerkingen voordat je met de casus begint:

- Vanwege praktische redenen komt het ras van de preparaten niet altijd overeen met de casus
- Bij alles wat je niet aan de preparaten kunt zien mag je er vanuit gaan dat het niet afwijkend is
- De kleur van de preparaten is niet betrouwbaar en kun je dus niet meenemen in je beoordeling
- ….

2. Start van de opdracht

Casus 1

Eigenaar:	NAAM
	ADRES
	POSTCODE + PLAATS
Roepnaam:	NAAM
Ras:	RAS
Geslacht:	GESLACHT, (niet) gecastreerd
Geb. datum:	DATUM
Gewicht:	GEWICHT (DATUM)

DATUM	INFORMATIE
DATUM	INFORMATIE
DATUM	INFORMATIE
HUIDIGE DATUM	*PROBLEEM*

VRAAG: Kennis/proces
VRAAG:

3. Informatie

Als hierboven een procesvraag gesteld is, kan hier het antwoord gegeven worden – zorg wel dat dit dan op een nieuwe pagina staat
Algemene indruk: …
Algemeen onderzoek: …

VRAAG: KR/proces
VRAAG: …

4. Verwijzing naar de preparaten

Bekijk de preparaten om te zien of ….

Als hierboven een procesvraag gesteld is, kan hier het antwoord gegeven worden – zorg wel dat dit dan op een nieuwe pagina staat (bv: vraag = welke orgaansystemen gaat u onderzoeken, dan moeten de preparaten de mogelijke orgaansystemen dekken. Zijn er orgaansystemen waarbij geen goed preparaat is, geef de informatie van deze orgaansystemen er dan bij)

VRAAG: bv naar belangrijkste problemen

5. Hypotheses

VRAAG: naar DDx

VRAAG: Proces

6. Aanvullende informatie

VRAAG: Wat valt u op aan "de informatie" (bv bloed- of urineonderzoek, een preparaat, een foto)?

VRAAG: Wat valt u op aan "de (andere) informatie"?

VRAAG: naar verandering/meest waarschijnlijke aandoening(en) uit DDx

VRAAG: Kennis/proces

7. Diagnose stellen

VRAAG: diagnose

Kan rechtstreeks naar vragen, maar ook door eerst te vragen (in aparte vraag) of aanvullende informatie in tekst/foto overeenkomt met preparaten, of door te zeggen dat de diagnose gesteld moet worden met behulp van de preparaten. Gebruik in ieder geval het woord 'diagnose' in de vraag, en niet bijvoorbeeld 'oorzaak', om er zeker van te zijn dat studenten een diagnose stellen.

8. Behandelplan

VRAAG: behandelplan

9. Reflectieve vragen

VRAAG: …

VRAAG: …

Voorbeeld 1

1. Algemene opmerkingen

Algemene opmerkingen voordat je met de casus begint:

- Vanwege praktische redenen komt het ras van de preparaten niet altijd overeen met de casus
- Bij alles wat je niet aan de preparaten kunt zien mag je er vanuit gaan dat het niet afwijkend is
- De kleur van de preparaten is niet betrouwbaar en kun je dus niet meenemen in je beoordeling

2. Start van de opdracht

Casus 1

Eigenaar:	Mevr. Van den Broek Burg. Van der Wielstraat 27 2245 AL Dieren
Roepnaam:	Juul
Ras:	Duitse herder
Geslacht:	Vrouwelijk, niet gecastreerd
Geb. datum:	22-02-12
Gewicht:	8 kg (07-05-12)

26-04-12 Komt voor enting, eerste pup voor eigenaar. Gekocht bij broodfokker (5 dagen geleden). Heeft nu drie dagen op rij braaksel gevonden, maar heeft de hond niet zien braken. Verder geen bijzonderheden, levendige hond. In paspoort staat dat ze wat achtergebleven is ten opzichte van de rest van het nest. In het paspoort staat dat hij ontwormd en gevaccineerd is volgens het schema van uw praktijk.
AI: pup is wat aan de kleine kant en voedingstoestand is te mager, verder g.b.
AO: g.b.
Advies: in de gaten houden hoe en wanneer de hond braakt. Bij aanhoudende klachten terugkomen en verder onderzoek doen.
1x lepto + parvo
1x kennelhoest

07-05-12 Het gaat niet zo goed met Juul, ze is een beetje sloom en hoest regelmatig. Ook vindt mevrouw nog dagelijks braaksel, wat bij uitvragen eerder lijkt op regurgiteren.

VRAAG: Hoe maak je onderscheid tussen braken en regurgiteren?

VRAAG: Welke specifieke informatie over het regurgiteren zou je willen weten om onderscheid te kunnen maken tussen de verschillende oorzaken van regurgiteren?

3. Informatie

AI: pup is wat sloom, groeit matig en voedingstoestand is niet verbeterd. Verder g.b.

AO: A 52/min, abdominale ademhaling
P 130/min, KRESS
T 39,0° C
Vacht en huid geen bijzonderheden
SV geen bijzonderheden
Lnn: mandibulaire lymfeknopen zijn beiderzijds vergroot, verder g.b.

VRAAG: Welke orgaansystemen gaat u aan de hand van bovenstaande gegevens onderzoeken en waarom?

4. Verwijzing naar de preparaten

Bekijk de preparaten om te zien of bij deze orgaansystemen afwijkingen aanwezig zijn. Aanvullende informatie vindt u hieronder.

Respiratie:
Bij druk op de larynx hoest Juul, verder g.b.

Circulatie:
Verder g.b.

Digestie:
Geen aanvullende afwijkingen.

5. Hypotheses

VRAAG: Stel uw probleemlijst op en een DDx op basis van het meest kenmerkende probleem.

VRAAG: Wat is uw verdere plan van aanpak?

6. Aanvullende informatie

VRAAG: Wat valt u op aan de röntgenfoto's?

VRAAG: Wat valt u op aan het bloedonderzoek?

	Bloeduitslag	Referentiewaarde
Hematocriet	0.32 L/L	0.27 – 0.61 L/L
Leucocyten	13.9 x 10^9/L	4.5 – 14.6 x 10^9/L
Lymfocyten	4.4 x 10^9/L	0.8 – 4.7 x 10^9/L
Monocyten	0.0 x 10^9/L	0.0 – 0.9 x 10^9/L
Neutrofiele granulocyt	8.0 x 10^9/L	2.9 – 11.0 x 10^9/L
Eosinofiele granulocyt	0.1 x 10^9/L	0.0 – 1.6 x 10^9/L
Basofiele granulocyt	0.0 x 10^9/L	0.0 – 0.1 x 10^9/L
Totaal Eiwit	57 g/L	55 – 72 g/L
Albumine	27 g/L	26 – 37 g/L
Natrium	146 mmol/L	141 – 150 mmol/L
Kalium	4.1 mmol/L	3.6 – 5.6 mmol/L
Chloride	111 mmol/L	111 – 120 mmol/L
Glucose	4.2 mmol/L	4.2 – 5.8 mmol/L
Ureum	7.2 mmol/L	3.0 – 12.5 mmol/L
Creatinine	112 µmol/L	50 – 129 µmol/L

VRAAG: Welke aandoening uit uw DDx acht u waarschijnlijk?

VRAAG: hoe ontstaat een megaoesophagus?

VRAAG: bedenk drie congenitale aandoeningen die ten grondslag kunnen liggen aan een megaoesophagus.
VRAAG: Bekijk de röntgenfoto's nogmaals en bedenk hoe je onderscheid maakt tussen deze oorzaken?

7. Diagnose stellen

VRAAG: Bekijk de preparaten om te zien of ze overeenkomen met uw bevindingen op de röntgenfoto. Wat is hier de oorzaak van de megaoesophagus?

9. Reflectieve vragen

Reflectieve vragen:

Hoe kan het dat de fokker het regurgiteren gemist heeft?

Waarom blijft de pup achter in groei en waarom is ze aan de magere kant?

Waarom is de larynx drukgevoelig?

Voorbeeld 2

1. Algemene opmerkingen

Algemene opmerkingen voordat je met de casus begint:

- Vanwege praktische redenen komt het ras van de preparaten niet altijd overeen met de casus
- Bij alles wat je niet aan de preparaten kunt zien mag je er vanuit gaan dat het niet afwijkend is
- De kleur van de preparaten is niet betrouwbaar en kun je dus niet meenemen in je beoordeling

2. Start van de opdracht

Casus 2

Eigenaar:	Dhr. Fientjes Lokven 14 6485 KS Dieren
Roepnaam:	Bobby
Ras:	Briard
Geslacht:	Mannelijk, gecastreerd
Geb. datum:	05-10-06
Gewicht:	33 kg

20-11-09	Eigenaar is een aantal maanden geleden verhuisd en nu nieuwe klant bij ons. Komt voor vaccinatie. Hond heeft tot nu toe weinig problemen gehad, alleen af en toe problemen met zijn huid. AI + AO: g.b. 1x lepto 1x kennelhoest 1x ontworming groot
03-03-10	Braakt sinds twee dagen en heeft ook diarree. Eet slecht en is ook wat minder actief dan normaal. Braakt enige tijd na het eten. Diarree is niet waterdun, geen bloed erbij en niet afwijkend van kleur. Onbekend of hij rare dingen heeft gegeten. AI: wat sloom, verder g.b. AO: AH=24/min, P=116/min, T= 39.0, slijmvliezen plakkerig, verder g.b. DIG: defense musculaire bij buikpalpatie, bij auscultatie beiderzijds veel hoogtonige borborygmi, verder g.b. Advies: antibraakmiddel en middel tegen diarree, belangrijk dat hij komende 24 uur niet braakt, dan gelijk terugkomen. Als het na enkele dagen niet verbeterd, dan terugkomen. 3,3 ml injectie maropitant (Cerenia)

	4 tabletten maropitant (Cerenia) 1x daags ingeven in de bek, morgen beginnen 23 tabletten sulfasalazine (Salazosulfa) 3x daags 1,5 tablet gedurende 5 dagen, direct beginnen
22-11-10	Geen bijzonderheden, hond ziet er goed uit. 1x lepto + distemper hepatitis parvo 1x kennelhoest
18-11-11	Geen bijzonderheden, probeer wel op gewicht te letten want hond is aan de zware kant (weegt nu 37 kg). 1x lepto 1x kennelhoest
21-11-12	Hond is weer keurig op gewicht, eigenaar wil in het voorjaar hond meenemen op vakantie naar Duitsland en vraagt zich af of daar nog extra vaccinaties voor nodig zijn. 1x lepto 1x rabies 1x kennelhoest Advies: bekijk op de website van het LICG de eisen waaraan je moet voldoen (bijvoorbeeld muilkorf mee), want eisen veranderen regelmatig.
24-06-13	Waren gisteren grote wandeling aan het maken. Daarbij kwamen ze een jonge Rottweiler tegen, waarmee hij ging spelen. Ineens piepte Bobby heel erg en liep daarna kreupel. Gaat nu (een dag later) nog steeds niet goed. AI: belast linker achterpoot bijna niet. AO: AH niet telbaar, hijgt alleen maar. P = 80/min, T=38.8°C, verder g.b.

VRAAG: Wat gaat u nu doen?

3. Informatie + 4. Verwijzing naar de preparaten

Locomotie: Kreupelheid is eigenlijk heel de dag door hetzelfde geweest, geen verbetering of verslechtering. In stand belast hij de poot matig, hij staat eigenlijk alleen op zijn teen. Bij het monsteren valt op dat hij duidelijk belastingkreupel is linksachter (graad II). Bij inspectie vallen u geen bijzonderheden op, beoordeling is lastig door het vele haar. Bij palpatie vindt u zwelling van en rond het kniegewricht. Bij passieve bewegingen van de knie verzet de hond zich en spant zijn spieren aan. Schuifladefenomeen en tibia-compressietest zijn niet betrouwbaar omdat de hond zich verzet. Ook bij palpatie van de distale femur reageert de hond pijnlijk.

Voor verdere informatie zie de preparaten

5. Hypotheses

VRAAG: Welke aandoeningen vindt u passend bij bovenstaande klachten? Stel een zo volledig mogelijke DDx op.

VRAAG: Wat is uw advies aan de eigenaar?

6. Aanvullende informatie

Vanwege het acute ontstaan van de klachten en een duidelijk moment waarop de klachten zijn ontstaan kun je de hond NSAIDS meegeven en het een aantal dagen aan laten kijken. Er is een klein risico aanwezig dat er een fissuur/fractuur is die kan verergeren zonder adequate therapie. Belangrijk is om dit goed met de eigenaar te communiceren en uit te leggen welke diagnostische mogelijkheden er verder zijn en indien de eigenaar dat wil, dan kan dat natuurlijk ook direct. Er zit alleen een kostenplaatje aan vast. In dit geval kiest de eigenaar ervoor om met rust en NSAIDS het een week aan te kijken.

01-07-13 Eigenaar heeft de hond goed rust gegeven en medicijnen gingen er goed in. Het leek de eerste dagen beter te gaan, maar de laatste dagen gaat het toch weer minder.
AI: belast linksachter nu wel in stand
AO: AH niet telbaar, hijgt veel, P=60/min T=39.0 verder g.b.
LOC: kreupelheid is iets minder geworden, maar nog steeds duidelijk aanwezig, zwelling is aan de distale zijde van de knie afgenomen, maar boven de knie nog steeds duidelijk voelbaar. Schuifladefenomeen en tibia-compressietest zijn nu negatief, maar de hond verzet zich hevig bij het uitvoeren van deze testen. Palpatie van de distale femur levert een pijnreactie op. Passieve bewegingen van de heup leveren geen afwijkingen op. Verder geen bijzonderheden.

VRAAG: Hoe is de volgorde van uw DDx nu (welke aandoeningen worden minder waarschijnlijk en welke aandoeningen passen nog steeds goed)?

VRAAG: Hoe kunt u onderscheid maken tussen deze aandoeningen?

Helaas is uw röntgenapparaat kapot en is het onmogelijk om op dit moment een foto te maken. Toch is het mogelijk om aan de hand van de preparaten uw diagnose te stellen.

7. Diagnose

VRAAG: Wat is uw definitieve diagnose?

Voorbeeld 3

1. Algemene opmerkingen

Algemene opmerkingen voordat je met de casus begint:

- Vanwege praktische redenen komt het ras van de preparaten niet altijd overeen met de casus
- Bij alles wat je niet aan de preparaten kunt zien mag je er vanuit gaan dat het niet afwijkend is
- De kleur van de preparaten is niet betrouwbaar en kun je dus niet meenemen in je beoordeling

2. Start van de opdracht

Casus 3

Eigenaar:	Mevr. Janssen Weegstraat 3 3675 JV Cadzand
Roepnaam:	Balou
Ras:	Yorkshire terrier
Geslacht:	Mannelijk, gecastreerd
Geb. datum:	05-01-13
Gewicht:	3.5 kg

08-02-13	Rustige pup, geen bijzonderheden. 1x lepto + parvo 1x kennelhoest 1x ontworming (volgende week geven)
01-03-13	Geen bijzonderheden 1x lepto + distemper hepatitis parvo 1x ontworming
05-08-13	Tijdens de afgelopen dagen heeft mevrouw een paar keer een plasje water in de gang gevonden en tijdens het uitlaten lijkt het of hij vaker moet plassen. Vanochtend zat er zelfs een beetje bloed bij de urine. Mevrouw vraagt zich af of het vaker plassen door zijn hormonen komt, want hij tilt zijn poot eigenlijk nog niet echt op. Volgens zijn baasje is hij ook wat slomer en als ze hem optilt piept hij soms. Ook moet mevrouw vaak zijn bek afvegen omdat er anders kwijl uitloopt. Hij eet niet zo goed, maar dat heeft hij eigenlijk nooit echt gedaan. Toch lijkt het of hij wel honger heeft, want hij staat vaak met zijn hoofd tegen de koelkast aan. Daarnaast heeft hij een periode gehad waarin hij regelmatig braakte. De ontlasting is wisselend van consistentie. De kleur is normaal.

3. Informatie

U onderzoekt de hond en vind het volgende:

Algemene indruk: De hond is sloom bij binnenkomst. Hij is wat klein voor zijn leeftijd en heeft een beetje een wollige vacht. Ook vindt u hem aan de magere kant. Zodra hij op de behandeltafel staat plast hij. Verder vindt u bij de algemene indruk geen afwijkende dingen.

Algemeen onderzoek:

A: 40 /minuut, regelmatig, costo-abdominaal en de hond hijgt veel

P: 130/ minuut, krachtig, regelmatig, geen uitval, equaal, symmetrisch

T: 39.2 °C, verder geen bijzonderheden

Huid en beharing: de vacht is dof en dun, verder geen bijzonderheden

Slijmvliezen: rood, verder geen bijzonderheden

Lymfeknopen: geen bijzonderheden

VRAAG: Welke orgaansystemen gaat u verder onderzoeken?

4. Verwijzing naar de preparaten

Bekijk de preparaten om te zien of bovengenoemde orgaansystemen afwijkingen vertonen.

3. Informatie

Aanvullende informatie orgaansystemen

Digestie:
Er loopt speeksel uit de bek en er is sprake van een fetor ex oro. De speekselklieren zien er normaal uit. Bij buikinspectie valt op dat de buik ingevallen is. Bij palpatie is er een defense musculaire en bij het palperen van het hypogastrium vertoont de hond een pijnreactie. Bij auscultatie hoort u beiderzijds veel, hoogtonige borborygmi. Verder zijn er geen bijzonderheden, anders dan te zien in de preparaten.

Nieren en urinewegen:
Pijnlijke buikpalpatie (zie digestie). Verder geen bijzonderheden bij het lichamelijk onderzoek van de nieren en urinewegen.

Zenuwstelsel:
Geen aanvullende afwijkingen, anders dan te zien in de preparaten.

Respiratie:
Geen aanvullende afwijkingen, anders dan te zien in de preparaten.

Circulatie:
Geen aanvullende afwijkingen, anders dan te zien in de preparaten.

VRAAG: Wat zijn de belangrijkste problemen?

5. Hypotheses

Kies de twee belangrijkste problemen en stel daarvan een DDx op.

VRAAG: Welk aanvullend onderzoek zou u willen doen?

6. Aanvullende informatie

Urineonderzoek:

Macroscopisch:

De urine is rood-bruin van kleur en troebel. Bij schudden ontstaat er schuim, wat enige tijd blijft staan.

	Urinemonster Balou	Referentiewaarde
Glucose	Negatief	Negatief
Eiwit	++ 1 g/L	Maximaal +
Bilirubine	Negatief	Negatief
Urobiligeen	Normaal	Normaal
pH	8.0	6.0 – 7.0
s.g.	1.045	1.015 – 1.045
Bloed	+++ 10 mg/L	negatief
Leucocyten	500 leu/microliter	Negatief

Sediment: Bevat veel leukocyten en een enkele erytrocyt. Zie ook de foto gemaakt op 05-08-2013.

VRAAG: Wat valt op aan het urineonderzoek?

VRAAG: Wat zie je op de foto, gemaakt op 05-08-2013 (specifiek)?

Bloedonderzoek:

	Bloeduitslag	Referentiewaarde
Hematocriet	0.30 L/L	0.27 – 0.61 L/L
Erythrocyten	7.4 x 10^{12}/L	6.2 – 8.9 x 10^{12}/L
Trombocyten	422 x 10^{9}/L	144 – 603 x 10^{9}/L
Leucocyten	20.1 x 10^{9}/L	4.5 – 14.6 x 10^{9}/L
Lymfocyten	4.5 x 10^{9}/L	0.8 – 4.7 x 10^{9}/L
Monocyten	0.7 x 10^{9}/L	0.0 – 0.9 x 10^{9}/L
Neutrofiele granulocyt	16 x 10^{9}/L	2.9 – 11.0 x 10^{9}/L
Eosinofiele granulocyt	0.5 x 10^{9}/L	0.0 – 1.6 x 10^{9}/L
Basofiele granulocyt	0.0 x 10^{9}/L	0.0 – 0.1 x 10^{9}/L
Totaal Eiwit	62 g/L	55 – 72 g/L
Albumine	30 g/L	26 – 37 g/L
Natrium	147 mmol/L	141 – 150 mmol/L
Kalium	3.8 mmol/L	3.6 – 5.6 mmol/L
Chloride	116 mmol/L	111 – 120 mmol/L
Glucose	3.9 mmol/L	4.2 – 5.8 mmol/L
Ureum	3.0 mmol/L	3.0 – 12.5 mmol/L
Ammoniak	200 µmol/L	24 – 45 µmol/L
Creatinine	76 µmol/L	50 – 129 µmol/L
Bilirubine totaal	8 µmol/L	< 3.4 µmol/L
Galzuren	22 µmol/L	< 10 µmol/L
AF	51 U/L	<73 U/L
ALAT	22 U/L	<54 U/L
AST	14 U/L	<34 U/L
GGT	6 U/L	<11 U/L
CK	186 U/L	<249 U/L

VRAAG: Wat valt op aan het bloedonderzoek?

VRAAG: Hoe verandert deze informatie uw DDx (welke aandoeningen worden minder waarschijnlijk en welke aandoeningen passen nog steeds goed)?

7. Diagnose

VRAAG: Wat is uw definitieve diagnose? Bekijk hiervoor zo nodig nogmaals de preparaten