Betsy Greiner  
Executive Director  
American College of Theriogenologists  

September 9, 2023  

Dear Ms. Greiner,  

I would like to submit the report from the Job Task Analysis (JTA) committee for consideration by the executive board of the American College of Theriogenologists (ACT).  

The JTA committee was appointed by the executive board in 2022 to conduct a study that would describe the knowledge requirements of competent ACT Diplomates and be used to determine the appropriate construction of the ACT certifying examination. Results of this study would be used to update the JTA previously conducted by the ACT in 2013.  

Members appointed to the JTA committee reflected the ACT diversity and included Diplomates with a variety of species interests working in academia, private practice, and industry. These included Drs. Gary Althouse, Leonardo Brito, Julie Cecere, Cheryl Lopate, Kristina Lu, Bret McNabb, Jennifer Roberts, and Carlos Pinto. The ACT also contracted Veterinary Specialty Exams, LLC and Dr. Robert Malinowski to assist with the development, conduction, and analysis of the JTA study.  

In addition to the comprehensive report that accompanies this letter, I would like to provide the following highlights:  

- The JTA committee created an outline of the knowledge and skills required of an ACT Diplomate that was organized into 16 knowledge domains and 129 subdomains.  
- The JTA study was conducted as an online survey. An email invitation was sent to 427 ACT Diplomates and 1,182 SFT members. A total of 158 ACT Diplomates and 35 SFT members participated in the survey (37.0% and 3.0% response rates, respectively).  
- Approximately 98% of respondents indicated that the survey completely or adequately covered the important knowledge areas required of ACT Diplomates.  
- New certifying exam specifications (blueprint) related to the distribution of assessment material according to species are recommended (see page 13). In addition, the previously used generic specification ‘Other species’ has been removed and only assessment materials related to the listed species shall be included in the exam.
The JTA committee elected to remove three subdomains from the content outline, due to their low importance and frequency ratings. These included (i) chemotherapeutics, (ii) accessory sex glands surgery, and (iii) gene-editing technology. Therefore, these knowledge subdomains shall not be assessed in the certifying exam.

The JTA committee elected to maintain all other subdomains in the content outline.

New certifying exam specifications (blueprint) related to content domains are recommended. These recommendations are presented for a single-phase examination process (i.e., current process; see page 15) and for a 2-phase examination process once that is implemented (see page 14).

With approval of the executive board, the report should be shared with the Exam Committee so that the new exam specifications can be implemented. The report should also be shared with the membership as it should also be used to guide the training of ACT candidates.

Yours sincerely,

Dr. Leonardo Brito, DVM, PhD, DACT
Chair, JTA committee
American College of Theriogenologists

Certifying Examination

Job Task Analysis Report
2023

Prepared by:

Robert Malinowski, DVM, MA, Ph.D.
Veterinary Specialty Exams, LLC
Executive Summary

Beginning in September 2022, the American College of Theriogenologists (ACT) conducted a Job Task Analysis study to define the role of a board-certified specialist in Veterinary Theriogenology. The ACT worked with Veterinary Specialty Exams, LLC (VSE) to develop and conduct the Job Task Analysis study that would describe the knowledge requirements of competent Diplomates. Results of the Job Task Analysis study provide the basis for making a valid claim of appropriate test score inference.

The ACT appointed a committee of subject matter experts (SMEs) to provide content expertise. The committee consisted of 8 members with diverse specializations, areas of employment and geographic locations. The committee spent considerable time discussing the knowledge and skills required of a day-one ready Diplomate. These elements were used to create a new content outline that consisted of 129 tasks organized into 16 content domains.

The new content outline was used to develop an online survey. The survey contained multiple scales to rate each competency required of board-certified specialists in Theriogenology. ACT also included several demographic questions to gather confidential data describing the survey respondents. VSE administered the survey instrument using the Qualtrics XM® platform.

An email invitation to take the survey was sent to 427 ACT Diplomates and 1,182 SFT members. 158 ACT Diplomates and 35 SFT members participated in the survey, for response rates of 37.0% and 3.0% respectively. Approximately 98% of respondents indicated that the survey completely or adequately covered the important knowledge areas required to be an ACT Diplomate.

VSE conducted a follow-up webinar, using Zoom web conferencing, to review the initial survey results and all comments from the respondents. The goal of this meeting was to establish exclusion criteria to differentiate between the important and unimportant competencies, based on respondents' ratings. The committee finalized the list of tasks and established domain weights, which will serve as the new blueprint for the examination. Adoption of the content outline and the examination blueprint establishes the link between the knowledge necessary to become a board-certified specialist in - Theriogenology and successful performance on the certifying examination.
**Introduction**

**Survey Overview: The Content Validation Model**

The foundation of a valid, reliable, and legally defensible professional certification program is a well-constructed Job Task Analysis study. The Job Task Analysis study establishes the link between test scores achieved on certification exams and the competencies being tested. Therefore, pass or fail decisions correlate to competent performance. When evidence of validity based on examination content is presented for a specific professional role, it is critical to consider the relative importance of the competencies being tested. *The Joint Standards for Educational and Psychological Testing (AERA, APA, and NCME, 2014)* state:

**Standard 14.10**
When evidence of validity on test content is presented, the rationale for defining and describing a specific job content domain in a particular way (e.g., elements, knowledge, skills, abilities or other personal characteristics) should be stated clearly.

**Standard 14.14**
The content domain to be covered by a credentialing test should be defined clearly and justified in terms of importance of the content for the credential-worthy performance in an occupation or profession. A rationale should be provided to support a claim that the knowledge or skills being assessed are required for credential-worthy performance in an occupation and are consistent with the purpose for which the licensing or certification program was instituted.

**Purpose of the Job Task Analysis Study**

The American College of of Theriogenologists (ACT) worked with Veterinary Specialty Exams, LLC (VSE) to develop a certification examination program to meet the above-mentioned standards. A Job Task Analysis study was conducted, beginning in September 2022, which included developing a survey that described the requirements for a competent board-certified specialist in Theriogenology. Based on the Job Task Analysis, ACT determined the content for its certification exam.

This report provides an overview of the survey design, analysis, and results. Survey results of demographic data are also displayed. In addition, the implications of these results on examination development are discussed.
Survey Methodology

Survey Development

Following the meetings with the subject matter experts (SMEs), VSE placed the tasks from the new content outline into a survey format. A copy of the final survey is available in Appendix A. The SMEs who participated in the Job Analysis process are listed in Appendix B.

Rating Scales

VSE and ACT established the following rating scales for the survey:

Importance: How important is it for new diplomates to have knowledge in this area?
- Not important (0)
- Somewhat important (1)
- Moderately important (2)
- Very important (3)

Frequency: How often do you perform duties that require skills or knowledge in this competency?
- Never (0)
- Rarely (1)
- Sometimes (2)
- Frequently (3)
Demographic Questions

In order to evaluate if the ratings varied based on respondents' years of experience or other pertinent information, VSE included a demographic questionnaire. These demographic questions gathered the following information:

- Year of DVM degree
- Diplomate of ACT or SFT member
- Year of ACT certification
- Veterinary education background
- Advanced degrees
- Current geographic region
- Primary employment type
- Percent of time spent per species
- Percent of time spent on clinical theriogenology

Sampling Protocol

The invitation email from the ACT Board served as a preamble to the survey, encouraging participation, describing the process for accessing the online survey, and highlighting the critical nature of the respondents' decisions and opinions. ACT sent multiple reminders via email to maximize the response rate.

Data Collection and Analysis

After the survey administration was complete, VSE exported the data from Qualtrics® and utilized Microsoft Excel 365® for further analysis.
Survey Results

Results are divided into four sections: A) Survey Metrics, B) Demographic Results, C) Rating Scales, D) Comments and Content Distribution and E) Decision Criteria for Determining the Exam Blueprint.

A. Survey Metrics

Survey Return Rate

Invitations to take the online survey were sent to the ACT and SFT listservs, which included 427 Diplomates and 1,182 members respectively. 158 ACT Diplomates completed the survey, for a response rate of 37.0%. 35 SFT members completed the survey, for a response rate of 3.0%.

Survey Adequacy

At the end of the survey, respondents were asked about the adequacy of survey content. 37.7% of the respondents indicated that the survey completely covered the important knowledge areas required to be an ACT Diplomate, 60.1% felt that it did so adequately, and 2.2% felt that the survey was inadequate (Table 1).

How well did this survey cover the important knowledge areas required to be an ACT Diplomate?

Table 1: Survey Adequacy

<table>
<thead>
<tr>
<th>Adequacy</th>
<th>Frequency</th>
<th>Valid Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completely</td>
<td>67</td>
<td>37.7</td>
</tr>
<tr>
<td>Adequately</td>
<td>107</td>
<td>60.1</td>
</tr>
<tr>
<td>Inadequately</td>
<td>4</td>
<td>2.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>178</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Following the survey adequacy rating question, respondents were given the opportunity to list any additional knowledge areas that they felt should have been included in the survey. They were also asked to include any additional comments, questions, or concerns.
B. Demographic Results

Year of DVM graduation

Respondents were asked to provide the year they received their DVM degree. The results are shown below in Table 2.

Table 2: Year of DVM degree

<table>
<thead>
<tr>
<th>Year</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974-1979</td>
<td>13</td>
</tr>
<tr>
<td>1980-1989</td>
<td>36</td>
</tr>
<tr>
<td>1990-1999</td>
<td>32</td>
</tr>
<tr>
<td>2000-2009</td>
<td>51</td>
</tr>
<tr>
<td>2010-2019</td>
<td>57</td>
</tr>
<tr>
<td>2020-2022</td>
<td>4</td>
</tr>
</tbody>
</table>

Year of certification

Respondents were asked to provide the year they received their certification, if they were an ACT Diplomate. The results are shown below in Table 3.

Table 3: Year of ACT Certification

<table>
<thead>
<tr>
<th>Year</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983-1989</td>
<td>11</td>
</tr>
<tr>
<td>1990-1999</td>
<td>28</td>
</tr>
<tr>
<td>2000-2009</td>
<td>40</td>
</tr>
<tr>
<td>2010-2019</td>
<td>60</td>
</tr>
<tr>
<td>2020-2022</td>
<td>18</td>
</tr>
</tbody>
</table>
Educational background

Respondents were asked to indicate their veterinary education background. The results are shown below in Table 4. The responses for “Other” are listed in Appendix C.

Table 4: Educational Background

<table>
<thead>
<tr>
<th>Degree</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVM/VMD</td>
<td>183</td>
</tr>
<tr>
<td>MS</td>
<td>68</td>
</tr>
<tr>
<td>MVSc</td>
<td>8</td>
</tr>
<tr>
<td>MBA</td>
<td>0</td>
</tr>
<tr>
<td>MPH</td>
<td>3</td>
</tr>
<tr>
<td>DVSc</td>
<td>8</td>
</tr>
<tr>
<td>PhD</td>
<td>60</td>
</tr>
<tr>
<td>Other</td>
<td>19</td>
</tr>
</tbody>
</table>

Advanced degrees

Respondents were asked to indicate if they earned any advanced degrees or other certifications. The complete list of responses to this question can be found in Appendix D.

Geographic region

Respondents were asked to indicate the geographic region in which they were currently employed. The results are shown below in Table 5. The responses for “Other country” are listed in Appendix E.

Table 5: Geographic Region

<table>
<thead>
<tr>
<th>Region</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-Atlantic</td>
<td>18</td>
</tr>
<tr>
<td>Midwest</td>
<td>23</td>
</tr>
<tr>
<td>New England</td>
<td>6</td>
</tr>
<tr>
<td>Pacific Coast</td>
<td>21</td>
</tr>
<tr>
<td>Rocky Mountain</td>
<td>13</td>
</tr>
<tr>
<td>South</td>
<td>52</td>
</tr>
<tr>
<td>Southwest</td>
<td>27</td>
</tr>
<tr>
<td>US Territories</td>
<td>0</td>
</tr>
<tr>
<td>Other country</td>
<td>0</td>
</tr>
</tbody>
</table>
Primary Employment Type

Respondents were asked to indicate their primary employment type. The results are shown below in Table 6. The most common responses were Academic (Clinics/Teaching) and Private Practice. The responses for “Other” are listed in Appendix F.

Table 6: Primary Employment Type

<table>
<thead>
<tr>
<th>Area</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academia (Clinics/Teaching)</td>
<td>79</td>
</tr>
<tr>
<td>Academia (Research)</td>
<td>14</td>
</tr>
<tr>
<td>Private Practice</td>
<td>77</td>
</tr>
<tr>
<td>Government</td>
<td>2</td>
</tr>
<tr>
<td>Industry/Commercial</td>
<td>3</td>
</tr>
<tr>
<td>Retired/not employed</td>
<td>11</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
</tr>
</tbody>
</table>

Percentage of Time Spent Per Species

Respondents were asked to indicate the percentage of time they spent working with each species. The results are shown below in Table 7.

Table 7: Time spent per species

<table>
<thead>
<tr>
<th>Species</th>
<th>Time (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equine</td>
<td>39.8</td>
</tr>
<tr>
<td>Canine</td>
<td>27.6</td>
</tr>
<tr>
<td>Bovine</td>
<td>15.4</td>
</tr>
<tr>
<td>Feline</td>
<td>4.3</td>
</tr>
<tr>
<td>Caprine</td>
<td>3.5</td>
</tr>
<tr>
<td>Ovine</td>
<td>2.4</td>
</tr>
<tr>
<td>Swine</td>
<td>1.3</td>
</tr>
<tr>
<td>Laboratory rodents</td>
<td>1.1</td>
</tr>
<tr>
<td>Pet carnivores</td>
<td>1.1</td>
</tr>
<tr>
<td>New world camelids</td>
<td>0.8</td>
</tr>
<tr>
<td>Other wild mammals</td>
<td>0.6</td>
</tr>
<tr>
<td>Reptiles</td>
<td>0.5</td>
</tr>
<tr>
<td>Cervids</td>
<td>0.4</td>
</tr>
<tr>
<td>Nonhuman primates</td>
<td>0.4</td>
</tr>
<tr>
<td>Poultry</td>
<td>0.4</td>
</tr>
<tr>
<td>Amphibians</td>
<td>0.3</td>
</tr>
</tbody>
</table>
### Old world camelids | 0.1
---|---
Fish | 0.1
Wild ungulates | 0.1
Bison | 0.0
Water buffalo | 0.0
Wild carnivores | 0.0
Pet birds | 0.0

### Time in clinical theriogenology

Respondents were asked to indicate the percentage of time they spent on clinical theriogenology. The results are shown below in Table 8. The mean time was 58.66%.

#### Table 8: Clinical Theriogenology Time

<table>
<thead>
<tr>
<th>Time (%)</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>26</td>
</tr>
<tr>
<td>11-20</td>
<td>13</td>
</tr>
<tr>
<td>21-30</td>
<td>17</td>
</tr>
<tr>
<td>31-40</td>
<td>14</td>
</tr>
<tr>
<td>41-50</td>
<td>11</td>
</tr>
<tr>
<td>51-60</td>
<td>11</td>
</tr>
<tr>
<td>61-70</td>
<td>20</td>
</tr>
<tr>
<td>71-80</td>
<td>20</td>
</tr>
<tr>
<td>81-90</td>
<td>17</td>
</tr>
<tr>
<td>91-100</td>
<td>44</td>
</tr>
</tbody>
</table>

### C. Rating Scales

The mean scores, using all rating scales, for each task are available in Appendix G.

#### Importance:

Respondents were asked to rate how important each task was based on the following scale: Not important (0), Somewhat important (1), Moderately important (2) and Very important (3). Scores ranged from 1.65 to 2.96. Eight competencies, listed below, had the lowest scores. The full list, sorted by ascending importance, is available in Appendix H.

- 7-6. Chemotherapeutics (1.65)
- 8-8. Genetic testing and assessment (male) (1.98)
- 9-7. Congenital and acquired disorders of bladder /urethra (1.84)
- 9-8. Genetic testing and assessment (female) (2.01)
14-3. Accessory sex glands surgery (1.99)
14-5. Prepuce surgery (1.96)
16-12. Somatic cell nuclear transfer (1.86)
16-13. Gene-editing technology (1.70)

**Frequency:**

Respondents were asked to indicate how often they personally performed tasks that required skills or knowledge in each area based on the following scale: Never (0), Rarely (1), Sometimes (2) and Frequently (3). Mean frequency scores ranged from 0.43 to 2.86. Eight tasks, listed below, had the lowest frequency scores. The full list, sorted by ascending frequency, is available in Appendix I.

7-6. Chemotherapeutics (1.01)
14-3. Accessory sex glands surgery (0.88)
14-4. Teaser preparation (1.02)
14-5. Prepuce surgery (0.83)
15-7. Sexed semen production and use (0.90)
16-8. Intracytoplasmic sperm injection (0.87)
16-12. Somatic cell nuclear transfer (0.53)
16-13. Gene-editing technology (0.43)

**D. Comments and Content Distribution**

**Knowledge Areas Not Covered**

Respondents had the opportunity to list important additional tasks that were not covered in the survey but considered important as ACT. The complete list of recommendations is available in Appendix J.

**Comments**

The respondents left detailed comments regarding each competency, as well as comments about the overall survey. These were collated and presented to the committee for review and discussion. The complete list of task-specific comments is available in Appendix K. Overall comments about the survey are available in Appendix L.
Frequency of knowledge use

Respondents were asked to indicate how often they used knowledge in each content domain area. The mean results for each domain area are listed below in Table 9.

Table 9: Frequency of Knowledge Use

<table>
<thead>
<tr>
<th>Domain</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Normal male reproductive anatomy and physiology</td>
<td>8.4</td>
</tr>
<tr>
<td>2. Normal female reproductive anatomy and physiology</td>
<td>10.11</td>
</tr>
<tr>
<td>3. Fertilization, embryology, and sexual differentiation</td>
<td>4.56</td>
</tr>
<tr>
<td>4. Pregnancy</td>
<td>10.76</td>
</tr>
<tr>
<td>5. Eutocia</td>
<td>4.25</td>
</tr>
<tr>
<td>6. Breeding management and population control</td>
<td>7.59</td>
</tr>
<tr>
<td>7. Pharmacology</td>
<td>4.55</td>
</tr>
<tr>
<td>8. Clinical approach to conditions of the male</td>
<td>5.89</td>
</tr>
<tr>
<td>9. Clinical approach to the non-pregnant female</td>
<td>7.42</td>
</tr>
<tr>
<td>10. Clinical approach to the pregnant and postpartum female</td>
<td>8.08</td>
</tr>
<tr>
<td>11. Clinical approach to pregnancy wastage</td>
<td>3.87</td>
</tr>
<tr>
<td>12. Neonatology</td>
<td>4.73</td>
</tr>
<tr>
<td>13. Urogenital surgery (female)</td>
<td>3.39</td>
</tr>
<tr>
<td>14. Urogenital surgery (male)</td>
<td>2.34</td>
</tr>
<tr>
<td>15. Artificial insemination</td>
<td>8.57</td>
</tr>
<tr>
<td>16. Embryo technologies</td>
<td>5.48</td>
</tr>
</tbody>
</table>

E. Decision Criteria for Determining the Exam Blueprint

VSE conducted a webinar discussion to present the results of the survey to the committee of subject matter experts for their review. Prior to the meeting, the committee members received a copy of the preliminary survey analysis report. The purpose of this meeting was to review the survey results, determine if any tasks needed to be removed from or added to the content outline, and finalize the exam blueprint. During the discussion, the committee members examined the tasks by the following criteria:

- Importance
- Frequency
- Respondent comments
- Respondent suggestions for additional tasks

The committee elected to remove three tasks from the content outline, due to their low importance and frequency ratings:

7-6. Chemotherapeutics (importance = 1.65, frequency = 1.01)
14-3. Accessory sex glands surgery (importance = 1.99, frequency = 0.88)
16-13. Gene-editing technology (importance = 1.70, frequency = 0.43)

Eight additional tasks with low importance and/or frequency ratings (listed below) were discussed in detail, but the committee elected to retain them in the content outline.

8-8. Genetic testing and assessment (importance = 1.98, frequency = 1.56)
9-7. Congenital and acquired disorders of bladder /urethra (importance = 1.84, frequency = 1.40)
9-8 Genetic testing and assessment (importance = 2.01, frequency = 1.57)
14-4. Teaser preparation (importance = 2.13, frequency = 1.02)
14-5. Prepuce surgery (importance = 1.96, frequency = 0.83)
15-7. Sexed semen production and use (importance = 2.13, frequency = 0.90)
16-8. Intracytoplasmic sperm injection (importance = 2.20, frequency = 0.87)
16-12. Somatic cell nuclear transfer (importance = 1.86, frequency = 0.53)

The committee reviewed the comments from respondents regarding additional tasks to include, but concluded that the suggestions were either already present in the content outline, or they would not be relevant additions.

The final exam specification, based on species, is shown below in Table 10. The committee elected to retain the seven highest rated species, but also added new world camelids and a general, non-species-specific area.

Table 10: Exam Specification by Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equine</td>
<td>35</td>
</tr>
<tr>
<td>Canine</td>
<td>25</td>
</tr>
<tr>
<td>Bovine</td>
<td>20</td>
</tr>
<tr>
<td>Caprine/ovine</td>
<td>6</td>
</tr>
<tr>
<td>Feline</td>
<td>4</td>
</tr>
<tr>
<td>General, non-species specific *</td>
<td>6</td>
</tr>
<tr>
<td>Swine</td>
<td>2</td>
</tr>
<tr>
<td>New world camelids</td>
<td>2</td>
</tr>
</tbody>
</table>

*Not other species
The final exam specification, based on content domain, is shown below in Tables 11 and 12. In the future, the exam will be split into two phases.

**Table 11: Exam Specification by Content Domain (Phase 1)**

<table>
<thead>
<tr>
<th>Domain</th>
<th>Weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Normal male reproductive anatomy and physiology</td>
<td>17</td>
</tr>
<tr>
<td>2. Normal female reproductive anatomy and physiology</td>
<td>20</td>
</tr>
<tr>
<td>3. Fertilization, embryology, and sexual differentiation</td>
<td>9</td>
</tr>
<tr>
<td>4. Pregnancy</td>
<td>21</td>
</tr>
<tr>
<td>5. Eutocia</td>
<td>9</td>
</tr>
<tr>
<td>6. Breeding management and population control</td>
<td>15</td>
</tr>
<tr>
<td>7. Pharmacology</td>
<td>9</td>
</tr>
</tbody>
</table>

**Table 12: Exam Specification by Content Domain (Phase 2)**

<table>
<thead>
<tr>
<th>Domain</th>
<th>Weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clinical approach to conditions of the male</td>
<td>12</td>
</tr>
<tr>
<td>2. Clinical approach to conditions of the non-pregnant female</td>
<td>15</td>
</tr>
<tr>
<td>3. Clinical approach to conditions of the pregnant and postpartum female</td>
<td>16</td>
</tr>
<tr>
<td>4. Clinical approach to pregnancy wastage</td>
<td>8</td>
</tr>
<tr>
<td>5. Neonatology</td>
<td>9</td>
</tr>
<tr>
<td>6. Urogenital surgery (female)</td>
<td>7</td>
</tr>
<tr>
<td>7. Urogenital surgery (male)</td>
<td>5</td>
</tr>
<tr>
<td>8. Artificial insemination</td>
<td>17</td>
</tr>
<tr>
<td>9. Embryo technologies</td>
<td>11</td>
</tr>
</tbody>
</table>
The intermediate exam specification, based on content domain, is shown below in Table 13. The next administration of the exam will be in a single phase until it can be fully transitioned. The committee elected to group several content domains to create the intermediate specification.

**Table 13: Intermediate Exam Specification by Content Domain**

<table>
<thead>
<tr>
<th>Domain</th>
<th>Weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Non-pregnant female anatomy, physiology and clinical reproduction</td>
<td>18</td>
</tr>
<tr>
<td>● Normal female reproductive anatomy and physiology</td>
<td></td>
</tr>
<tr>
<td>● Clinical approach to conditions of the non-pregnant female</td>
<td></td>
</tr>
<tr>
<td>2. Fertilization, embryology, and sexual differentiation</td>
<td>4</td>
</tr>
<tr>
<td>3. Pregnancy</td>
<td>11</td>
</tr>
<tr>
<td>4. Clinical approach to the pregnant and postpartum female</td>
<td>16</td>
</tr>
<tr>
<td>● Eutocia</td>
<td></td>
</tr>
<tr>
<td>● Clinical approach to conditions of the pregnant and postpartum female</td>
<td></td>
</tr>
<tr>
<td>● Clinical approach to pregnancy wastage</td>
<td></td>
</tr>
<tr>
<td>5. Male anatomy, physiology and clinical reproduction</td>
<td>14</td>
</tr>
<tr>
<td>● Normal male reproductive anatomy and physiology</td>
<td></td>
</tr>
<tr>
<td>● Clinical approach to conditions of the male</td>
<td></td>
</tr>
<tr>
<td>6. Breeding management and population control</td>
<td>8</td>
</tr>
<tr>
<td>7. Artificial insemination</td>
<td>9</td>
</tr>
<tr>
<td>8. Embryo technologies</td>
<td>6</td>
</tr>
<tr>
<td>9. Urogenital surgery</td>
<td>6</td>
</tr>
<tr>
<td>● Urogenital surgery (female)</td>
<td></td>
</tr>
<tr>
<td>● Urogenital surgery (male)</td>
<td></td>
</tr>
<tr>
<td>10. Neonatology</td>
<td>5</td>
</tr>
<tr>
<td>11. Pharmacology</td>
<td>3</td>
</tr>
</tbody>
</table>

The final content outlines are available in Appendix M (dual phase) and Appendix N (intermediate single phase). Adoption of the content outline and the examination blueprint establishes the link between the knowledge necessary to become a board-certified specialist in Theriogenology and successful performance on the certifying examination.
Dear colleague,

Thank you for filling out the Job Task Analysis (JTA) survey. The JTA is an instrument used by the ACT to determine the appropriate construction of the certifying examination. It is a requirement from the American Board of Veterinary Specialties (ABVS) and must be performed at least once every 10 years. This process is to ensure that the exam reflects the knowledge required for a minimally competent candidate to become a board-certified expert.

The survey is divided into 16 knowledge domains, each with a different number of sub-domains. Note that examples are sometimes provided to illustrate some of the descriptions but are not meant to be exhaustive. You will be asked to rate the importance of each knowledge sub-domain and indicate how often you perform tasks that require such knowledge. In addition, you will be asked to provide an estimate of how often you are required to use each of the main knowledge domains.

The survey will take approximately 60-90 minutes to complete. You can exit the survey and resume it later, so you don’t need to do it all in one session. **Please note that you must use the same computer and web browser for the “save and continue” feature to work. Do not clear your web browser’s history/cookies until you have completed the entire survey.** Please take the time to fill out the entire survey completely and accurately.

After completing the JTA survey, you will have the opportunity to fill in a survey about the certification process. The results from this additional survey will be used to guide the Executive Board on the future of the process.

Your input is invaluable and your involvement has a direct impact on the future of the ACT. Thank you for your time and consideration. If you have any issues filling the survey, please contact the ACT office [https://www.theriogenology.org/general/?type=CONTACT](https://www.theriogenology.org/general/?type=CONTACT)

**Demographics**

Presented below are demographic questions used to help evaluate the role of an ACT Diplomate. All information is held in confidence and is only used to establish a profile of the survey respondent group. Please select only one option for each question, unless otherwise noted.
Email address:

________________________________________________________________

In what year did you receive your DVM degree?

________________________________________________________________

Are you a Diplomate of the ACT, or an SFT member?

○ ACT Diplomate (1)

○ SFT member (2)

Display This Question:

If Are you a Diplomate of the ACT, or an SFT member? = ACT Diplomate

In what year did you become certified by ACT?

________________________________________________________________
What is your veterinary education background? (choose all that apply)

☐ DVM/VMD (1)
☐ MS (2)
☐ MVSc (3)
☐ MBA (4)
☐ MPH (5)
☐ DVSc (6)
☐ PhD (7)
☐ Other (please specify) (8) ________________________________

Please list your advanced degrees, or other certifications, and where you earned them.

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

________________________________________________________________
What is your current geographic region?

- Midatlantic (NY, NJ, PA, MD, DE, DC) (4)
- Midwest (IN, IL, MI, OH, WI, IA, KS, MN, MO, NE, ND, SD) (5)
- New England (CT, ME, MA, NH, RI, VT) (6)
- Pacific Coast (CA, OR, WA, AK, HI) (7)
- Rocky Mountain (MT, ID, CO, UT, WY, NV) (8)
- South (FL, GA, NC, SC, VA, WV, AL, KY, MS, TN, AR, LA) (9)
- Southwest (TX, AZ, NM, OK) (10)
- US Territories (Puerto Rico, American Samoa, Federal States of Micronesia, Guam, Midway Islands, US Virgin Islands) (11)
- Other country (please specify) (12)

What is your PRIMARY employment type?

- Academia (Clinics/Teaching) (1)
- Academia (Research) (2)
- Private Practice (3)
- Government (4)
- Industry/Commercial (5)
- Retired/not employed (6)
- Other (please indicate) (7)
Please indicate the percent of time you work with each species.

- Amphibians (1)
- Bison (2)
- Bovine (3)
- Canine (4)
- Caprine (5)
- Cervids (6)
- Equine (7)
- Feline (8)
- Fish (9)
- Laboratory rodents (10)
- New world camelids (11)
- Nonhuman primates (12)
- Old world camelids (13)
- Other wild mammals (14)
- Ovine (15)
- Pet birds (16)
- Pet carnivores (17)
- Poultry (18)
- Reptiles (19)
- Swine (20)
- Water buffalo (21)
- Wild carnivores (22)
- Wild ungulates (23)

What percent of your time is spent on clinical theriogenology?

<table>
<thead>
<tr>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Time ()
Rating Scales

This survey includes a comprehensive list of 129 knowledge areas across 16 content domains. Please evaluate each area using the following rating scales:

**How important is it for new diplomates to have knowledge in this area?**

- Not important
- Somewhat important
- Moderately important
- Very important

**How often do you perform tasks that require skills or knowledge in this area?**

- Never
- Rarely
- Sometimes
- Frequently

If there are any knowledge areas you feel have been omitted, please list them in the area provided at the end of the survey.
P1-1-1
1. Normal male reproductive anatomy and physiology
1. Comparative anatomical structure and function (e.g., vasculature, innervation, accessory sex glands, scrotum, spermatic cords, testes, epididymides, penis, prepuce)

P1-1-1-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

P1-1-1-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

P1-1-1-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
1. Normal male reproductive anatomy and physiology

2. Reproductive endocrinology (e.g., hypothalamic-pituitary-gonadal axis, steroidogenesis, pheromones)

P1-1-2-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

---------

P1-1-2-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

---------

P1-1-2-C Comments:

________________________________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________

________________________________________________________________

Page Break
1. Normal male reproductive anatomy and physiology

3. Testicular descent/migration

P1-1-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

P1-1-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

P1-1-3-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
P1-1-4
1. Normal male reproductive anatomy and physiology

4. Puberty (e.g., definition, factors affecting onset)

---

P1-1-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

---

P1-1-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

---

P1-1-4-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

---

Page Break
1. Normal male reproductive anatomy and physiology

5. Spermatogenesis (e.g., spermatogenic cycle, spermatocytogenesis, spermiogenesis, spermiation, testicular thermoregulation)

P1-1-5-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

P1-1-5-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

P1-1-5-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
1. Normal male reproductive anatomy and physiology

6. Ejaculate constituents (e.g., sperm, seminal plasma, accessory sex glands and epididymal contributions)

P1-1-6-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

P1-1-6-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

P1-1-6-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
P1-1-7
1. Normal male reproductive anatomy and physiology

7. Sperm structure and function (e.g., morphology, concentration, motility)

P1-1-7-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

P1-1-7-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

P1-1-7-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
1. Normal male reproductive anatomy and physiology

8. Erection, emission, ejaculation, detumescence

P1-1-8-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

P1-1-8-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

P1-1-8-C Comments:
P1-1-9
1. Normal male reproductive anatomy and physiology

9. Sexual behavior (e.g., pubertal, peripubertal)

P1-1-9-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

P1-1-9-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

P1-1-9-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
1. Normal male reproductive anatomy and physiology

10. Reproductive senescence

P1-1-10-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

P1-1-10-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

P1-1-10-C Comments:
2-1
2. Normal female reproductive anatomy and physiology
   1. Comparative anatomical structure and function (e.g., vasculature, innervation, ovaries, oviducts, ovarian bursa, uterus, cervix, vagina, vestibule, vulva, mammary gland)

2-1-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

2-1-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

2-1-C Comments:
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
2-2
2. Normal female reproductive anatomy and physiology
   2. Reproductive endocrinology (e.g., hypothalamic-pituitary-gonadal axis, steroidogenesis, pheromones)

2-2-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

2-2-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

2-2-C Comments:
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
2-3
2. Normal female reproductive anatomy and physiology

3. Puberty (e.g., definition, factors affecting onset)

2-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

2-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

2-3-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
2-4
2. Normal female reproductive anatomy and physiology
   4. Oogenesis (e.g., oocyte recruitment, oocyte differentiation, folliculogenesis, follicular dynamics, ovulation)

2-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

2-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

2-4-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
2. Normal female reproductive anatomy and physiology
5. Estrous cycle (e.g., stages, corpus luteum formation and function, luteolysis)

2-5-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

2-5-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

2-5-C Comments:

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
Page Break
2-6
2. Normal female reproductive anatomy and physiology
   6. Behavior (e.g., estrous, peri-pubertal, maternal)

2-6-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

2-6-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

2-6-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
2-7
2. Normal female reproductive anatomy and physiology
7. Reproductive immunology

How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
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________________________________________________________________

Page Break
2. Normal female reproductive anatomy and physiology
   8. Reproductive microbiology and microbiome

2-8-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

2-8-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

2-8-C Comments:

________________________________________________________________
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________________________________________________________________
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Page Break
2-9
2. Normal female reproductive anatomy and physiology
9. Reproductive senescence

2-9-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

2-9-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

2-9-C Comments:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
2-10
2. Normal female reproductive anatomy and physiology
10. Lactation

2-10-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

2-10-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

2-10-C Comments:
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
3. Fertilization, embryology, and sexual differentiation

1. Fertilization process (e.g., sperm capacitation and acrosome reaction, oocyte maturation and activation)

3-1-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

3-1-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

3-1-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
3-2
3. Fertilization, embryology, and sexual differentiation

2. Embryonic stages of development (e.g., cytula, zygote, morula, blastocyst, hatched blastocyst, parthenogenesis)

3-2-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

3-2-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

3-2-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
3. Fertilization, embryology, and sexual differentiation

3. Cytogenetics (e.g., DNA, mitosis, meiosis, diploid, haploid, karyotypes, chromosome)

3-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

3-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

3-3-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
3. Fertilization, embryology, and sexual differentiation

4. Chromosome anomalies (e.g., aneuploid, monosomic, trisomic, chimeras, mosaics, translocations, inheritance)

3-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

3-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

3-4-C Comments:

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

Page Break
3-5-I
3. Fertilization, embryology, and sexual differentiation

5. Embryonic anatomy and differentiation (e.g., sex determination, system differentiation)

---

3-5-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

---

3-5-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

---

3-5-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
4-1
4. Pregnancy

1. Maternal recognition of pregnancy

4-1-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

4-1-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

4-1-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
4-2
4. Pregnancy

2. Pregnancy diagnosis methods (e.g., palpation, ultrasonography, radiography, blood tests)

4-2-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

4-2-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

4-2-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
4-3

4. Pregnancy

3. Comparative placentation (e.g., deciduate, adeciduate, epitheliochorial, syndesmochorial, interspecies pregnancy)

4-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

4-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

4-3-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
4-4
4. Pregnancy

4. Fetal development

4-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

4-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

4-4-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
4-5

4. Pregnancy

5. Polytocous pregnancy (e.g., prolificacy, embryo migration, uterine capacity, spontaneous embryo reduction, twin pregnancy in monotocous species)

---

4-5-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

---

4-5-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

---

4-5-C Comments:

________________________________________________________________
________________________________________________________________
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Page Break
4-6
4. Pregnancy

6. Fetal circulation

4-6-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

4-6-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

4-6-C Comments:

________________________________________________________________
________________________________________________________________
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Page Break
4-7
4. Pregnancy

7. Endocrinology of pregnancy

<table>
<thead>
<tr>
<th>▼ Not important (0) ... Very important (3)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>▼ Never (0) ... Frequently (3)</th>
</tr>
</thead>
</table>

4-7-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
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________________________________________________________________
4-8
4. Pregnancy

8. Maternal hematologic changes (e.g., hematocrit, neutrophilia)

4-8-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

4-8-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

4-8-C Comments:

_________________________________________________________________
_________________________________________________________________
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_________________________________________________________________
_________________________________________________________________
4. Pregnancy

9. Gestational length (e.g., seasonality, fetal sex, nutrition, fetal numbers)

---

4-9-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

---

4-9-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

---

4-9-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
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________________________________________________________________

Page Break
4-10

4. Pregnancy

10. Fetal well-being (e.g., fetal stress signs, combined thickness of the uterus and placenta)

4-10-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

4-10-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

4-10-C Comments:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
5. Eutocia

1. Endocrinology of parturition (e.g., fetal stress, ACTH, Ferguson's reflex)

5-1-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

5-1-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

5-1-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
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________________________________________________________________
________________________________________________________________

Page Break
5. Eutocia

2. Stages of parturition (e.g., definition, timing, behavior, maternal and fetal physiological changes)

5-2-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

5-2-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

5-2-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Page Break
5-3-I

5. Eutocia

3. Techniques for monitoring parturition (e.g., temperature drop, waxing, milk electrolytes, tocodynamometry)

---

5-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

---

5-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

---

5-3-C Comments:

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

---

Page Break
5-4
5. Eutocia

4. Multiple births (e.g., monozygotic, dizygotic, conjoined twins)

5-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

5-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

5-4-C Comments:

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Page Break
5-5
5. Obstetric nomenclature (e.g., fetal presentation, position, and posture)

5-5-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

5-5-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

5-5-C Comments:
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6-1
6. Breeding management and population control

1. Normal breeding behavior

6-1-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

6-1-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

6-1-C Comments:
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6-2
6. Breeding management and population control

2. Analysis of animal and herd breeding records (e.g., per cycle pregnancy rate, calving interval, fecundity rate)

6-2-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

6-2-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

6-2-C Comments:

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Page Break
6. Breeding management and population control

3. Estrous cycle manipulation (e.g., supplemental light, hormones, male-effect, estrus induction)

6-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

6-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

6-3-C Comments:

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Page Break
6. Breeding management and population control

4. Estrous cycle monitoring (e.g., estrus behavior, estrus detection aids, ultrasonography, cytology, hormone levels, timing breeding)

6-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

6-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

6-4-C Comments:

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6-5
6. Breeding management and population control

5. Estrus suppression (e.g., indications and limitations, hormones, vaccines, gonadectomy)

6-5-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

6-5-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

6-5-C Comments:

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Page Break
6-6
6. Breeding management and population control

6. Nutrition management (e.g., nutritional requirements according to sex, age and physiological status, male and female, pre-pubertal, gestating, post-partum, body condition scoring and recommendations, micronutrients, excessive dietary protein, “flushing”)

6-6-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

6-6-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

6-6-C Comments:

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Page Break
6. Breeding management and population control

7. Nutritional deficiency and toxicity (e.g., vitamin A deficiency, selenium deficiency, mycotoxins)

6-7-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

6-7-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

6-7-C Comments:

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6-8
6. Breeding management and population control

8. Disease prevention programs (e.g., venereal disease testing, vaccination program)

6-8-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

6-8-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

6-8-C Comments:
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Page Break
6-9

6. Breeding management and population control

9. Genetic counseling (e.g., common genetic conditions, recessive vs dominant genetic conditions, polygenic vs single gene conditions, pedigree analysis, common breed predispositions)

6-9-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

6-9-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

6-9-C Comments:

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6-10
6. Breeding management and population control

10. Contraception (e.g., hormonal implants, chemical castration, vaccines)

6-10-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

6-10-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

6-10-C Comments:
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7-1
7. Pharmacology (MOA, hormones, analgesics, etc.)

1. Pharmacological analogs of reproductive hormones (e.g., mechanisms of action, clinical uses, toxicity)

7-1-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

7-1-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

7-1-C Comments:

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Page Break
7. Pharmacology (MOA, hormones, analgesics, etc.)

2. Hormones of diagnostic utility (e.g. progesterone vs progestogens, inhibin, AMH, testosterone, estrogen, estrogenic compounds)

7-2-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

7-2-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

7-2-C Comments:
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7-3
7. Pharmacology (MOA, hormones, analgesics, etc.)

3. Antimicrobials and non-antimicrobials (e.g. antibiotic classes, antifungals, antivirals, chelators, biofilm disruptors, mechanisms of action, mechanism of resistance, bioavailability and penetration of the reproductive tract, pharmacokinetics and pharmacodynamics)

7-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

7-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

7-3-C Comments:
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Page Break
7. Pharmacology (MOA, hormones, analgesics, etc.)

4. Anesthetics (e.g., local, regional, general, choice for gravid and non-gravid animals, contraindications)

7-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

7-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

7-4-C Comments:

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Page Break
7. Pharmacology (MOA, hormones, analgesics, etc.)

5. Analgesics, antipyretics, anti-inflammatories (mechanisms of action, penetration)

7-5-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

7-5-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

7-5-C Comments:

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7-6
7. Pharmacology (MOA, hormones, analgesics, etc.)

6. Chemotherapeutics (e.g., TVT, SCC treatments)

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7-6-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

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7-6-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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7-6-C Comments:

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Page Break
7-7
7. Pharmacology

7. Animal Medicinal Drug Use Clarification Act and use of prescription agents to improve reproductive performance

7-7-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

7-7-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

7-7-C Comments:

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8. Clinical approach to conditions of the male (diagnostics, therapeutics, management, prognosis)

1. Exam of the reproductive tract (e.g., palpation, ultrasonography, endoscopy, cytology, histopathology, culture)

8-1-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

8-1-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

8-1-C Comments:

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Page Break
8-2
8. Clinical approach to conditions of the male (diagnostics, therapeutics, management, prognosis)

2. Reproductive hormones in health and disease (e.g., testosterone with cryptorchidism, steroids with gonad neoplasia, gonadotropins with testicular degeneration)

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8-2-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

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8-2-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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8-2-C Comments:

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8-3-I

8. Clinical approach to conditions of the male (diagnostics, therapeutics, management, prognosis)

3. Congenital and acquired disorders affecting mating ability (e.g., behavior, neurologic, musculoskeletal)

8-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

8-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

8-3-C Comments: 

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8-4
8. Clinical approach to conditions of the male (diagnostics, therapeutics, management, prognosis)

4. Congenital and acquired disorders of the scrotum and its contents (e.g., XXY syndrome, testicular hypoplasia, spermatic cord torsion, epididymitis; hydrocele)

8-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

8-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

8-4-C Comments:

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Page Break
5. Congenital and acquired disorders of the prepuce and penis (e.g., persistent frenulum, coital exanthema, transmissible venereal tumor)

8-5-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

8-5-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

8-5-C Comments:

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8-6
8. Clinical approach to conditions of the male (diagnostics, therapeutics, management, prognosis)

6. Congenital and acquired disorders of accessory sex glands (e.g., benign prostatic hyperplasia, seminal vesiculitis, ampullary obstruction)

8-6-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

8-6-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

8-6-C Comments:

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8-7

8. Clinical approach to conditions of the male (diagnostics, therapeutics, management, prognosis)

7. Spermiogram analysis (e.g., methods of analysis, sperm production and output, CASA, flow cytometry, seminal plasma evaluation, hemospermia, urospermia, oligospermia, asthenospermia, teratospermia, obstructive/non-obstructive azoospermia)

X-

8-7-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

X-

8-7-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

8-7-C Comments:

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### 8-8-I How important is it for new diplomates to have knowledge in this area?

- Not important (0) ... Very important (3)

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### 8-8-F How often do you perform tasks that require skills or knowledge in this area?

- Never (0) ... Frequently (3)

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### 8-8-C Comments:

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Page Break
8-9
8. Clinical approach to conditions of the male (diagnostics, therapeutics, management, prognosis)

9. Endocrine disruptors (e.g., effect of drugs on spermatogenesis, mycotoxins)

8-9-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

8-9-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

8-9-C Comments:

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9-1
9. Clinical approach to conditions of the non-pregnant female (diagnostics, therapeutics, management, prognosis)

1. Exam of the reproductive tract (e.g., palpation, ultrasonography, endoscopy, cytology, histopathology, culture)
9-1-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

9-1-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

9-1-C Comments:

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Page Break
9-2

9. Clinical approach to conditions of the non-pregnant female (diagnostics, therapeutics, management, prognosis)

2. Reproductive hormones in health and disease (e.g., progesterone with anestrus, inhibin and AMH with gonad neoplasia, acquired endocrinological and metabolic disorders)

9-2-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

9-2-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

9-2-C Comments:

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Page Break
9. Clinical approach to conditions of the non-pregnant female (diagnostics, therapeutics, management, prognosis)

3. Abnormal cyclicity (e.g., anestrus, persistent estrus, short/long interestrus interval)

9-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

9-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

9-3-C Comments:

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Page Break
9. Clinical approach to conditions of the non-pregnant female (diagnostics, therapeutics, management, prognosis)

4. Congenital and acquired disorders of the ovaries (e.g., XO syndrome, granuloma cell tumor, cystic ovarian disease)

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9-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

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9-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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9-4-C Comments:

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Page Break
9-5
9. Clinical approach to conditions of the non-pregnant female (diagnostics, therapeutics, management, prognosis)

5. Congenital and acquired disorders of the uterine tubes and uterus (e.g., hydrosalpinx, uterus unicornis, leiomyoma, endometritis, pyometra)

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9-5-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

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9-5-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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9-5-C Comments:

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9-6

9. Clinical approach to conditions of the non-pregnant female (diagnostics, therapeutics, management, prognosis)

6. Congenital and acquired disorders of the vulva, vestibule and vagina (e.g., persistent hymen, coital exanthema, prepubertal and peripubertal vaginitis)

9-6-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

9-6-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

9-6-C Comments:

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9-7
9. Clinical approach to conditions of the non-pregnant female (diagnostics, therapeutics, management, prognosis)

7. Congenital and acquired disorders of the bladder and urethra (e.g., ruptured bladder, urethral mass)

9-7-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

9-7-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

9-7-C Comments:

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9-8

9. Clinical approach to conditions of the non-pregnant female (diagnostics, therapeutics, management, prognosis)

8. Genetic testing and assessment (species/breed-specific testing)

9-8-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

9-8-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

9-8-C Comments:

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10-1

10. Clinical approach to conditions of the pregnant and postpartum female (diagnostics, therapeutics, management, prognosis)

1. Exam of the reproductive tract (e.g., palpation, ultrasonography, culture; hormone levels, CMT)
10-1-I How important is it for new diplomates to have knowledge in this area?

❚ ▼ Not important (0) ... Very important (3)

10-1-F How often do you perform tasks that require skills or knowledge in this area?

❚ ▼ Never (0) ... Frequently (3)

10-1-C Comments:

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Page Break
10-2

10. Clinical approach to conditions of the pregnant and postpartum female (diagnostics, therapeutics, management, prognosis)

2. Disorders of pregnancy (e.g., vaginal prolapse, hydropic conditions, abdominal hernia, placentitis, pregnancy toxemia)

10-2-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

10-2-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

10-2-C Comments:

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Page Break
10-3
10. Clinical approach to conditions of the pregnant and postpartum female (diagnostics, therapeutics, management, prognosis)

3. Dystocia causes (e.g., primary/secondary uterine inertia, fetomaternal disproportion, abnormal presentation)

10-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

10-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

10-3-C Comments:

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Page Break
10. Clinical approach to conditions of the pregnant and postpartum female (diagnostics, therapeutics, management, prognosis)

4. Dystocia management (e.g., obstetrical maneuvers, controlled vaginal delivery, fetotomy, cesarean section)

10-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

10-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

10-4-C Comments:

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10-5
10. Clinical approach to conditions of the pregnant and postpartum female (diagnostics, therapeutics, management, prognosis)

5. Fetal monsters (e.g., Schistosomus reflexus, arthrogryposis, anasarca)

10-5-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

10-5-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

10-5-C Comments:

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Page Break
10. Clinical approach to conditions of the pregnant and postpartum female (diagnostics, therapeutics, management, prognosis)

6. Disorders of the postpartum period (e.g., recto-vaginal trauma, uterine prolapse, uterine artery rupture, hypocalcemia, retained fetal membranes, metritis, eclampsia, lactational anestrus)

10-6-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

10-6-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

10-6-C Comments:

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Page Break
10-7
10. Clinical approach to conditions of the pregnant and postpartum female (diagnostics, therapeutics, management, prognosis)

7. Disorders of the mammary gland (e.g., agalactia, mastitis, neoplasia)

10-7-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

10-7-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

10-7-C Comments:

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Page Break
10-8
10. Clinical approach to conditions of the pregnant and postpartum female (diagnostics, therapeutics, management, prognosis)

8. Induction abortion/parturition (e.g., indications and limitations, non-hormonal methods, hormone actions and dosage/protocol)

10-8-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

10-8-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

10-8-C Comments:

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Page Break
10. Clinical approach to conditions of the pregnant and postpartum female (diagnostics, therapeutics, management, prognosis)

9. Endocrine disruptors and metabolic diseases (e.g., effect of drugs on pregnancy, lactation, diabetes, PPID, insulin disregulation, mycotoxins)

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10-9-I How important is it for new diplomates to have knowledge in this area?

▲ Not important (0) ... Very important (3)

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10-9-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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10-9-C Comments:

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________________________________________________________________
11. Clinical approach to pregnancy wastage

1. Pregnancy wastage investigation (e.g., epidemiological record analysis, exam of aborting female, necropsy findings of aborted/stillbirth animals, collection of samples for laboratory tests, laboratory test options)

11-1-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

11-1-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

11-1-C Comments:
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Page Break

Page 91 of 138
11-2
11. Clinical approach to pregnancy wastage

2. Embryonic death (e.g., occurrence and causes, clinical signs)

11-2-1 How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

11-2-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

11-2-C Comments:

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Page Break
11. Clinical approach to pregnancy wastage

3. Bacterial causes (e.g., brucellosis; leptospirosis, campylobacteriosis)

11-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

11-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

11-3-C Comments:

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________________________________________________________________
11. Clinical approach to pregnancy wastage

4. Viral causes (e.g., PRRS virus, feline panleukopenia virus, equine herpes virus)

11-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

11-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

11-4-C Comments:

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Page Break
11. Clinical approach to pregnancy wastage

5. Protozoal causes (e.g., trichomoniasis, toxoplasmosis, neosporosis)

11-5-1 How important is it for new diplomates to have knowledge in this area?

- Not important (0) ... Very important (3)

11-5-F How often do you perform tasks that require skills or knowledge in this area?

- Never (0) ... Frequently (3)

11-5-C Comments:

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Page Break
11.6
11. Clinical approach to pregnancy wastage

6. Fungal causes (e.g., Aspergillus, Mucor)

11-6-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

11-6-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

11-6-C Comments:
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Page Break
11-7
11. Clinical approach to pregnancy wastage

7. Teratogens and toxins (e.g., drugs, toxic plants, mycotoxins)

11-7-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

11-7-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

11-7-C Comments:

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Page Break
11-8
11. Clinical approach to pregnancy wastage

8. Other non-infectious causes (e.g., iatrogenic, nutritional deficiencies, heat stress, hypoluteoidism, twinning in mares, endometrial health)

11-8-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

11-8-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

11-8-C Comments:

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12-1
12. Neonatology

1. Assessment of neonates (e.g., postpartum and neonatal viability scoring, passive transfer evaluation, limb deformities, conditions caused by the birthing process, congenital conditions, hernias)
12-1-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

12-1-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

12-1-C Comments:

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Page Break
12. Neonatology

2. Neonatal care (e.g., resuscitation, colostrum/plasma supplementation orphan neonates, husbandry, assessment of environment)

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12-2-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

---

12-2-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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12-2-C Comments:

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Page Break
12-3
12. Neonatology

3. Neonatal development (e.g., suckling reflex, body weight doubling, eyes opening)

12-3-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

12-3-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

12-3-C Comments:

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Page Break
12. Neonatology

4. Clinical assessment and management for neonatal disease and surgery (sepsis, neonatal isoerythrolysis, cleft palate, patent urachus, intestinal obstruction/colic, septic joints, angular limb deformities)

---

12-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

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12-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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12-4-C Comments:

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13. Urogenital surgery (female)

1. Vaginal vestibular surgery (e.g., urine pooling, hymenal remnant, Buhner's vulvar suture technique, vaginal septum)
13-1-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

---

13-1-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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13-1-C Comments:

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13-2
13. Urogenital surgery (female)

2. Cervical surgery (e.g., lacerations, fibrosis, cervical wedge resection)

<table>
<thead>
<tr>
<th>13-2-I How important is it for new diplomates to have knowledge in this area?</th>
</tr>
</thead>
<tbody>
<tr>
<td>▼ Not important (0) ... Very important (3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13-2-F How often do you perform tasks that require skills or knowledge in this area?</th>
</tr>
</thead>
<tbody>
<tr>
<td>▼ Never (0) ... Frequently (3)</td>
</tr>
</tbody>
</table>

13-2-C Comments:
__________________________________________________________________________
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__________________________________________________________________________
13. Urogenital surgery (female)

3. Uterine surgery (e.g., Cesarean section, hysterectomy, mass removal)

13-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

13-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

13-3-C Comments:

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Page Break
13. Urogenital surgery (female)

4. Ovarian surgery (e.g., ovariectomy, ovarian remnant syndrome, colpotomy, cyst removal)

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13-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

---

13-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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13-4-C Comments:

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13-5

13. Urogenital surgery (female)

5. Routine desexing surgeries (OHE, OVX)

13-5-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

13-5-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

13-5-C Comments:

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Page Break
13-6
13. Urogenital surgery (female)

6. Perineal surgery (e.g., Caslick's, episiotomy, perineal repair)

-------------------------------------------------------------

13-6-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

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13-6-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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13-6-C Comments:

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13-7

13. Urogenital surgery (female)

7. Effects of gonadectomy on general health and welfare, growth performance

13-7-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

13-7-I How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

13-7-C Comments:

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________________________________________________________________
14. Urogenital surgery (male)
   1. Penile surgery (e.g., amputation, reefing, urethrostomy, trauma)

---

14-1-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

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14-1-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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14-1-C Comments:

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Page Break
14. Urogenital surgery (male)
   2. Testicular surgery (e.g., hemicastration, adult castration, prepuberal castration, testicular biopsy)

14-2-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

14-2-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

14-2-C Comments:

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Page Break
14. Urogenital surgery (male)
3. Accessory sex glands surgery (e.g., prostate, vesicular glands)

14-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

14-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

14-3-C Comments:

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Page Break
14-4
14. Urogenital surgery (male)
   4. Teaser preparation (e.g., penile translocation, vasectomy, epididymectomy, penopexy)

   ▼ Not important (0) ... Very important (3)

   ▼ Never (0) ... Frequently (3)

   ▼ Comments:

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   __________________________________________
14-5

14. Urogenital surgery (male)
   5. Prepuce surgery (e.g., diverticulectomy, amputation)

14-5-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

14-5-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

14-5-C Comments:

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Page Break
14-6
14. Urogenital surgery (male)
6. Effects of gonadectomy on general health and welfare, growth performance

14-6-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

14-6-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

14-6-C Comments:

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________________________________________________________________________
15. Artificial insemination

1. Semen collection techniques and procedures

---

15-1-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

---

15-1-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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15-1-C Comments:

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Page Break
15. Artificial insemination

2. Requirements for sanitation, hygiene and quality control

15-2-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

15-2-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

15-2-C Comments:

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Page Break
15. Artificial insemination

3. Producing fresh and cooled extended semen doses (e.g., semen extenders, processing, packaging, and transporting, breeding dose quantity/quality, sperm cold shock)

15-3-1 How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

15-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

15-3-C Comments:

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Page Break
15. Artificial insemination

4. Producing frozen semen doses (e.g., semen extenders, processing and packaging, breeding dose quantity/quality, sperm cryobiology)

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15-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

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15-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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15-4-C Comments:

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15-5
15. Artificial insemination

5. Insemination techniques (e.g., choice of method according to species/semen type, deep-horn insemination, endoscopy-guided insemination)

15-5-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

15-5-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

15-5-C Comments:
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Page Break
15-6
15. Artificial insemination

6. Processing epididymal sperm (e.g., sperm harvest, semen extenders, processing and packaging)

15-6-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

15-6-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

15-6-C Comments:

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Page Break
15-7
15. Artificial insemination

7. Sexed semen production and use (e.g., X- and Y-chromosome bearing sperm differences, flow cytometry cell sorting, pregnancy rate and gender bias)

---

15-7-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

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15-7-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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15-7-C Comments:

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Page Break
15-8

15. Artificial insemination

8. Disease transmission through semen (e.g., potential pathogens, semen donor testing, control with semen antibiotics, import/export regulations)

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15-8-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

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15-8-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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15-8-C Comments:

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________________________________________________________________
16. Embryo technologies

1. In vivo embryo production (e.g., indications, limitations, expected outcomes)

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16-1-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

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16-1-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

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16-1-C Comments:

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Page Break
16-2-I
16. Embryo technologies

2. Requirements for sanitation, hygiene and quality control

16-2-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

16-2-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

16-2-C Comments:

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Page Break
16. Embryo technologies

3. Superovulation (e.g., hormone treatment protocols and basis)

16-3-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

16-3-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

16-3-C Comments:

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Page Break
16-4
16. Embryo technologies

4. Embryo recovery and transfer techniques (e.g., surgical and non-surgical)

16-4-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

16-4-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

16-4-C Comments:
16. Embryo technologies

5. Recipient synchronization (e.g., hormone treatment protocols and basis, pregnancy rates according to synchrony)

16-5-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

16-5-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

16-5-C Comments:

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Page Break
16-6
16. Embryo technologies

6. Oocyte aspiration techniques (e.g., excised ovaries, ultrasound-guided aspiration)

16-6-I How important is it for new diplomates to have knowledge in this area?
▼ Not important (0) ... Very important (3)

16-6-F How often do you perform tasks that require skills or knowledge in this area?
▼ Never (0) ... Frequently (3)

16-6-C Comments:
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16. Embryo technologies

7. In vitro embryo production (e.g., indications, limitations, and expected outcomes, media requirements, timing, oocyte maturation, sperm selection, in vitro fertilization, embryo culture)

16-7-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

16-7-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

16-7-C Comments:

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Page Break
16-8
16. Embryo technologies

8. Intracytoplasmic sperm injection (e.g., indications, limitations, and expected outcomes, equipment, sperm selection, oocyte injection procedures)

16-8-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

16-8-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

16-8-C Comments:

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16-9
16. Embryo technologies

9. Embryo evaluation and classification (e.g., stage of development, morphology/quality)

16-9-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

16-9-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

16-9-C Comments:

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Page Break
16-10

16. Embryo technologies

10. Embryo cryopreservation (e.g., in-vivo vs in-vitro embryos, processing and packaging, embryo cryobiology, vitrification)

16-10-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

16-10-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

16-10-C Comments:

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Page Break
16. Embryo technologies

11. Disease transmission through embryos (e.g., potential pathogens, oocyte and semen donor testing, control through processing, import/export regulations)

16-11-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

16-11-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

16-11-C Comments:

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Page Break
16-12
16. Embryo technologies
12. Somatic cell nuclear transfer (e.g., indications, limitations, and expected outcomes, procedures overview)

16-12-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

16-12-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

16-12-C Comments:

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Page Break
16-13
16. Embryo technologies
13. Gene-editing technology (including CRISPR) and uses in reproductive medicine

16-13-I How important is it for new diplomates to have knowledge in this area?

▼ Not important (0) ... Very important (3)

16-13-F How often do you perform tasks that require skills or knowledge in this area?

▼ Never (0) ... Frequently (3)

16-13-C Comments:

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Please use the sliders below to indicate how often you are required to use each competency. Your choices must total 100%.

1. Normal male reproductive anatomy and physiology (1)
2. Normal female reproductive anatomy and physiology (26)
3. Fertilization, embryology, and sexual differentiation (27)
4. Pregnancy (28)
5. Eutocia (33)
6. Breeding management and population control (34)
7. Pharmacology (35)
8. Clinical approach to conditions of the male (36)
9. Clinical approach to conditions of the non-pregnant female (37)
10. Clinical approach to conditions of the pregnant and postpartum female (38)
11. Clinical approach to pregnancy wastage (39)
12. Neonatology (40)
13. Urogenital surgery (female) (41)
14. Urogenital surgery (male) (42)
15. Artificial insemination (43)
16. Embryo technologies (44)

How well did this survey cover the important knowledge areas required to be an ACT Diplomate?

- [ ] Completely (1)
- [ ] Adequately (4)
- [ ] Inadequately (5)

Please list any additional knowledge areas that were not covered by this survey.

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Do you have any additional comments, questions, or concerns you would like to share?

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## Appendix B: Subject Matter Expert Participants

<table>
<thead>
<tr>
<th>Name</th>
<th>Year Certified</th>
<th>Species Focus</th>
<th>Primary Area</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Gary Althouse</td>
<td>1995</td>
<td>Swine</td>
<td>Academia</td>
<td>University of Pennsylvania</td>
</tr>
<tr>
<td>Dr. Leonardo Brito</td>
<td>2004</td>
<td>Bovine/Equine</td>
<td>Academia</td>
<td>University of Pennsylvania</td>
</tr>
<tr>
<td>Dr. Julie Cecere</td>
<td>2013</td>
<td>Small animals</td>
<td>Academia</td>
<td>Virginia Tech</td>
</tr>
<tr>
<td>Dr. Cheryl Lopate</td>
<td>1997</td>
<td>Small animals</td>
<td>Private practice</td>
<td>Reproductive Revolutions, OR</td>
</tr>
<tr>
<td>Dr. Kristina Lu</td>
<td>2004</td>
<td>Equine</td>
<td>Private practice</td>
<td>Hagyard, KY</td>
</tr>
<tr>
<td>Dr. Bret McNabb</td>
<td>2012</td>
<td>Bovine</td>
<td>Academia</td>
<td>University of California, Davis</td>
</tr>
<tr>
<td>Dr. Carlos Pinto</td>
<td>1997</td>
<td>Equine</td>
<td>Academia</td>
<td>Louisiana State University</td>
</tr>
<tr>
<td>Dr. Jennifer Roberts</td>
<td>2015</td>
<td>Bovine</td>
<td>Industry</td>
<td>Boehringer Ingelheim, MI</td>
</tr>
</tbody>
</table>
Appendix C: Educational background (other)

Bachelor of Science, Veterinary Science

BVMS
BVMS
BVMS
BVMS
BVSc
BVSc
BVSc
BVSc & AH
BVSc & AH
CVA
CVA
DMV
Dr med vet
DrPH

Fellow, Royal College of Veterinary Surgeons

M. Phil Theriogenology

MA

Master of education

Post doctoral fellow
Appendix D: Advanced Degrees

1991 Australian Veterinary Specialist (Equine Reproduction)
1991 Member (Animal Reproduction) Australian and New Zealand College of Veterinary Science
1992 Fellow (Canine Reproduction) Australian and New Zealand College of Veterinary Science
ABVP (Equine)
ABVP (equine), ACT
ACT university of florida
AETA (American Embryo Transfer Association) Certified
American College of Veterinary Pathologists
B.S. Animal Science & DVM from Iowa State University
B.S. Brigham Young University, Animal Science
Bachelor of Science- Auburn University, Master of Agriculture- Auburn University, Doctor of Veterinary Medicine- Lincoln Memorial University, Theriogenology Residency- Texas A&M University (passed board certifying examination in 2023)
BIT ( Uni Canberra), BLM (CQ University), MANZCVS
BS - UMass
BS in agriculture at Tennessee Tech University
BS, AS
BScAgr(HONS) (USYD) BScVetBiol/BVMS(HONS) (Murdoch) PhD (USYD)
BVetMed, CertAVP(ESM), DACT, MRCVS.
Certification in cattle reproduction (Japan, 1991)
Certification in ruminant reproduction (France, 1987)
Colorado State, MS, 2012
Completed comparative theriogenology residency from University of Missouri-CVM in September 2022
Cornell University: BS, DVM, Theriogenology Resident
Currently doing a PhD
CVA Chi Institute
CVA Chi Institute
D.V.M. Washington State University, Pullman, WA, Veterinary Medicine
DABVP
DABVP
DACT
DACT - Colorado State University
DACT - Colorado State University
DACT - OkState
DACT - Practice Route (Hagyard Equine Medical)
DACT - resident North Carolina State University
DACT (residency; certification)
DACT- alternate route"
DACT Louisiana State University
DACT Oklahoma State
DACT TAMU
DACT, American College of Theriogenologists
DACT: Auburn University
DACT: Virginia-Maryland CVM 2023
DACVIM (Small Animal Internal Medicine) - Residency UC Davis VMTH
DECAR
Degrees
DES (residency program at UdM, QC, Canada), postdoctoral studies (research in reproduction, 5 yrs)
Diplomate, American College of Theriogenologists
DrPH - Johns Hopkins
DVM - Kansas State
DVM - Kansas State University
DVM - Kansas State University CVM
DVM - Kansas State, MPH - Kansas State, PhD - Univ of TN
DVM - TAMU
DVM - Texas A&M
DVM - Tufts Univ 2004 (followed by internship)
DVM - UF
DVM - universidad de cordoba argentina
DVM - Universidade Federal de Minas Gerais
DVM - University of Minnesota
DVM & MS: Auburn University
DVM at University of Tennessee
DVM- Colorado State University
DVM Cornell University
DVM Michigan State Univ
DVM Michigan State, MS and DACT Texas A&M
DVM UC Davis
DVM University of Saskatchewan, 1982
DVM, LSU and PhD, Cornell University
DVM, Masters of Large Animal Surgery and Medicine - both from Auburn University
DVM, MS and DACT from VMCVM
DVM, MS- Michigan State University
DVM, MS Univ of FL
DVM, MS University of Illinois
DVM, MS, PhD, DACT - All earned at the University of Illinois
DVM, MSc, internship in bovine theriogenology, Residency in veterinary theriogenology
DVM, Oklahoma State University
DVM, University of Sao Paulo, Brazil
DVM: NC State
DVM: The University of Georgia
DVM: Venezuela
DVM; Auburn University
DVM-UC Davis
DVM-VMRCVM
DVSc - Ontario veterinary College, University of Guelph
DVSc University of Guelph
DVSc, U of Guelph
Epidemiology - University of Michigan
Equine Internship at New Jersey Equine
Executive Veterinary Program University of Illinois
Fellow of the Royal Veterinary College, Uppsala, Sweden
Fellowship, Royal College of Veterinary Surgeons
I am in the process of doing my doctorate at Charles Sturt University in Wagga Wagga Australia
M.S. Brigham Young University, Provo, UT, Animal Reproduction
MA Brain and Behavior Duke University
MANZCVS (Small Animal Medicine) - by examination
Master in Science, Sao Paulo State University
Master of Science, Louisiana State University
Masters degree in 1998
MEd James Cook University
Med. Vet. (DVM equivalent), Federal University of Goias
MPH - University of Minnesota
MS
MS - 2008
MS - Colorado State Univ with therio residency 2005-2007
MS - Colorado State University
MS - Kansas State University
MS TAMU
MS - University of Florida
MS - University of Minnesota
MS - Worcester Polytechnic Institute
MS and PhD at WSU
MS and PhD, University of Wisconsin-Madison, 1988 and 1990, respectively
MS at Washington State University
MS- Auburn University
MS- Colorado State University
MS Equine Reproduction- Texas A&M University
MS from UW-Madison 1989
MS from WSU
MS UC Berkeley
MS- UNESP, Brazil
MS University of Minnesota, PhD University of Minnesota, DSC Morocco
MS- University of Wyoming
MS, Iowa State University
MS, Ohio State University
MS, PhD from University of Missouri-Columbia
MS, Reproductive Physiology, West Virginia University, WV. 1989
MS, residency Univ Florida
MS: Oklahoma State University
MS; Michigan State University, Animal Science
MSc - University of Saskatchewan Canada
MSc and PhD, University of Florida
MSc University of Illinois, USA
MSc: University of Saskatchewan
MS-CSU
MS-UC Davis
MV, University of La Pampa, Argentina
MVSc (RAU, Bikaner), Ph.D., Residency and MVSc (University of Saskatchewan)
Noate: ACT diplomate 2023
Passed ACT boards 2016, therio paper published and diplomat 2018
Passed board exam but have not written the paper for Diplomate status
Ph.D. University of Kentucky, Lexington, KY, Veterinary Science (Infectious Diseases)
PhD - 2013
PhD - Colorado State Univ (CSU)
PhD - Cornell
PhD - Louisiana State University
PhD - Univ of PA School of Medicine
PhD - University of Calgary
PhD - university of Tennessee
PhD (Comparative Pathology) UC Davis
PhD Cornell
PhD- Gluck Equine Research Center
PhD in comparative and experimental medicine at University of Tennessee
PhD James Cook University
PhD LSU
PhD North Carolina State University
PhD Reproductive Physiology- Texas A&M University
PhD UC Davis
PhD University of Illinois
PhD University of Minnesota 1984
PhD University of Pennsylvania
PhD, Colorado State University, USA
PhD, DVM - University of Minnesota
PhD, Iowa State University
PhD, Louisiana State University
PhD, Louisiana State University
PhD, University of Idaho
PhD: Washington State University
PhD; Auburn University, Biomedical Sciences
PhD-2016
Post doctoral degree- Auburn University
Post-doc 2010-2012 - on faculty at CSU since 2012
RCVS Recognised Specialist in Veterinary Reproduction (Equine)
Residence in Animal Health, INTA, Argentina
Residency - Cornell University
Residency - Cornell University
Residency in Equine Theriogenology- Texas A&M
Residency in Large Animal Reproduction at University of Pennsylvania
Residency: Texas A&M
Southpaws SA rotating internship 2013
Swine Production
Therio Residency: Texas A&M
Theriogenology Internship: Auburn University
Theriogenology residency - Cornell
Theriogenology Residency- University of Pennsylvania, New Bolton Center
Theriogenology residency: Washington State University
UGA CVM 2012
UPenn small animal reproduction pediatrics genetics residency 2016
Veterinary executive training from veterinary practice solutions, Business growth strategies from Goldman Sachs 10,000 businesses, USDA-SBIR phase I recipient from the USDA
Veterinary School and Residency University of Pennsylvania
VMD - Univ of PA SVM
VMD at University of Pennsylvania; MS Endocrinology/Reproductive Physiology at University of Wisconsin-Madison, MSc Livestock Health and Production/Epidemiology at Royal Veterinary College University of London

VMD-University of Pennsylvania
Appendix E: Geographic region (other countries)

Argentina
Australia
Australia
Australia
Australia
Australia
Australia
Australia
Australia
Australia
Australia
Australia
Australia - NSW
Belgium
Canada
Canada
Canada
Canada
Canada
Canada
Canada
Canada
Canada
Canada
Canada - West coast (Pacific North West)
Canada (SK)
Canada, Ontario
England
Germany
Grenada
Grenada
Israel
Netherlands
New Zealand
SE Australia
St Kitts & Nevis
UK
UK
United Kingdom
Appendix F: Primary employment type (other)

Academia (Clinics/Teaching/Research/Extension)
Academia, department chair
Corporate practice
PhD Student
Retired
Service dog school
Theriogenology Resident
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15-2. Requirements for sanitation, hygiene and quality control
4-7. Endocrinology of pregnancy
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1-2. Reproductive endocrinology
6-1. Normal breeding behavior
9-3. Abnormal cyclicity
15-5. Insemination techniques
1-1. Comparative anatomical structure and function
8-1. Exam of the reproductive tract
1-7. Sperm structure and function
2-1. Comparative anatomical structure and function
4-9. Gestational length
5-2. Stages of parturition
10-1. Exam of the reproductive tract
15-1. Semen collection techniques and procedures
9-1. Exam of the reproductive tract
2-2. Reproductive endocrinology
6-4. Estrous cycle monitoring
4-2. Pregnancy diagnosis methods
2-5. Estrous cycle
Appendix J: Additional knowledge area recommendations

All the topics are extremely important and should be known by a theriogenologist. In addition, in my opinion, all Theriogenologists should be doing and teaching all the topics listed. I found it depressing having surgeons and internal medicine diplomates performing some reproductive techniques that should be done by a Theriogenologist. We should elevate our profession and not become technicians.

ASc

BOARD CERTIFIED SHOULD HAVE KNOWLEDGE OF ALL - AS THOSE OF US IN THE FIELD NEED TO HAVE A REFERENCE

Breeds; nutrition; management

Communication

Ethics associated with reproductive biology and emerging conditions. Animal welfare - factors affecting it, how it can be assessed as this impacts most of what we do.

Ethics of breeding certain breeds; French bull dogs - Caesarian section? Catering to dog breeders

Exotic animals.

How to answer the exam questions. Most of the time we know the answer but do not know how to answer.

I am not completely sure what the intent of this survey was. If there is concern about the topics covered on the ACT examination, each one of these areas, with the possible exception of anesthesia, is critical to being a specialist in reproduction. These topic areas provide the building blocks for a good clinician and a reproductive expert. A new ACT Diplomate should be smarter than the rest of us and have a strong working knowledge of all of these topics. While I may not remember exact details of things like sexual differentiation I have a working knowledge to draw from as I problem solve clinical conditions. Also, as an educator, having a solid basis in reproductive processes of all species makes me a better teacher. Exam committee, you are doing a great job. Thank you for critically evaluating the process and the examination. Please never lose sight of the fact that we are specialists in our field. The exam should never be easy, otherwise everyone could be an ACT Diplomate. The members of our college are incredibly intelligent and talented. While I do not adhere to the premise that others must "walk 10 miles in the snow to school" like I did (haha) I do believe that one must not lose sight of the rigorous examination process that demonstrates the intellectual depth that Diplomates in our College possess.

I noticed one question about teratology and toxins. I wonder if there would be a touch more about that asked.
I think in order to accurately tease out points that need to be clarified, more questions with more specific content would have been better able to differentiate btw "impt and not impt". The question about teaser Sx was good, sexed sperm use. I worry that my answers are not going to provide my variation even though I feel that the current test covers areas that are less practical and are more trivia (pocket pet information that we rotely memorize but then forget, but know where to go look it up).

I think it was very thorough. Good job!

I think there is a separation between what a boarded reproductive specialist should know and what they can do in a clinical setting. Although I don't freeze on a regular basis, I still need to explain the process and understand it when handling frozen semen for breeding. I have never done an ovary sparing Sx, but I need to understand it well enough to explain the pro:con to clients. I think we should focus on a broad base of practical knowledge and minimize the non-clinical knowledge base. As a specialist, I should have a basic understanding of a procedure but not necessarily perform those tasks in clinic (ie - gene manipulation)

Knowledge of reproductive pathology, specifically practical applications of histopathology such as the equine endometrial biopsy are not covered.

Microbiome male

More emphasis on internal medicine and effects on reproduction

Other ARTs that are upcoming such as spermatogonial stem cell transfer, in vitro gametogenesis, and artificial womb - although these are not commercially available yet, I believe a specialist should be aware that work is being done in these areas and the baseline premise. I also wonder if we should consider adding reproductive aspects of bee breeding to our knowledge base as bees are growing as an agriculturally important species and are being added to veterinary core curriculum.

Reproduction related pathologies seemed to be marginally touched upon

Research or teaching

Some questions may need to be split out by the skill. e.g. critical to know sperm morphology but not as critical to know how flow cytometry works.

Specifics - such as non-antibiotic treatments, extralabel use of drugs,

The final part of totaling to a 100% did not feel realistic of clinical practice. All of those were on different days used as a part of being clinically competent. Even skills/tasks infrequently used in some species as compared to others are still commonly asked/discussed. As specialists, we should have knowledge in all those areas to continue giving clients evidence-based medicine and teaching next generations for their future research.

The percentage allocation is/was cumbersome - especially for those in comparative academic programs.
The use of epidemiology data is paramount for population medicine. Prevalence, sensitivity, specificity, positive predictive value, negative predictive values are important parameters when you use tests and for their correct interpretation. Diagnosis of mastitis, treatments, prevention, etc.

This seemed to be a very thorough representation of what a specialist in this area should know upon completion of a residency program. There were certain topics that related to advanced genetic testing in embryos, especially associated with ethics behind allowing an embryo to continue, but I do feel like this is the way of the future and should receive a large proportion of attention.

Understanding history of techniques and procedures should also be incorporated well.
Appendix K: Task-specific comments

1-1 Comparative anatomical structure and function

I no longer offer very many stallion services in my practice.

BSE of male bovines and canines was common in my practice (private and university)

Comparative approach is critical for anybody interested in exotics and to translate strengths in one species to other species

Essential

Even if we are not actively thinking about the anatomy, we are always using anatomy structure and function. Especially comparing the anatomy between species.

How can you know any pathology or normal semen collection methods without knowing this information?

I believe this is foundational information and essential for a theriogenologist to have in-depth understanding

I have a 65% teaching effort for anatomy, physiology and topics in theriogenology - this material is foundational to what I instill in day one ready veterinary students and therefore I consider it to be essential for diplomates

I retired 2m ago. Answers based on activities in academic setting over last 15-20y

I teach anatomy and relate reproductive anatomy to clinical cases. I also teach reproductive physiology and reproductive pathology.

I use this information regarding surgery and abnormal anatomy in puppies / kittens. I also use it during cases involving trauma / injuries to the genitals.

Now limited to primarily elephants

perform in breeding soundness evaluation of the male

Stallion work is not as common as mare work thus the sometimes. But when performed, the knowledge is critical

the ability to perform breeding soundness examinations and do routine infertility work-ups in male animals of the common veterinary species is a critical skill set for theriogenologists

The comparative part is not as important as mastery in a small subset of species

This is core knowledge for the practice of medicine and surgery

This is fundamental anatomy that is critical to problem solving clinical conditions.

This is vital for the basis of understanding normal castrations to cases such as paraphimosis
This should be a basic requirement for the examination; the general component Ultrasound of these structures is also very important
1-2  Reproductive endocrinology

Again, essential tools

From an internal medicine lens, the theriogenology folks need a far greater understanding in this area. There should be two components (a) general examination - basic concepts for all species (b) focus in the area of practice - small animal etc.

I do think that basic anatomy, physiology and endocrinology of both males and females is the foundation for each diplomate, although I personally work more with the female side of basic physiology than the male.

I have a 65% teaching effort for anatomy, physiology and topics in theriogenology - this material is foundational to what I instill in day one ready veterinary students and therefore I consider it to be essential for diplomates. While I don't expect someone to draw out pregnenalone to estrogen, I do expect them to understand the difference between a steroid hormone and a hypothalamic pituitary releasing hormone.

I have not yet used knowledge of steroidogenesis in a practical setting.

I teach reproductive physiology and pathology and relates this material to clinical cases.

I use this information regarding breeding timing, abnormal cycles in queens and bitches, changes in sperm morphology, exposure to exogenous hormones / toxins. I also get many calls from local DVM regarding these types of cases and need to explain / review the physiology / pathophysiology to DVM and then step it down to explain to clients.

Same as before, critical knowledge for a diplomate

This is core knowledge for understanding the physiopathology of reproductive disorders

This is used daily

To be able to properly examine the male reproductive tract and to determine if there is any abnormalities

Used for synchronization programs in a variety of species

Using our physiology tends to lead to understanding our pathology across species.
1-3 Testicular descent/migration

BSE

Cryptorchidism is one of the most common testicular abnormalities. Understanding the physiology of how testes descend and the regulation is a foundational knowledge that even undergraduate and DVM students should know. A specialist NEEDS to know this.

I get calls from local DVM, breeders and have referred cases regarding retained testicles (mono or bilateral) and the potential cause, treatment (which I ethically advise against), and Sx management (castration and the various locations retained testicle may be found and reasons for more than one incision, reasons for removal).

I rate this moderately important because with small animals, there is argument for not breeding males that even have a delayed descent or induced descent (manual or chemical). So when it comes to practical application, there is not much importance outside of knowing where the testicle might be for removal (which may be more related to anatomy).

If you do not understand testicular descent/migration as a day one veterinarian, how do you advise someone on a cryptorchid case? Again, this is day one DVM not DACT knowledge.

Important for pathophysiology and diagnosis of cryptorchidims in different species.

Important to understand when dealing with cryptorchid cases and explaining the canine heritability to clients.

Mainly important (practically) when diagnosing suspected cryptorchid.

More in relation to finding cryptorchid testicles or working up cases and diagnostics.

Necessary for cryptorchid cases etc.

One must understand this process to understand cryptorchidism.

part of routine exam of males.

This knowledge is important for cryptorchidism and intersex conditions.
1-4 Puberty

Determine age for breeding - both males and females

I have a minimum breeding age of 18 months so rarely see anything younger than this

If you do not understand puberty as a day one veterinarian, how do you advise someone timing to castration? Again, this is day one DVM not DACT knowledge

Important for breeding soundness exam, reproductive management

Maybe more important in production animal species, but the understanding of this is necessary to be able to plan with regards to breeding potential and time frame, and to properly advise clients

More in relation to herd work and managing breeding programs in a group setting.

Puberty is a seismic event in reproductive physiology and changes in anatomy, behavior, production, etc. All vets need to know this and again a specialist MUST know this

Students need to understand the comparative aspects of puberty across species.

This is more important perhaps for small animal as it pertains to OVH/neuter timing. I talk about this probably daily .... mainly from a nutrition lens, and "when should I nether - OVH" and why

This is still important, as others will look to you for proper guidance. It is not seen commonly in my practice

Very important when conducting breeding soundness exams

We discuss puberty, pro/con of surgical sterilization before or after puberty, home situation for delaying sterilization, reasons for delay, reasons for sterilization later in life if owner declines Sx at younger age. These discussions happen on a daily basis (several times a day).
1-5 Spermatogenesis

Again, this is day one DVM not DACT knowledge. Perhaps not every detail of spermatogenesis, but recognizing where in that process abnormalities may occur and how that is reflected in a semen sample as morphologic abnormalities (or azoospermia) is critical.

Basically using the knowledge lends itself to any BSE across species. Especially when owners want to understand changes or concerns we find during BSE work.

BSE

BSE and semen analysis of young vs old

Critical knowledge for evaluation of males

Essential

I use this information when discussing sperm changes in a stud dog or tom. What sorts of treatments can be used, when we would want to re-evaluate after starting therapy, how it may affect fertility, how we can manage females differently to enhance pregnancy / size of pregnancy using a stud with sub-optimal sperm.

Key area for understanding reproductive disorder in the male, sperm production and output, evaluation of breeding capacity, sperm morphology

Knowledge used when dealing with drugs affecting spermatogenesis in dogs

Need to add a section on reproductive microbiome for males - frequently performed, very important

Something that can be quantitatively and qualitatively evaluated in most species - how to do this is also important.

Spermatogenesis is critical for reproduction and again all DVMs should know this and a Specialist MUST know this process as it is absolutely critical for reproduction

This information is important for all students, especially those dealing with production animals.
1-6 Ejaculate constituents

Again, this is day one DVM not DACT knowledge. How else do you collect an ejaculate if you don't know what's in it?

Again, this is important for clinicians involved with semen collection, semen transportation, and ARTs.

Basic knowledge when performing male breeding soundness evaluation

Basis of male breeding soundness exam and semen processing

BSE and extension of semen for breeding and/or freezing

Essential

I use this information when discussing normal & abnormal semen collections, abnormal semen collections that arrive from outside the clinic, and what area of the anatomy the issue may be arising from - prostate, glans, testis. I also need to discuss / explain abnormal semen collection with other DVM or owners when they ship in a poor semen sample.

Knowing the contents of an ejaculate is critical for semen evaluation which is a fundamental task of reproductive specialists

Prostate gland information is VITAL for male dogs; ejaculate constituents important for shipping and freezing semen

Relevant for stallion collections and epididymal flushes

Semen assessments as part of a BSE in bulls -
1-7  **Sperm structure and function**

Based of male breeding soundness exam, infertility evaluation and semen processing

BSE morphology assessment for satisfactory breeder

Critical knowledge for breeding soundness evaluation

Essential

For every BSE and for teaching our students critical components they need to understand for practice

I use this information when doing sperm morphology, teaching staff about sperm morphology and when explaining abnormal sperm morphology to clients.

Important for the diagnosis of abnormalities of spermatogenesis

Semen evaluation is perhaps one of the most frequently performed analysis for reproductive specialist and these (sperm evaluation) is critical for this

Skills used daily in a semen lab

This is basic information needed for anyone involved in semen collection, semen transportation, and ARTs

This is certainly DACT knowledge. While we may not all be semen experts, the basics of this are essential for understanding fertility.

VITALLY IMPORTANT!!!  Semen evaluations necessary for pre-purchase, breeding, shipping, freezing, etc.

When I took the ACT test (that I did not pass) there weren't any questions or visual slides in this area, yet when we collect semen or perform AI on Canine, Equine, Bovine it is needed every time.  It is not emphasized enough.  It seems we only care about if it is normal or not and the location; head, midpiece, tail, which has little use.  Knowing the types of sperm morphological abnormalities is vital to help with understanding if there is a potential genetic trait, insults occurring when and types that may have contributed, prognosis, and the effects on potential fertility of the bull.  Yet these are seldom used or discussed including the ACT test.
1-8  Erection, emission, ejaculation, detumescence

Basis for male breeding soundness examination, erection and ejaculatory disorders during BSE

Especially when related to pathologic conditions or if any concerns after collect attempts across species

Essential

I use this information when discussing abnormal collection process to owners. I also discuss this problem with local DVMs and stud owners that are having issues with collection for shipment to our clinic.

Should be basic knowledge for all veterinarians

These are basics needed to evaluate breeding soundness.

These are critical components for understanding infertility along with spermatogenesis and endocrinology.

This is certainly DACT knowledge. While we may not all be collecting males, the basics of this are essential for understanding fertility.

Usually this works fine but as a specialist, problems of erection, emission, ejaculation, and detumescence is critical for managing problem studs
1-9 Sexual behavior

Basic andrology knowledge

Essential

I use this information daily in puppy / kitten appointments, when/why we want to sterilize, pro:con of sterilization before or after puberty, the effect of puberty on behavior, and what behavior is not affected by puberty.

Not always used knowledge but an ACT should know it

Questions from clients and assessment of breeding capabilities

Teasing and collection understanding

This is certainly DACT knowledge. The basics of this are essential for understanding fertility.

This is important knowledge for breeding soundness

Very important for stud management, behavioral problem, semen collection and disorders of ejaculation and herd management
1-10 Reproductive senescence

It is important to understand this relative to species differences.

Many of our domestic species are seasonal and experience an annual senescence. This is critical for a DACT.

Not a very common occurrence in domestic species, perhaps seen in horses more than other species but the concept is well known in humans and we should know it is possible when managing older females.

Particularly important in companion animals in may case stallion and male camelids.

Tends to be more concern in equine and some canine work.

The majority of our clients have their dogs/cats sterilized after they have finished their breeding careers. I have a few that want them to remain intact. This information is needed for those occasional animals that develop age related issues: BPH, testicular tumors, mammary masses, irregular estrous cycles.

Varies across species and is basic knowledge for diplomate.

Very common conversation in managing aged animals and breeding schedules.
2-1 Comparative anatomical structure and function

Essential

I use this information for surgery, dealing with abnormal anatomy (intersex cases, abnormal development), explaining to clients and local DVMs issues that may arise during surgery.

If one does not understand the fundamentals of anatomy, endocrinology and physiology of the reproductive system it is impossible to problem solve. Understanding from a comparative basis is essential, and that comment comes from someone that works in one species.

Mastery of a few species crucial mastery of all species not as important

Normal is necessary to understand abnormal

Per rectum palpation in large animal species as well as OHE, lap ovarioectomy, knowledge of female's normal reproductive anatomy as well as abnormal

Same as for normal male

See responses for male

Similar to male anatomy structure and function

Similar to the comparative anatomy and physiology of the male, comparative evaluation of the female anatomy and physiology allows the ability to translate work in exotic species and to learn from other species when dealing with reproductive abnormalities

The is a fundamental area for any clinical examination and surgical procedure in theriogenology

These basics are essential.

This is basic fundamental that's super important in training ... maybe not so much afterwards
2-2 Reproductive endocrinology

Core knowledge for clinical theriogenology in the female

Daily manipulation of oestrous cycles in practice

Essential

Explain normal animal behavior and responses as well as determine those that are abnormal

HPG axis is important, steroidogenesis less so

Most vets work on the female side and knowledge of anatomy and physiology is absolutely critical for the management of reproduction

Same as before, this is critical knowledge for diplomate

See previous comment under male.

Tends to lend itself to maintenance of pregnancy or cycle manipulation concerns

These basics are important. I teach this information in Reproductive Anatomy, Physiology and Pathology.
2-3  Puberty

A lot more for heifer selection work in our practice

Client questions as well as knowing when to breed, what is normal and abnormal

Clinical management of reproduction, reproductive disorders, and disorders of sexual development

Essential

It is particularly important to understand comparative aspects of puberty.

Puberty of females is similar to the puberty management of males. Important for production, understanding changes to anticipate as a female is at pubertal age but maybe not something we work with daily

See previous comment under male

See responses for male

Varies across species and should be basic knowledge for a diplomate

While rarely evaluated, the knowledge is necessary to know when discussing management options and when to initiate evaluation of breeding animals
2-4 Oogenesis

Basic knowledge

Due to the nature of mammalian reproduction, the female repro physiology understanding is the backbone of reproductive management in any species.

Essential

Examining follicles and dynamics during cycle and determining ovulation very important

Follicular dynamics and ovulation are evaluated clinically on a daily basis. Understanding the steps that lead up to dominant follicular development and ovulation are a must for a specialist and do become important on problem breeder cases that are seen more frequently in a specialty clinic.

For most breeding management across species

I use this information when discussing abnormal ovulation, but I don't go into great detail w/clients or DVMs. It seems to be too much information for them. I think it is important for myself when thinking through abnormal cases.

See responses for male. This is also my area of research and I find my existing therio colleagues to be capable in this area.

Synchronization

These are important basics that I teach in reproductive anatomy, physiology, and pathology.

This is relevant to all my work in equine, ruminants and camelids. Basis for estrus synchronization, IVF

Understanding oogenesis and follicular development is absolutely critical for the management of cyclicity and breeding management.
2-5  Estrous cycle

Core knowledge, important for estrus synchronization, maternal recognition of pregnancy

Essential

I use this information almost daily when reviewing breeding timing, first cycle in puppies, behavior changes in queens, most fertile period for breeding or avoiding pregnancy.

See responses for male. This is also my area of research and I find my existing therio colleagues to be capable in this area.

Synchronization and is responding properly

The extension of follicular development, management of the corpus luteum for pregnancy maintenance, luteolysis for cycle management is an absolutely critical physiology to understand in detail

These are basics that I teach in reproductive anatomy, physiology, and pathology.

Varies by species and is essential basic knowledge
2-6 Behavior

All stages of the cycle in the horse - peri-pubertal, anoestrus, transitional and cycling

Basic knowledge for clinical theriogenology and behavioral problems, neonatology

Behavior usually matches with reproductive physiology but less so than evaluating specific gonadal status but it is a useful ancillary test that is used by owners and breeders

Essential

Essential knowledge

I use this information daily. See comment under male.

See responses for male. This is also my area of research and I find my existing therio colleagues to be capable in this area.

These are clinically relevant concepts. I teach these in reproductive physiology.
2-7 Reproductive immunology

Assuming this question relates to infections in regions of the reproductive tract, as well as maternal recognition of pregnancy and tolerance of the allogeneic embryo, and the etiology and management of placentitis.

Essential

I use this information regarding vaccination prior to breeding, colostrum quality and when to start vaccinating puppies. Honestly, most clients understand about vax prior to pregnancy and no one so far has been interested in testing the dam for predicting when and what to vaccinate puppies.

It is important to understand the immunology of newborns relative to placentas, colostrum, etc.

More in cases of pregnancy toxemia or concerns for periparturient conditions related to immune system changes.

Most reproductive physiology is directly or peripherally associated with immune system so understanding immunology of reproduction is useful.

This is a growing area of knowledge in theriogenology (and veterinary medicine in general) and is critically important for creation of, recognition of, and maintenance of pregnancy and will influence clinical practice.

While rarely discussed and evaluated now, this is a developing topic in research and clinical application.
Reproductive microbiology and microbiome

A developing topic - very important to understand but not all mentors maybe knowledgeable on the topic and latest research. This is one of the topics that a study guide or recommended scientific journal articles could be specifically described to guide a candidate or new diplomat in study.

Emerging area. Likely to increase in importance

Essential

I use this information when dealing with vulvar discharge in puppies and rarely kittens/queens. I also use this information when discussing preputial discharge in dogs.

Important for diagnosis of infectious disorders of the reproductive system. I am not sure about the microbiome. The later is very interesting but it seems too early to consider it in practice

Microbiology is more important in some species than others. there are some common and important microbial infections, especially in some species. The microbiome of the reproductive tract is a growing area but not quite clinically relevant on a daily basis

Need to have same section in males

Overuse of antibiotic therapy as a first response should be discouraged

Seems to be a growing area. Not used clinically as much

So important when dealing with pyometra

This is a field that needs more research and education

This is a growing area of knowledge in theriogenology (and veterinary medicine in general) and is critically important for creation of and maintenance of pregnancy and will influence clinical practice.

This is an emerging field that may become more important as our understanding increases.
2-9 Reproductive senescence

Frequent discussion when managing aged animals

Huh, I guess I misunderstood the question for males (which is less important). Reproductive senescence is far more important in the female

I assume by this you are also including seasonal anestrus/other causes of anestrus? Not just age?

Important for IVF, ICSI and dealing with aged companion or valuable female

making culling decisions/not breeding any longer - knowing abnormal

Mares are living longer

More for older mares and bitches

See response to male. Many of our domestic females are seasonally senescent so this understanding is critical.

The majority of my clients sterilize their animals when their breeding career is complete.

This is important from a comparative aspect - knowing which species exhibit this and when.
2-10  Lactation

Excellent knowledge in reproductive anatomy and physiology is the basis for being a good theriogenologist, I feel that this area is neglected more and more by the recent applicants (personal observation)

From an endocrinology perspective, this is essential knowledge for offspring wellbeing and inappropriate lactation, which we get called about frequently.

I teach the basics in physiology. Students going into reproduction of dairy herds probably need additional training in this area.

I use this information with timed c-sections, first time mothers, mastitis cases, large or small litter management

Induction of lactation

Management of the postpartum period is a common task so lactation is an important component of that. Also with the growing sanctuary/rescue industry in large animals, inappropriate lactation is a growing caseload for us.

Normal vs abnormal as well as production for offspring

Part of managing the parturient female and neonate. Colostrogenesis, lactation and disorders of the mammary gland are part of the reproductive process
3-1 Fertilization process

Again, fundamental part of breeding management that we need to know and manage for our most routine caseload

Essential

I teach this in reproductive physiology.

I think this information is important when thinking through cases, but I rarely explain this process to clients or DVMs calling with questions.

more in relation to ART work. Depends on the program for how much IVF or ICSI type work they perform

This area is important for understanding infertility - similar to steriodogenesis, every single molecular signal may not be essential for a DACT clinician vs. a non-researcher, but certainly an ability to navigate the literature or a challenging case is essential...

This is core knowledge for in vitro production of embryo, sperm function and evaluation of reproductive loss.

This knowledge helps drive my breeding timings in relation to the female cycle and semen processing.
3-2    Embryonic stages of development

Again relates to amount of IVF, ICSI, and ET work for the program

I think a person specializing in reproduction should understand this process. However, I rarely use this information to explain cases to other DVMs or clients.

I work with ART so this is of particular interest for me but for a regular ACT diplomate I would say it is more of a moderate importance

Important for understanding embryocryopreservation and embryo transfer, which may become more common in the future in the dog

Key areas for understanding all embryo technologies

Really critical for embryo transfer work in practice

This area is important for understanding infertility and given the frequency of DACT who do ET, this is essential for a DACT.

This is most important for those students expecting to do work/research in development and areas such as transgenics.

What is a cytula?

While it seems we all follow a protocol - knowing when and why we perform embryo flushes and pregnancy examinations at certain times is a must for a specialist.
3-3  Cytogenetics

A minimum karyotypes and common abnormalities of the karyotypes are part of clinical understanding of reproductive disorder (abnormal differentiation)

I teach this in physiology and have been asked to relate this to the cell cycle by pathologists and oncologists.

I think is should be understood, but I rarely use this information on a detailed basis w/clients.

I work with ART so it is important to my work but for an average ACT diplomate it is more in the evaluation of disorders of sexual differentiation which is a smaller portion of the caseload

Rarely using. More applying the concepts for disorders of sexual development and early embryonic failure issues.

Similar to oocyte maturation and acrosome reaction, the molecular details may not be necessary for a clinician vs. a researcher, but using this knowledge as a DACT clinician is important.
3-4 Chromosome anomalies

Again, I work with ART so this is very important to my work but for an average ACT diplomate, it is of modest importance.

Even though tasks are uncommon, I think this is very important from a translational science and social perspective.

I teach this in order to understand developmental anomalies/intersex.

Important to understand breeding genetic issues for genetic counseling.

Recognizing as a cause of infertility more often as genomics are understood more.

See previous comment.

Similar to the previous question, the molecular details may not be necessary for a clinician vs. a researcher, but using this knowledge as a DACT clinician is important.
3-5 Embryonic anatomy and differentiation

Clinical practice: fetal gender determination

Even though tasks are uncommon, I think this is very important from a translational science and social perspective.

I teach this to help understand developmental anomalies/intersex conditions.

I use this information when discussing abnormal development in puppies/ kittens and when noted during surgery.

Important for Disorders of sexual development and for fetal sexing which is a relatively commonly done procedure, especially in equine and bovine work

In abnormal cases

More about cases of DSD and being able to properly identify and understand where the defect occurred.

Normal embryo anatomy on ultrasound across species at specific gestation time points

Similar to the previous question, the molecular details may not be necessary for a clinician vs. a researcher, but using this knowledge as a DACT clinician is important.

Toxicology
Maternal recognition of pregnancy

Although important to understand as a reproductive specialist, this rarely comes up for discussion with clients or other DVMs seeking advice.

Core knowledge to understand early pregnancy loss

Critical knowledge for diplomate

Determine when abnormalities could occur

Essential

It is important knowledge but less commonly evaluated by an average ACT diplomate's daily caseload.

Similar to the previous question, the molecular details may not be necessary for a clinician vs. a researcher, but using this knowledge as a DACT clinician is important.

The comparative aspect of this is important, particularly how this is incorporated into testing for pregnancy.
4-2  Pregnancy diagnosis methods

All these are integral part of any reproductive services.

Bread and butter of practice

Essential

I use this information almost daily with pregnancy diagnosis, explaining to clients and DVMs how to dx pregnancy.

Mainstay of our practice

Pregnancy diagnosis is super important for our regular breeding work.

Should have knowledge and skill set to determine pregnancy by multiple methods

Used almost daily in our practice

Very basic and important. I teach this as part of reproductive anatomy and physiology.

Very very important

While becoming an expert in each of these on all of the primary domestic species may be beyond the scope of a training program, understanding the basics of when to use these tools to assess pregnancy is essential.
4-3 Comparative placentation

Again, this is important for clinical outcomes and is essential for a practicing DACT. Although important to know, I rarely use this information when discussing cases w/clients or other DVMs. Clients' eye seem to glaze over when I get into this level of detail.

Core knowledge for clinical evaluation of pregnancy and for abortion work or postmortem exam

Equine only

Essential

Important for understanding pregnancy and maternal transfer as well as evaluation of placental function but not something an average ACT diplomate deal with on a daily basis

It is important to understand the species differences in placentation, particularly as they relate to antibodies passing to the fetus.

Knowledge of comparative placentation is necessary if you are going to work on more than one species

May our specialty always keep a multi-species base, at least for theory learning

This is just one example of the many instances in which we can take advantage of species comparison in therio; may as well stress my point using this slot, even though it will apply to others obviously. I have always thought, even as a newly graduate, that the comparative aspect of theriogenology across species is of high value in our specialty in comparison to other specialties. That is due to how easily it can be done, how much it aids in teaching (power of contrast) and how many gaps in the knowledge in one species is made evident by what we understand on another. It presents a continuous source of points for research.
4-4  Fetal development

Again, this is important for clinical outcomes and is essential for a practicing DACT. Especially in terms of gestational ageing across the species

I use this information during pregnancy u/s when reviewing study w/clients.

need for knowledge increasing with the increased frequency of in vitro embryo production and the monitoring of their development

Normal fetal aging

Not as common as pregnancy diagnosis but evaluating fetal development is important for high risk pregnancy and other problems with pregnancy which is a smaller portion of the caseload

Pregnancy and fetal well-being assessment, abortion and postmortem exam

This is important in some species more than others, particularly related to clinical problems that could be treated or conditions that could be avoided.
4-5 Polytocous pregnancy

Again, this is important for clinical outcomes and is essential for a practicing DACT.

Core for any work in clinical theriogenology applied for management of twins, pregnancy disorders, reduce prolificacy in prolific species and reproductive loss

Essential

Frequency increasing with in vitro embryo production

I do a fair bit of equine work so this is a critical issue for early pregnancy management of twins as well as maternal recognition and pregnancy diagnosis in horses. If a diplomate does not do any work with equines, it would be a lower importance

I don’t work with these species - therefor answered rarely

This depends upon the species. For example, it is very important in horses.

This was very important when I did equine reproduction, but rarely use it in dogs/cats.
4-6  Fetal circulation

I use this information when discussing heart murmurs (PDA) and liver issues (MVD vs PDV).

It is more of a niche knowledge that is helpful for neonatology and perinatology but not many cases require knowledge of this area.

Relevant for disorders of the neonate

This is another topic that is newer in some species. In equine, understanding vascular resistance issues can be related to fetal and/or placental compromise. This information can be helpful in managing a compromised pregnancy.

This is covered in anatomy relative to development of the heart and liver.

This is important for not only teaching day one ready DVMs but also clinical outcomes that are essential for a practicing DACT.
4-7 Endocrinology of pregnancy

Again, the relative importance is species specific. An example is the use of exogenous progesterone during gestation in horses and dogs. On the flip side there is the issue of pregnant animals exposed to environmental hormones or hormones being used by owners.

Again, this is important for clinical outcomes and is essential for a practicing DACT. Like pregnancy diagnosis or the estrous cycle - there may be variation, but the basics are critical.

I use this information when discussing pregnancy loss, fetal loss with remaining pregnancy still viable, Hx of pregnancy loss.

management of high risk pregnancies, maintenance of pregnancy

This is important to understand to evaluate the pregnancy, including pregnancy diagnosis and viability. It is a common question posed by rDVMs

Understand normal and abnormal pregnancy as well as abortion
4-8 Maternal hematologic changes

A bit more of a medical topic but overlaps and guides a treatment plan when managing a pregnant or post-partum mare with concurrent medical issues.

Clinical evaluation of the high risk pregnant female

I don't do that much neonatology so it is not something I use a lot of. I consult with my colleagues when dealing with neonatology but for those who do lots of work with this it is important

I get lots of calls from local DVMs and clients regarding pregnancy CBC/Chem. When I have questions and contact internal med consults (Idexx) even they are a bit flummoxed with interpreting these cases. Defiantly need more information and more instruction in this area.

Like immunology, this area is growing and is not just the purview of ACVIMs. If we relinquish this knowledge, we erode our value in the outcome of the pregnant female patient.

This is covered by others in physiology.

While working with canine species it was a constant. Not now that I work only with equine
4-9 Gestational length

Clinical management of high risk pregnancy, induction of parturition

I use this information almost daily when discussing pregnancy, scheduling c-section and calls from local DVMs.

Pregnancy and parturition management is an area that is important in my practice so I would say it is very important

See previous comments - many apply!

This is basic information all candidates should know.

Very important
4-10  Fetal well-being

Clinical management of high risk pregnancy, pregnancy toxemia, abortion

I look at the CTUP and check for foetal movement on every late term mare scan - even those expected to be normal - anything that feels or looks suspicious gets a more advanced work-up.

I use this during all my pregnancy u/s.

Like the previous answer, this area is growing and is not just the purview of ACVIMs or criticalists. If we relinquish this knowledge, we erode our value in the outcome of the pregnant female patient.

Similar as the last question, I use this frequently for the management of pregnancy and parturition

This is of importance in certain species, particularly horses and dogs.
5-1 **Endocrinology of parturition**

Again management of pregnancy and parturition does require this knowledge especially in companion animal but also for others

Core knowledge for induction of parturition and consequences on neonate

Essential

I use this information when discussing natural whelp vs schedule c-section and why we use progesterone and u/s to gage the best time for scheduled c-section.

See previous answer, this area is growing and is not just the purview of ACVIMs or criticalists. If we relinquish this knowledge, we erode our value in the outcome of the pregnant female patient or the neonate.

The initial trigger is still unknown,

This knowledge is important relative to clinical issues.
5-2  **Stages of parturition**

Comparative species differences are important.

Critical for client education and obstetrical intervention

Essential

I use this information when discussing cases w/clients and local DVMs.

Obstetrics is another area of great interest for me so this is a critical issue and one that many/most ACT diplomates will have to deal with

See previous answer, this area is growing and is not just the purview of ACVIMs or criticalists. If we relinquish this knowledge, we erode our value in the outcome of the pregnant female patient or the neonate.
5-3 Techniques for monitoring parturition

Again, an interest of mine and a big part of our caseload. This knowledge is important again, these are species specific and more important in some species than others. Critical for companion and valuable animals. Management of high risk pregnancy I question tocodynamotry's relevance/utility

My clients either have no idea how to free whelp and hire an experienced helper or use Whelpwise. I do use this information to review options with clients when they want to free whelp at home and talking them 'off the edge' when a bitch has gone 'too long' based only on breeding dates or a single rectal temp drop w/out breeding timing.

See previous answer, this area is growing and is not just the purview of ACVIMs or criticalists. If we relinquish this knowledge, we erode our value in the outcome of the pregnant female patient or the neonate.
Multiple births

Critical to know when and how to intervene

Good knowledge of the theriogenologists. More relevant for ICSI

I teach these as part of reproductive pathology.

I’m not sure what this means

More frequent with in vitro embryo production

Not a super common component of my caseload but it is a good bit of knowledge to have

Rarely because I don’t work with these species

See previous answers. If we relinquish this knowledge or skill in dystocia management, then we erode our value in the outcome of the pregnant female patient or the neonate.
5-5 Obstetric nomenclature

Essential for effective communication

I teach these as important in large animals as positions can be predictive of dystocias.

Ideally never, but we are prepared and train our staff to understand these terms should we need to convey this information

Important to be able to communicate with referring veterinarians and colleagues during a dystocia situation.

Important to properly describe these findings

It is important that we refer in all our work in scientific/medical precise terminology. This is important not only from an academic point of view but also from a legal point.

Knowledge of obstetrical nomenclature is most important when communicating about referrals

See previous answers. If we relinquish this knowledge or skill in dystocia management, then we erode our value in the outcome of the pregnant female patient or the neonate.

This is a critical ability to speak eloquently related to obstetrics. All vets should know this and it is especially important for ACT diplomates to be able to use proper terms

This was important when I was in large animal. In small animal, it is difficult to diagnose depending on the size of the female and the ease of just going to c-section.
6-1 Normal breeding behavior

Absolutely foundational knowledge across species

I use this when discussing stud behavior and female acceptance of the stud when managing natural breeding. I also use it to explain when things don't go as planned and how to adjust environment / other options to complete objective.

It is very important to have a working knowledge of normal to be able to identify abnormal

Like endocrinology and puberty, we need knowledge in this area as we are the experts that are sought out for clinical advice.

This is basic information. Comparative aspects are important.

We see normal behavior regularly but it is probably more important to understand normal behavior in managing males with problems
6-2  **Analysis of animal and herd breeding records**

Critical knowledge for production animals. To know what is important economically is useful

Everyday breeding management considerations.

I review these for mouse breeding colonies and use the same principles I learned for dairy herds. Does someone need to have those numbers memorized, maybe not, but we again need knowledge in this area as we are the experts that are sought out for clinical advice.

I worked primarily in the dairy industry so records were critical

Not needed for small animal folks so much

Not performing for bovine/large animals as the question implies

Theriogenologists should be able to analyze in depth breeding records on herds. It is essential that theriogenologists be efficient in calculating and discussing benchmarks for reproductive efficiency and factors affecting them

This is important for reproduction in herd animals and swine.

Very important in large animal. In small animal, I have very few clients that keep detailed enough records with objective data to make evaluation meaningful.

We need to do more in this area. However, the knowledge needed to improve needs to also include a better understanding of business and human behaviors. These are often poorly understood or taught.
6-3  Estrous cycle manipulation

Comparative aspects are important

I use this information when delaying with abnormal cycles in females (both clients and DVMs calls).

Rarely in small animals

Something we work with frequently

Synchronization for breeding management

This area is critical for equine and production animal services
6-4  **Estrous cycle monitoring**

Behavior monitoring important for client education, ultrasonography, cytology and endocrine events are critical in the management of artificial insemination and embryo transfer

Critical part of our work in breeding management

These are important parts of basic breeding and all the ARTs

Typical breeding timing cases
6-5 Estrus suppression

I work more on the breeding/fertility side but I think it is basically the other side of the coin for contraception/suppression

Managing the non-breeding female is a less common part of my day to day - multiple referrals when progesterone doesn't work.

Mostly for companion animals (equine and small animals)

The hormones for cycle suppression area difficult to find. The majority of clients elect to adjust their schedule instead of adjusting estrus timing.

The importance is species specific. Often used for show animals or animals participating in sports.
6-6 Nutrition management

A common first discussion on evaluation of a breeding female and how it impacts fertility. Endocrinology overlaps this topic and is also an important discussion point.

I use this information in every pregnancy diagnosis case and when people are planning to breed.

Not a huge area of interest for me but I know it is an important area

Not as much for small animal

Seek other specialist advice

Should be basic knowledge for all veterinarians

Theriogenologists cannot be full blown nutritionists but they have to have a working knowledge of effect of nutrition or reproduction on the male and female. Areas of emphasis should be on reproductive disorders linked to metabolic disorders: pregnancy toxemia, dystocia, postpartum disorders....

This is an area of knowledge, like immunology, that is growing and expert knowledge may be beyond the practical scope of a DACT but working knowledge is important for clinical outcomes that may be more nuanced.

This is taught primarily by the nutrition clinicians.
6-7  **Nutritional deficiency and toxicity**

Again, not my favorite topic but it is important to know and manage

Not many mineral issues or mycotoxins in my area so rarely something I need to deal with. That being said, the knowledge is very important in some regions and recognition is necessary for all specialist to consult on those advanced or first time cases.

This comes up with pregnancy loss or poor semen quality. Most clients elect not to pursue more detailed workup.

This is an area of knowledge, like immunology, that is growing and expert knowledge may be beyond the practical scope of a DACT but working knowledge is important for clinical outcomes that may be more nuanced.

This is covered by the nutrition clinicians.

This is more important in our large animal breeds, which I rarely deal with.

Where they pertain to pregnancy loss, cyclic and spermatogenesis
6-8  **Disease prevention programs**

Always know prevention strategies

Perhaps just as important as knowing how to identify and treat diseases, is the knowledge of how to prevent and manage diseases.

Theriogenology should have a good knowledge of preventive program (viral, parasite and bacterial) and in depth knowledge of venereal and abortive diseases diagnosis and prevention.

This is taught during third and fourth year by clinicians as part of herd health.

We discuss Brucellosis testing in all breeding animals. I also review vaccination schedule prior to estrus.
Genetic counseling

Get geneticist advice

Growing interest in small animal clients warrants improved knowledge

I do not think this is the main focus of a therio specialist

I have admittedly not much interest in this but I know it is important. Perhaps more so in the diseases predilection than the actual genetic counseling

I teach this in reproductive pathology relative to developmental anomalies/intersex.

Is this Theriogenology or genetics? Needs to be defined IN or OUT by the ACT

It is not possible to know all these disorders but a theriogenologist should be familiar with the most common disorders and their mode of inheritance.

The common conditions, how they present and how to test for them are more important to know as a practitioner than the exact genomic sequencing, etc

This is an area of knowledge, like immunology, that is growing and expert knowledge may be beyond the practical scope of a DACT but working knowledge is important for clinical outcomes that clients will expect from us.

This is becoming it's own separate area, and impossible to keep relevant on all tests for all species- at some point I leave this up to the medical geneticists

Until more definitive information comes out regarding genetics, it is difficult to gain a consensus on how to advise
6-10  Contraception

Clients are very interested in this,

I discuss almost daily with puppy clients Pro:con of sterilization before /after puberty and gonad sparing Sx techniques.

Not a common area that I deal with but a ACT diplomate should know

Not frequently performed but clients often ask about this option with behavior issues (Dr Google).

This is an area where we need more information and alternatives

This will likely be the future of population control
Pharmacological analogs of reproductive hormones

Drugs especially hormones are commonly used and synthetic hormones have different uses/ pros and cons that an ACT should know.

I think important to understand, but most people don't want to use 'drugs' in their animals and elect either to alter their schedule or sterilize their dog / cat.

This is taught by clinicians third and fourth year. There are species differences.
7-2  **Hormones of diagnostic utility**

Bread and butter knowledge that we use daily

Essential

I sue this information when dealing with calls from local DVMs and when presented abnormal reproductive cases (ovarian rem & retained testicle).

The importance of these depends upon the species. For example in dogs and cats AMH can be used to diagnose ovarian remnant syndrome.
7-3  Antimicrobials and non-antimicrobials

I did not concentrate much on the pharmacokinetics and dynamics when studying - that knowledge is necessary and very valuable in the face of treatment selection and the OneHealth antimicrobial resistance that we are all learning to take into consideration.

I think important to understand. I use this information when discussing treatment options w/variety of cases (even outside reproductive cases).

Must understand how drugs work to use them effectively. We use it daily and the knowledge is critical.

This is an area of knowledge that is growing and changing so understanding principles may be more important than drug names or doses.

This is an area that is becoming increasingly important for new theriogenologists to have a working understanding. Particularly with regards to the responsible use of antimicrobials.

This is covered in pharmacology ad in clinics.
7-4  **Anesthetics**

Again, if we don't know this, we need an anesthesiologist to do this for us, which devalues or contribution.

Gain surgeon or anesthetist help

I use this info when discussing c-section and any other sedation / anesthetic procedure.

In an academic setting I leave it to my colleagues but I think an ACT should know basics especially contraindications

Not a therio specialist main focus

So much of what we know is just inferred from other species, or presumed bad because we don't know...so I think these questions can be tricky as black and white exam questions

This is species specific and is covered in clinics.

This topic seems to come up frequently on the exam and I am not sure that it is the best thing to discuss. The goal is to understand the effect of anesthesia on the dam and the fetus, not necessarily the means of inducing anesthesia. We are not anesthetists, we are reproductive specialists.
7-5  **Analgesics, antipyretics, anti-inflammatories**

A common therapy in all animals - a must to know when to use, what drug is best and how long of therapy is appropriate

Again, if we don't know this, we need someone else to do this for us, which devalues or contribution, and yet much of this may be day one ready DVM knowledge.

I always discuss pain control w/c-sections, neonatal tail doc / dew claw removal. I also discuss options w/local DVMs and emergency pet hospitals.

I am asked a lot about this and I have strong opinions but I guess for an average ACT diplomate the topic would be of moderate importance

This is covered in pharmacology.
7-6  **Chemotherapeutics**

I admit to not following this area of knowledge in great detail. It is probably something we need to know the basics.

I think the knowledge of options to treat inclusive of chemotherapy is important but not the details on chemotherapeutic pharmacology.

Like other pharmacology, principles may be more important than drug names and doses here.

Majority of these cases are seen by local oncology practice.

Refer to oncologists....

The importance of this is species specific,
As veterinarians, theriogenologists should have knowledge of these rules. I would not use this area for testing for board certification.

I have not read this particular Act.

Not exactly sure what this mean - Dis you mean what drugs we can use and what are illegal?

There will be significant geographical differences for this topic which should be explored. Otherwise this is very USA specific.

This is taught by clinicians in third and fourth year. Compounding, and state and federal regulations are important.

Understanding extra label drug use is essential for all practicing vets.

Unsure of question

Well....I need to go read that Act I guess
8-1 Exam of the reproductive tract

Builds on previous knowledge.

Core, please do not forget that this should include also general physical examination (heart murmurs, respiratory disorders, metabolic disorders)

Essential

Essential knowledge and skills

Fundamental knowledge that all ACT must know

Get a pathologist to interpret

I teach this in anatomy (also taught in histology/physiology). Clinicians also cover this.
8-2  Reproductive hormones in health and disease

Fundamental knowledge that all ACT diplomates must know

See previous comments.

This is an important part of reproductive pathology and is also covered in clinics.
8-3  Congenital and acquired disorders affecting mating ability

Important but less so than the previous topics

See previous comments.

These anomalies are often species specific.
8-4  

**Congenital and acquired disorders of the scrotum and its contents**

As a specialist, it would be likely to manage more of these cases due to referral.

I teach this in Reproductive pathology.

Not a huge part of the caseload but we do get asked to consult on these periodically.

See previous comments.
8-5 Congenital and acquired disorders of the prepuce and penis

I teach this in reproductive pathology.

Important knowledge but not a daily case

See previous comments.
Congenital and acquired disorders of accessory sex glands

I use this info frequently in sub-fertile dogs, hematuria cases. I also discuss this issue w/local DMVs (phone call consults).

Important but not a daily case

See previous comments.

There are some species differences. For example, prostate issue are seen primarily in the dog. I teach this in Reproductive pathology.
8-7  Spermiogram analysis

Critical knowledge and something we use all the time

Essential

Every bull breeding soundness exam that has less than 70% normal sperm, or other species with similar findings.

I use this when discussing normal and abnormal morphology.

Importance and techniques depend upon the species. Analysis occurs in all species.

Knowing that these options are available is very important. However knowing every stain that is possible for analyzing sperm by heart is not a necessity when you can review that before running the test. Knowing that the test is available is the most important part. i.e. what stain is what color is not worthy of 3 test questions.

See previous comments.

This is a very broad topic - CASA is used daily. The others should be known and ready to be evaluated and interpreted when abnormalities are found.

THIS!! Huge breaking point between specialist theriogenologists and general practitioners playing with repro
8-8 Genetic testing and assessment

Geneticist

I advise all my breeding clients to genetically test all their breeding animals prior to breeding and to help select breeding pairs. Many follow my suggestions, some only go by pedigree.

Is this Theriogenology or Genetics?

More knowledge, practical testing or facilities providing genetic testing would be beneficial. Cost prohibited.

Not really an area of great interest or expertise for me but I suppose it is good to know

Rarely performed as the breeders generally takes this initiate.

See previous comments.

Should be part of any discussion when evaluating the suitability of a specific individual for use as a breeding animal. Owners don't always comply with recommendations for genetic testing or have already run screening tests (either themselves or through their GPs) before the animal presents

Students should know about this in general, but importance varies among the species.

This seldom goes through veterinarians, the labs have bypassed us.

Until more definitive information is available, it is tough to have clinical application

We frequently facilitate owners utilizing genetic testing, radiographs for certification etc. Very little actual consultation or questions regarding specific conditions takes place though.
8-9  Endocrine disruptors

Again - when presented with an infertile male for evaluation need to know about so can rule in or out. (Dog clients in particular are always concerned and ask about environmental factors that could be causing the problem in their animal)

Effects of drugs/environmental toxins on spermatogenesis is an area in need of research

I teach this in reproductive physiology and pathology.

I wish I know more on this one, maybe then I would use it more. I don't remember much information in the BBSE manual either but maybe I missed it or it was not very detailed.

It is important to know but not something we deal with daily

See previous comments.

Seems to be increasing in clinical cases across species. Or at least questions about endocrine disruptors

There is a gap in knowledge in this area.

This comes up when abnormalities (development, pregnancy loss, abnormal sperm) cases are presented. I also use this information when discussing cases from local DVMs.
9-1 Exam of the reproductive tract

Bread and butter skills and knowledge must know

Core also detailed physical examination

Essential

See previous comments.

This is basic information that all students should know.
9-2 Reproductive hormones in health and disease

Essential

Fundamental knowledge and a must know

See previous comments.

These are approached in several course in first and second year, then again as clinically relevant in third and fourth year.

With increasing maternal age I expect this area of theriogenology with continue to grow
9-3 Abnormal cyclicity

A must know

It is important to know the normal cycling for each species.

See previous comments.
9-4  Congenital and acquired disorders of the ovaries

A common type of case and consult requested
Granuloma cell tumor???? It should be granulosa cell tumor.
I teach this in reproductive pathology.
Multiple referral cases a year from veterinary colleagues.
See previous comments.
9-5 Congenital and acquired disorders of the uterine tubes and uterus

A common problem that we deal with for problem females

Endometritis brings this into the frequent category. The others mentioned are rare to sometimes.

Endometritis very important

Essential

I teach this in reproductive pathology.

Pyometra is most commonly encountered, but very rarely from the other examples given, in private practice

See previous comments. As an anatomy professor, I am relied upon to explain these when we see them in lab.
9-6  **Congenital and acquired disorders of the vulva, vestibule and vagina**

I teach this in reproductive pathology.

Not a daily set of disorders seen in our specialty practice

See previous comments. As an anatomy professor, I am relied upon to explain these when we see them in lab.
9-7 Congenital and acquired disorders of the bladder and urethra

I do emphasize the connections between the urinary and reproductive tracts anatomically, developmentally and clinically.

I don't come across these very often, but I need to be able to recognize them when I do.

In our specialty hospital the Internal Medicine group mainly sees urinary issues and we only see the cases that may have secondary reproductive issues. We also use this knowledge when interpreting vaginal issues.

Include congenital problems (ectopic ureters) differential diagnoses of hematuria, hemospermia, blood vaginal discharge

Maybe originally noted by reproductive examination but more of a medicine topic.

More of an internal medicine area

See previous comments. As an anatomy professor, I am relied upon to explain these when we see them in lab.
Genetic testing and assessment (species/breed-specific testing)

Not a primary interest of mine and I rarely do direct genetic counseling

Probably performed more frequently by the non-equine practitioner. This is often done by breeders but the knowledge should be there for discussion.

See previous comments.

Should be part of any discussion regarding the suitability of an individual animal as a breeding animal

This depends upon the species and the reason for testing i.e. intersex, inbreeding, etc.

Very few cases seen and assays are too expensive.

We facilitate owners in performing screening tests, radiographs for certification. Very few questions are asked by the owners and little to no conversation. Usually takes place once we have performed the services.
10-1 Exam of the reproductive tract

Fundamental skill to obtain information on what is normal and what is abnormal or even to correlate physical and endocrine status of the animal

Please include physical examination (i.e colic in the mare, weight loss during pregnancy etc....)

See previous comments.

These are taught in first and second year, then covered again by clinicians third and fourth year.
10-2 Disorders of pregnancy

Essential

I teach this in reproductive pathology.

Medicine specialist

Not a super common case but we see enough of it and these cases tend to be more complicated

See previous comments.
10-3  Dystocia causes

A common case that we manage and a critical area for proficiency
Covered in first and second year, then again by clinicians in third and fourth year.

Essential

I do not manage parturition in my practice, but do believe knowledge about complications is important in communicating with a referral facility.

I use this when helping clients choose between medical management or Sx management of dystocia. Typically, most go on to Sx due to concern of fetal distress. The small size of many dogs and all queens makes vaginal manipulation impossible.

Rarely performed, but often talked about

See previous comments.
10-4  Dystocia management

A critical knowledge to manage a common case

Diplomate should not have to refer to surgeon for case management

Essential

I do not manage parturition in my practice, but knowledge about what is normal or abnormal is key to properly communicating with clients and referral practices

Rarely used, but frequently talked about

See previous comment

See previous comments.

This is taught primarily in third and fourth year.
10-5  Fetal monsters

Any time you are doing an obstetrical exam, assessments for the presence of these conditions is part of what you are doing. You need to be able to recognize them when you come across them and know how best to manage them.

Certainly more common in bovine practice but as a diplomate, we should know these things.

Don't see many of these cases but need to know why it happens when local DVM calls or when noted at Sx.

Focus on the most common

Mentioned in reproductive pathology.

Not common in the horse so rare in my day-to-day practice

Not common, but important

See previous comments.
10-6 Disorders of the postpartum period

Essential

I teach this in reproductive pathology. It is covered in clinics third and fourth years.

Particularly retained fetal membranes

Postpartum diseases are common and important cases that we manage or be asked to consult on

See previous comments.

These cases don't happen much in small animal, but large concern in equine.
Disorders of the mammary gland

See previous comments.

These conditions are more or less important depending upon the species.

Use this info with timed c-sections and first time dams.

We check for it but do not see that many cases but it would depend on the species and case demographic.
10-8  **Induction abortion/parturition**

I use this info when discussing options w/clients from accidental breedings and discussing cases w/local DVMs

See previous comments.

Something that I get asked about a lot by practitioners. Diplomates should know

This is species dependent. I cover this in physiology. It is covered again in clinics third and fourth year.
Endocrine disruptors and metabolic diseases

Not commonly done for me but I do like the subject.

Seems to be increase in caseload related to metabolic disorders especially in equine practice

The more we learn about endocrinology, the more this topic is evaluated and treated in abnormal cases.

There are species specific issues.

This is actually an area of research for me and while I think some of this research may be beyond a practicing DACT, an appreciation for this growing body of knowledge is important.
11-1  Pregnancy wastage investigation

Hard to get objective and detailed records from dog/cat breeders. Very important in large animal.
I'm a dairy dipl. ACT and an epidemiologist!
See previous comments.
This is a very broad topic that often there is no answer ever found.
This is covered primarily in pathology.
While not something I work on daily, it is an important area for the specialty
**11-2 Embryonic death**

I teach this as part of reproductive pathology, it is covered in clinics third and fourth year.

Popular use of ART has greatly increased the incidence

See previous comments.

Very important in equine, but not as big a problem in dog/cat since typically have multiple fetuses. Absorption of one fetus doesn't concern majority of clients. Absorption of most of pregnancy gets clients very concerned. Their concern and willingness to workup depends on value of litter. If not very valuable, they typically don't do extensive workup and usually sterilize female.
11-3  **Bacterial causes**

Discuss Brucellosis testing in all breeding dogs / Felv/FIV testing in all cats.

Equine specific - bacterial endometritis is a huge cause of pregnancy loss (not the organisms mentioned above).

I teach this in reproductive pathology. It is also covered in infectious disease and clinics.

See previous comments.
11-4 Viral causes

Focus on the most commonly found in North America

I cover this in reproductive pathology, but it is covered in greater depth in infectious disease. It is also covered third and fourth year.

See previous comments.

See previous. I don't see may queens / cattery clients. ON phone call consults, most elect to spay / neuter affected animals and re-home instead of pursuing further workup. My last large eatery had and FIP issue and elected to stop breeding all together.
11-5 Protozoal causes

Again a thorough knowledge of the common diseases with emphasis on North America
I cover this in reproductive pathology. It is covered in parasitology and in clinics.

see previous comments

See previous comments.
11-6  Fungal causes

Depends on your geographical location

See previous comments.

This is covered in reproductive pathology and again in clinics.
11-7  **Teratogens and toxins**

Common toxic plants and mycotoxins in North America

I cover some of this in reproductive pathology. It is also covered in toxicology and in the clinics.

I suspect incidence is higher than we realize due to as yet unknown causes

Our practice is fortunate not to encounter many environmental toxins

This topic comes up with many clients and local DMV calls. We have many gated communities in the area that typically spray yards / plants / clean buildings without clients' knowledge of what is being used and why.
11-8 Other non-infectious causes

I teach this in reproductive physiology and pathology. It is covered again in clinics. More of an issue in equine therio, not as large a concern in small animal. See previous comments.
12-1  **Assessment of neonates**

For the congenital condition, emphasis should be on common abnormalities

I regard Neonatology to be a very important part of a Theriogenologist's skill set

I teach some of this in reproductive anatomy, physiology, and pathology. It is covered on a more practical basis in clinics.

I use this info almost daily in discussions w/clients and when evaluating neonates post c-section or prior to tail dock/dew claw Sx.

Important for ACT to decide in Neonatology is part of Theriogenology (for the purposes of examination) or not. And if it is then define when the "neonatal" period finishes

Internal medicine specialist and ambulatory Repro vet

Neonatology is not part of my practice

See previous comments. Again, we don't want to lose our value and while I don't want to manage the NICU patient, I also don't want DACTs to be eliminated from the consult.

The knowledge of abnormal and when to refer will be expected as a minimum for an attending veterinarian

Those cases are usually held by internal medicine of different species.

Where is the overlap with medicine/orthopaedics?
12-2 Neonatal care

Even colleagues in emergency and internal medicine ask me for advice. Neonatology is neglected in teaching, so Diplomates should know.

Probably even more critical in these earlier time points.

This is taught third and fourth year.

This may be a point of discussion or debate but I think we should emphasize the importance of this so that people do know to study the content. If people know to study the content ahead of time the debate will be minimal.

Timed c-sections, emergency c-sections, post part evaluations - especially with clients new to breeding.

Where is the overlap with medicine/orthopaedics?
12-3  Neonatal development

Again, know what is abnormal and when to be concerned is necessary. Referral to a medicine clinician for management is then an option but I think a reproduction specialist should be able to identify and triage a sick neonate

Don't see small animals

Essential

If people taking a certifying, examination are aware of this emphasis before hand, I don’t think it will be a point of debate. Currently, this may not be an area where it is widely agreed-upon that this falls under our college. I believe it should but more verbal emphasis should be given to it to people, taking examination and have a bigger presence at the SFT’s annual conferences.

May be more relevant to small animal

See previous comment

See previous comments.

This is taught primarily third and fourth year.

Usually only for foals, but again, those cases are transferred to internal medicine. I believe the responsibility of a Theriogenologist should mainly encompass the item #2 under the Neonatology topic. Our specialty is already very broad to encompass also neonatal care other them assuring colostrum intake.

Where is the overlap with medicine/orthopaedics?
12-4 Clinical assessment and management for neonatal disease and surgery

Emphasis should be on disorders of the first 2 weeks of life. I would not include surgical procedures for angular limb deformities.

Familiarity with in utero developmental conditions (cleft palate) important.

I don't see many of these cases, but I do field calls from local DVMs and emergency hospitals. Sometimes get referred cases, but most just want guidance on how to manage at their own clinics.

Important to be able to assess, but management of these conditions tends to be more of a medicine and/or surgery case.

See previous comments.

The assessment component is more important in these scenarios. Identification of a problem and appropriate referral of a neonate is frequently performed. The knowledge of the specific medical and surgical therapies in great detail is less important.

This is taught third and fourth year.

This needs to be in light to recognize and refer. We are not internal med specialists or surgeons.

Where is the overlap with medicine/orthopaedics?
13-1  Vaginal vestibular surgery

Caslicks all the time. Hymen remnants encountered and managed any time I breed a Maiden mare. Assessing for urine pooling anytime I am doing a vaginal speculum exam (I refer to experienced surgeons for extension surgery if indicated). Was more directly involved in vulvo/vestibular reconstructions when I was part of academic clinical referral services. Used to do Buhner's when required when I did more cattle work. Still run into vaginal anomalies in particular when asked to evaluate camelids - but also refer those for surgery.

Do not need to know details of surgeries

I would not include urine pooling in this criteria for Theriogenologists to be the primary clinician to fix these cases. We must know how to reestablish reproductive health after the problem is resolved, but not involved in the surgical repair of it.

More of an issue in large animal, rarely a problem in small animal (except for recessed vulva issues that don't respond to medical management).

See previous comments.

This is taught by clinicians third and fourth year.

We are fortunate to have gifted surgeons in our practice that will perform all surgical procedures.

We should re-emphasize these procedures within our college. I believe the expertise of these procedures are being lost with the older generation, retiring, or passing away. We need to bring it back.
13-2 Cervical surgery

Although I believe that this knowledge-area is very important, my lack of performance is directly related to a lack of experience. Hopefully there is more surgical training afforded to Theriogenology residents now. Surgical case management from admission to discharge is critical for: (1) the training of residents/boarded clinicians and (2) the maintenance of a financially-sound and viable specialty-identity.

Cervical exams post foaling are part of my post partum/ pre breeding evaluations as well as any BSE I am asked to perform - if I encounter something that requires a surgical repair I refer them to experienced surgeons

Due to our surgery department helping with most of these procedures

I believe identification, and a pair of these procedures, and the expertise that goes along with it, are being lost with a specialist in retiring, or passing away. We need to re-emphasize this and bring it back.

I believe theriogenologists must know how to diagnose them and refer to surgeons for treatment

I do not perform the surgery myself but I am in charge of evaluating the females and referring to surgery when surgery is indicated as well as communicating prognosis and expectations to owners

I refer these cases. I think it is critical for new diplomats in the Equine world to know about how/when to assess the post-partum cervix for trauma that might complicate a mareâ€™s fertility and her ability to support/maintain a pregnancy

Not many ACT diplomats still have skills in this area.

Overlap with surgery, procedure often performed together with a surgeon

See previous comment

The surgery residents at our university have to log these reproductive surgeries and have taken overperforming them during the last 20 years.

The surgical expertise of a DACT may vary, but knowledge of the techniques and their use is still critical.

This is taught by clinicians third and fourth year.

With surgeon assistance
13-3 Uterine surgery

Again, anytime dealing with a dystocia or BSE need to have knowledge of and judgement as to how best to handle. I am not currently part of a surgical referral practice or academic center so now I refer when need arises.

All surgeries referred to board certified surgeon

C section, important.

I think this is mostly performed by surgeons these days. Possibly assisted by an ACT

Scheduled and emergency c-sections

Sent to surgeon

should not require referral to a surgeon

Surgery residents now perform them at our institution.

Surgical contraceptive techniques in females: historically, has not been emphasized as much as vasectomy in the past. Exam questions over OVH technique, for example, not needed in my opinion

Teach the basics for these surgeries in reproductive anatomy, physiology, and pathology. Clinicians cover this again in third and fourth year.

The surgical expertise of a DACT may vary, but knowledge of the techniques and their use is still critical.

Unfortunately, in much of academia this - surgery- falls into the realms /silos of large or small animal surgery. It is hard to get theriogenology residents trained in surgery.

Would love to do more, but surgeons took over all repro surgeries in North America.
13-4 Ovarian surgery

Again - need to have knowledge to evaluate accurately. I am no longer part of a surgical referral practice or academic clinical center so I refer these surgeries as needed.

All surgeries referred to board certified surgeon

I leave this to qualified equine surgeons;-)

I work in a specialty hospital, most my surgeries are dealt with by surgeons with. My assistant in what need to be done and/or when

Overlap with surgery, procedure often performed together with a surgeon

Referred to surgical facility

Should not have to refer to a surgeon

The surgical expertise of a DACT may vary, but knowledge of the techniques and their use is still critical. I perform OVX routinely for research in sheep and mice.

These jobs are sadly becoming the surgical domain vs the theriogenologist. At least in equine practice

This should be basic knowledge, particularly for small animal reproduction.

We no longer perform colpotomy due to risk but other practitioners do so important for candidate to know about the procedure
13-5 Routine desexing surgeries

Again...all done by surgeons or generalists

All surgeries referred to board certified surgeon

As a specialist, need to understand the changes that can occur w/abnormal development. For instance, if you have uterine segmental aplasia, you can't assume the ovary did not develop based on understanding embryology and normal/abnormal development.

Don't see small animals

Goes to surgery at my college, unfortunately

I don't perform the surgeries but a knowledge of how the surgeries may affect behavior is important (eg equine ovariectomised mare as tease mare)

In equine not common, for other species, yes of course

Larger part of canine work than equine or food animal in my experience. I answer a lot of questions regarding these procedures, but refer for the actual surgeries when needed.

Overlap with surgery, procedure often performed together with a surgeon/general practitioner.

Referred to surgical facility - i work with equine species only

Should not require referral to a surgeon

The basics for these surgeries are covered in reproductive anatomy, physiology, and pathology. These are basic skills for small animal reproduction.

The surgical expertise of a DACT may vary, but knowledge of the techniques and their use is still critical.

This is not a part of my equine practice. I refer OVX cases to the university

Why are we using the term desexing? Tract and gonads are removed during surgery but they still are females.
13-6  **Perineal surgery**

A Caslick's procedure is commonly performed in our clinical practice, but postpartum perineal repair is often referred to our surgery department.

Essentially the only surgery that I perform.

I teach some of the basics for these surgeries in reproductive anatomy. These are important primarily for horses.

I work in a specialty clinic where these are done by surgeons but with my input on how/when to do them, and are usually managed by therio pre and post op.

Overlap with surgery.

SA therio

The surgical expertise of a DACT may vary, but knowledge of the techniques and their use is still critical.

Very common in equine repro. Use when medical management of recessed vulva in dogs is not helping clinical signs (pervulvar dermatitis, chronic UTI).
13-7  Effects of gonadectomy on general health and welfare, growth performance

Clients’ favorite thing to ask about in all species!

Equine only

Hot topic these days, especially for small animal clients.

I have often discussed these effects with owner

Important in other breeds - more of a client discussion point than performed procedure

These are points for discussion, as there are conflicting ideas about the pros and cons of gonadectomy

This is not a topic that has great relevance to my practice type (equine). However, fundamental knowledge on this topic is essential for a new Diplomate to be conversant.

Use daily when discussing pro/con of sterilization before or after puberty.
14-1  **Penile surgery**

All surgeries referred to board certified surgeon

Being generally aware of these procedures needed, but knowing step by step how to do them in depth not required

Evaluation part of normal BSE. I am no longer part of a surgical referral practice or academic clinical center so these days I refer to experienced surgeons if surgery is indicated for a patient.

Goes to surgery

I teach the basic anatomy for these surgeries in reproductive anatomy. The importance of these surgeries is species specific.

I work in a specialty clinic where these are done by surgeons but with my input on how/when to do them, and are usually managed by therio pre and post op

In consultation with surgeon or giving options to a client when penile pathology is found - often a surgical referral.

Procedure on equines mostly/always done by a surgeon. Hard to get good clinical skills as an ACT.

Rare in small animal, important in large animal but would need large Sx facility to manage these types of cases.

Send as referral surgeries

The surgical expertise of a DACT may vary, but knowledge of the techniques and their use is still critical.

These are referrals only in my practice.
14-2  **Testicular surgery**

All castrations, as long as two scrotal testicles are present, are performed by our general medicine DVMs.

All of these are frequent except a testicular biopsy which would be a last resort and I would not place in the same category as the rest of these procedures.

I teach the basics for these surgeries in reproductive anatomy. These are basic skills for animal reproduction.

I work in a specialty clinic where these are done by surgeons but with my input on how/when to do them, and are usually managed by therio pre and post op.

Identification of pathology and providing a treatment option of surgery is an important knowledge base. The surgical techniques are less important - often collaboration with the surgical team or a very routine procedure (castration).

It is rare that I am involved in the actual surgical procedures anymore (as compared to earlier on in my career). Still need to identify testicular issues on BSE and equine colic exams of stallions, and to be able to discuss knowledgeably with clients. Refer surgeries when needed (even routine castrations). Testicular biopsies are sometimes recommended if need to nail down a diagnosis, and have exhausted all other diagnostic avenues and usual treatment/breeding management/sexual rest options.

Routine procedures less important to know in depth step by step.

Some of these are day one ready DVM tasks and others may depend on the surgical expertise of a DACT may vary, but knowledge of the techniques and their use is still critical.

Testicular biopsy for dx purposes, yes.

These are referral surgeries.
14-3 Accessory sex glands surgery

I do not perform the surgery itself, but again I feel it is important for candidates to know when surgery is indicated, prognosis for breeding, etc.

I teach basic anatomy related to the sex glands. I relative importance of these surgeries is species specific.

I work in a specialty clinic where these are done by surgeons but with my input on how/when to do them, and are usually managed by therio pre and post op

If performed in a horse done by surgeon

Important to diagnosis these cases, but I typically leave the Sx to boarded specialists.

Need to be able to palpate/ultrasound/seminal plasma analysis to assess these structures as part of any male BSE. Performed some vesicular gland removals on bulls earlier in my career in an academic setting, but otherwise no. Would refer to experienced surgeons if felt surgical intervention was indicated in a patient.

The surgical expertise of a DACT may vary, but knowledge of the techniques and their use is still critical.

We never do it.
14-4  Teaser preparation

I do not do enough food animal work anymore for this topic to come up very often in my day-to-day work.

I teach the basics for these procedures in reproductive anatomy and physiology. The relative importance is species specific - particularly important in ruminants.

Not that commonly used where I am at.

Not used in small animals. but more important in food animal.

some consider not an ethical approach....?

The surgical expertise of a DACT may vary, but knowledge of the techniques and their use is still critical.

This is not something done in small animals but it is in large animals and therefore i consider it important

Vasectomy is done by general practitioners, penile translocation by surgical specialists.
14-5 Prepuce surgery

All surgeries referred to board certified surgeon

I teach the basics for this in reproductive anatomy. This is particularly important for swine.

I work in a specialty clinic where these are done by surgeons but with my input on how/when to do them, and are usually managed by therio pre and post op

Knowledge of when the procedure should be done due to pathology rather than performing the surgical technique itself.

More common as pet pigs are farm animals are on the rise

Paraphimosis or other penile injury/pathology management requires knowledge and judgement of options - but again would refer if to an experienced surgeon if felt surgical intervention was required. Do not do any bull work anymore but earlier in career did do some diverticulectomies.

Rare in small animal, more important in food animal - especially bulls w/pendulous sheaths

Surgeon

The surgical expertise of a DACT may vary, but knowledge of the techniques and their use is still critical.
Effects of gonadectomy on general health and welfare, growth performance

Again, clients LOVE to ask about this.

Discuss the topic with owners

Hot topic these days, especially with small animal clients

I use this daily in puppy and kitten cases discussing pro/con of sterilization before or after puberty.

This is a point for discussion, as there are pros and cons for performing gonadectomies.
15-1 Semen collection techniques and procedures

Essential

I teach the basics for this in reproductive anatomy and physiology. The techniques are very species specific.

Regular work that is a must know for all vets working in repro

Semen collection very common for semen evaluation, freezing and cooled shipment. Also need to discuss process w/clients when things don't go as planned (either on shipping or receiving semen)
15-2 Requirements for sanitation, hygiene and quality control

Becomes a habit and don't really think much of it but it is important

DVMs need to understand and teach staff. Also need to teach clients about home care with dam/sire and litter care. I have even done home visits to help sort out health issues. Last one was a series of UTIs in young female labs. Removed the plastic pools from kennel area and UTI issues stopped.

This is basic information that all students should know.
15-3 Producing fresh and cooled extended semen doses

Again, species differences and extender types may change (or vary by species/animal) but principles remain the same.

Daily work for repro vets

Essential

This very much depends upon the species.

Variations by species, not always good "industry" standards
15-4 Producing frozen semen doses

Again, species differences vary but principles remain the same.

Critical work that usually separates the lay vets from the specialists

I don't have a large case load for freezing semen but I do have frozen semen ship in from other locations. Even if not freezing, one needs to understand the process, how to counsel clients on stud selection, frozen semen selection, success rate, post thaw motility, morphology, age of stud when frozen, acids to more doses (stud dead or alive)...

This is something students should know about generally, but they do not need to now all the details.
15-5  Insemination techniques

Again, species differences vary but principles remain the same.

I teach about AI relative to different species anatomy. The techniques vary by species.

Understanding the techniques and what to use in different situations is critical.

Use this information when discussing breeding management in all breeding timing cases.
15-6 Processing epididymal sperm

Again, species differences vary but principles remain the same.

Important for semen freezing, chilled, fresh collections. Also need to feel comfortable enough to discuss w/clients and local DVMs and help trouble shoot when things not going well with those cases.

Increasingly common technique demand is increasing

Not all students will need to be proficient at this technique.

This is an elective and emergency procedure in the horse - the limitations of use in the sick animal should be considered too
15-7  Sexed semen production and use

Due to our area, more about herd work and obtaining sex-sorted semen to use. vs truly using flow cytometry in our practice. More for our research samples

I do not perform sex sorting of semen but use it frequently in bovine reproduction

I like this topic as it is ART related but for a regular DACT probably not something they think about daily

Important in food animal equine but not used in small animal.

Occasionally comes up in conversations surrounding a specific planned breeding. I would not be the one performing the production of the sexed semen however.

Rarely used but new technologies are developing making this an option for the general practitioner

Students should know about this technique, but not necessarily the details.
15-8 Disease transmission through semen

Discuss with all semen collections (chilled, side by side, frozen)

This is basic information.

Usually there are already protocols but it is good to know the basis
16-1 In vivo embryo production

An important area that is expected of repro specialists and an area of interest for me. Important in food animal & equine. Not practical in small animal. Not in small animal practice, yes for research and in large animals. This is a specialty item.
16-2  Requirements for sanitation, hygiene and quality control

Always a consideration

Even if our practice doesn't do enough. Most facilities have a large portion of embryo work and need to be very knowledgeable about quality control and sanitation concerns.

Future of our species-canine

Not in small animal practice, yes for research and in large animals

Part of regular protocol but good to know the reasoning and theory

See previous comment

This is basic information.
I deal primarily with horses, but this topic comes up in case discussions with clients from time to time. One of those areas when knowledge of other species for examples of comparison is useful.

If vets become embryo transfer practitioners, even as Diplomates they will most likely become a member of CETA/AETA and be trained through them, so basic knowledge in ET would be good enough for therio board exam

Important to know especially for ruminant but less so for other species

Not currently an option in the horse but other species a common consideration

Not in small animal practice, yes for research and in large animals

Not performed in equine practice, but important for other species

See previous comment

This is used in ARTs in many species. I teach about this in physiology.
**Embryo recovery and transfer techniques**

IN important area for repro specialist and an area of interest for me

Not in small animal practice, yes for research and in large animals

See previous comment

This technique is used in many species. It is important to know comparative techniques.
16-5 Recipient synchronization

I synchronize donor mares and recipients all the time
Not in small animal practice, yes for research and in large animals
See previous comment
This is important in man ARTs.
16-6 Oocyte aspiration techniques

But will be incorporating into practice in future

Even if not performing the technique daily, the discussion with clients is very routine.

I learned from different facilities and it is becoming more common to offer. So residents should know more about this technique and everything involved.

I refer these cases

I work closely with a referral center that performs the actual oocyte aspirations/ICSI/frozen ET, but I follow the mares pre and post and interface/discuss with the owners all of the time.

Not in small animal practice, yes for research and in large animals

See previous comment

This is only performed in some species.

While expertise in performing this may be limited by training, knowledge is still key.
16-7  In vitro embryo production

Again - I work with a center that actually performs the lab procedures, but I am the one who primarily answers questions and explains the procedures to the mare clients I refer.

Food animal/ equine

General knowledge in this topic is useful for assisting owners with decision making

Laboratory techniques and media would be out of the wheelhouse of a clinical DVM. In my opinion, that information can be expected to be known by those who actually do it > PhDs and embryologists

Not in small animal practice, yes for research and in large animals

Students should be aware of this technology but do not need to know all the details.

This are is vast. Knowledge should pertain to basic principles and not details of media etc...

While a this is mostly done in a lab - the discussion on the techniques and limitations often comes from the veterinarian.

While expertise in performing this may be limited by training, knowledge of key principles is still key.
16-8 Intracytoplasmic sperm injection

Again - I work closely with a referral center that performs the actual procedure, but I am the one who follows the mares pre and post and who primarily discusses with and answers the questions and manages the expectations of the mare owner.

Again not performing the procedures but providing information to the client.

Food animal & equine, not small animal

I have never performed or worked in ICSI labs. But a lot more common in practice or as emerging for commercial work

Knowledge of this topic is used to provide guidance to owners who choose this technology for their horses

Most of what I do is receiving ICSI embryo. Theriogenologist should be familiar with the general laboratory steps and how they impact embryo quality but not the details. This is not a clinical skill

Not in small animal practice, yes for research and in large animals

Only the basic technique, not specific protocols should be required

Therio specialists should be expected to generally know about content related to this, but the detailed procedures should be expected to be within those who truly utilize it, and this instance, PHDs, and embryologists

These responses are dependent on the type of practice the theriogenologist is in.

This is a specialty technique.

While expertise in performing this may be limited by training, knowledge of key principles is still key.
16-9  Embryo evaluation and classification

Embryologist engaged

I used to do a lot of this directly when I did embryo flushes at referral centers. These days I interpret/explain to my mare owners what the report descriptions mean.

Not in small animal practice, yes for research and in large animals

See previous comment

This is important for certain ARTs but is not necessary in general/

While expertise in performing this may be limited by training, knowledge of key principles is still key.
16-10 Embryo cryopreservation

I work closely with a referral center that performs the actual cryopreservation and the post that ETs of ICSI embryos for mares that I refer. My role is to primarily provide information and answer mare owner questions about the procedures and expected success rates for a given mare/transfer.

Not in small animal practice, yes for research and in large animals

See previous comment

Theriogenologists should know the details of the cryobiology principles applied to gametes and embryos.

This is important to know about, but not necessarily all the details as they differ from species to species.

We do much TVA but the ET is performed by practices with large herds of recips.

While expertise in performing this may be limited by training, knowledge of key principles is still key.
16-11 Disease transmission through embryos

Difficult to determine necessary knowledge of a candidate due to regional and international regulation differences.

Not in small animal practice, yes for research and in large animals

This is important to know about.

This is something I feel is more of a "where do you go to look this up", not a "memorize this"

While expertise in performing this may be limited by training, knowledge of key principles is still important.
16-12 Somatic cell nuclear transfer

I am not involved with the actual procedures, but it is not unusual for a discussion of cloning technologies to come up with individual clients. I often discuss the differences between somatic and embryonic clones, as well as the implications of mitochondrial DNA from oocyte donors used in somatic clones, and its implications for the production of animals to be used in breeding (stallions vs mares) or performance. We also discuss differences in individual gene activations and differences in phenotypes between multiple clones of the same animal. We also discuss breed registry limitations/implications

It's out there and clients ask about it relatively frequently in cases of acute death

Not in small animal practice, yes for research and in large animals

once again, don't go too deeply

Theriogenologists should be familiar with limitations and expected outcome

This is an important ART to know about, students should be able to explain the technique, but not necessarily the details.

While expertise in performing this may be limited by training, knowledge of key principles is still important.
16-13 Gene-editing technology (including CRISPR) and uses in reproductive medicine

Again, students should know the concept and be able to explain it, but necessarily in detail.

I am old. I wish I understood these technologies better. New dips should be able to converse in this language.

I need to understand this technology, but not in realm of clinical practice currently.

Indications more common in the future

May fall more under geneticists

More from research and classroom work

Not in small animal practice, yes for research and in large animals

Not there yet as far as "daily use" in a clinical setting, but important to keep up with advances as it will likely become a topic of conversation with clients at some point in the future

Only very superficial coverage, i.e. know it's possible... this is a VETERINARY practical specialty certification, not one for researchers...

This may become more important in the near future.

While expertise in performing this may be limited by training, knowledge of key principles is still important.
Appendix L: Overall comments

A successful diplomate should not only pass a written examination, but they should also demonstrate the skills necessary. I favor a written exam on the competencies. Successful candidates should then be invited to undertake the practical portion of the exam. I also believe a diplomate should be competent with surgery of the reproductive tract. I do acknowledge that some veterinarians do not enjoy surgery.

Adequately and Inadequately create a very dichotomous thought. I choose inadequate because it is impossible for any survey of this nature to not have a significant amount of human error or incomplete understandings. We all have our unknown unknows. It is very likely that I have knowledge areas that are lacking and if I know or understood these areas I would change how I practice. We are missing out on potential of innovative advancement when only surveys of this nature are used. It takes "customer discovery" processes to dig in and uncover the unknowns, areas of practice pain/difficulties, or opportunities we are likely missing out on. This is important in areas of ACT testing because it also has the real possibility to create tendencies of cultures (how we believe things are) within the veterinary communities.

Although I took the certifying exam about 10 years ago, I feel the information covered was fair and pertinent in my practice today and would be appropriate with adding some content about current technology.

ASC

Because of the very broad nature and wide variation in skills used depending on the field the ACT works in, it is hard to make this comprehensive now only a comparative exam is offered. I think if the "old" system of a general/comparative part (for physiology/anatomy) is done with a species specific part a more tailored exam can be made. Certain areas are very applicable to certain skill sets (biotechnology/equine/bovine/small animal), but are not applicable to others. (eg. the chance that a small animal ACT will be involved in cloning/CRI) is small, where this is very important for biotechnology or embryo transfer is important for equine/farm animal but not applicable in for small animal.) Broad knowledge is still required, but no in depth.

Excellent work guys. For exams, its important for the ACT to clearly define how much (if any) knowledge is required in these areas: Genetics, the Mammary Gland, Neonatology.

For the last table, it is difficult to divide into percentages the knowledge that you use on a daily basis. For most of those areas of knowledge, I draw on them daily in a variety of ways depending on the time of year and what happens to be in front of me at the time. To quote DaVinci "Success lies in the relentless execution of the basics." I strongly believe that our specialty exam should ensure that each successful candidate should have a solid understanding and working knowledge of the core comparative anatomy/physiology/breeding management/production goals/pregnancy/obstetrics/andrology/pathology/infertility/neonatology/medical and surgical reproductive treatments/etc. of each of the "major" domestic species as well as a knowledge of the "sexier" ARTs and current research focuses. A tall order to be sure, but a strong foundation
will lend itself to clinical competency (quite frankly what we are judged on by our colleagues and clients) as well as a secure jumping off point from which any "young" Theriogenologist can chart their more specific career path in species and research. Theriogenology, by definition, covers a lot of ground and overlaps with a lot of other specialties which is what makes it challenging, but it is also very rewarding and always interesting. If we do not emphasize the importance of our core knowledge, then why should anyone else value it?

From Wikipedia, the free encyclopedia:
Theriogenology is a specialty of veterinary medicine concerned with animal reproduction. This includes the physiology and pathology of male and female reproductive systems of animals and the clinical practice of veterinary obstetrics, gynecology, andrology and assisted reproductive technologies (ART). Theriogenologists are veterinarians with advanced training in animal reproduction like semen analysis, evaluation and processing, breeding soundness, IVF, embryo transfer and obstetrics. In the United States, all theriogenologists are board-certified by the American College of Theriogenologists.

This says it all, and should be a guideline going forward and succinctly describes the information the
At the JTA seeks to obtain through the survey.

Keep your eye on the ball!

The last portion of this survey will prove to be useless.

Prediction: The JTA will have a low participation rate, and be slightly short of useless. Nonetheless it will assume outsized importance.

The AVMA ABVS has created an exercise that will guide the discipline, but the instrument to collect the data will always be flawed, and because it is difficult to standardize, and low participation rates, Theriogenology will be ill served.

Glad to see emphasis on neonatology. Felt like this area was lacking in my exam compared to how much of it I do as a therio vet in practice.

I am confused as to why any of the subjects would be classified as anything less than most important

I am curious to see how what diplomates think is important correlates to what we do regularly- some of the basic physiology is used and important foundationally, but not practically in a clinical setting on a regular basis

I appreciate the efforts to assemble, deliver and analyze this survey

I appreciate the work of everyone on the JTA.

I believe that becoming a diplomate in reproduction needs to continue to be a challenge and to be able to show knowledge to the specialty standards. All aspect of reproduction covered in this
survey are very important for the candidates and consequently I feel that needs to be covered in the exam and for the candidates to have complete knowledge at the level of the specialty.

I see a skewed caseload as a referral clinician.

I think it is important to recognize that there are many different types of DACTs and not all of us are practicing, but we still use our knowledge or are relied upon for that knowledge. Thank you.

I think the test for board certification in reproduction should evaluate the working knowledge of a candidate. Information on cloning, histopathology of evaluation of normal uterine involution, or diet management of dairy cattle for maximal milk production is out of the scope of the average theriogenologist working in a clinical setting. I need to know that cloning can be done and where to send a client, but knowing how to clone on a detailed basis is not practical since people in that field have the experience and stay current with all the changes that occur in cloning. I don't need to know the cellular level of uterine involution in a clinical setting. I need to have enough information to discuss uterine involution on a microscopic level with a pathologist, that is all. Nutrition and milk production starts to cross the line from reproduction to food production and all the complexities associated with food production. I just need to know how to maintain milk supply to grow a neonate to weaning. We need to focus on the more practical things in reproduction and only ask for a 'client level' of discussion in the techniques that are currently not available in practice. As those areas grow and develop and become available at the practice level, then we should require a deeper working knowledge of that area.

I would be very worried if any of the knowledge areas on this survey were removed from the training or the examination. Even if it is not a topic you personally deal with on a daily basis there is an expectation that as an ACT Diplomate that you are up to date and aware of all of the areas covered in this survey. I don't feel we should be reducing the content of the residency programme/exam to make it less comprehensive. It is vital that standards are maintained and knowledge always pushed, we should be striving for the best not settling for anything less. What is the point of becoming an ACT Diplomate if you are not proficient/knowledgeable in all aspects of Theriogenology? Thank you for your hard work in this important area.

Just a plug that normal physiology is very important for clinical understanding of pathology and potential therapeutics. Understanding the core mechanisms of normal and abnormal physiology is the difference that creates specialists.

Like many of the others have noted, taking the exam as a group I think bodes well in the community of meeting others. Many of the friends I have came from the exam time I took it. Not opposed to change but with the ever changing world, change to make everything virtual is not always good.

I am also frustrated with the ample opportunities people have to get boarded, specifically the PhD route. It is incredibly difficult to fill academic positions (normal route) because of the practitioner route and the PhD route. Seems to broad and will end up hurting the college in the long run. Already see many openings in college settings that don't get filled and the academic...
side just eliminates the programs. Need to train the next generation to be able to do clinical work otherwise we will all be researchers.

Many areas represent knowledge base that should have been established in veterinary school.

The specialist works in the area of the rare and infrequent, thus the fact that someone rarely has to deal with certain cases doesn’t diminish its importance.

Our specialty is both broad and deep- it is time we move to a scheme or system in which candidates are given a broad exam to achieve DACT status and then provide a mechanism for sub-specialty accreditation in which the already boarded individual displays a "deep" level of knowledge and competency in a specific area.

MANY OF THE QUESTIONS ARE IMPORTANT AND USED WHEN NEEDED BUT NOT ALL ARE NEEDED THE MAJORITY OF THE TIME

My responses may seem a bit odd, as I am currently in industry and not actively practicing. However, I utilize my knowledge to consult with other veterinarians in most/all of these topics daily. Therefore, even though I don't often perform the functions myself, knowledge of each of these areas has been vitally important to my career.

My responses to the importance questions, were based on my status as a Diplomate and a former Professor of Theriogenology.

NOTE: SINCE I AM RETIRED, my responses as to the frequency of performing tasks requiring knowledge in those areas were based upon consultations with veterinarians and lay people rather than the actual performance of those tasks and therefore, may skew the data.

New techniques regarding biotechnology should be emphasized in the exam, including, ICSI, oocyte and embryo vitrification, and sexed semen. I would recommend that most questions should be about comparative aspects among domestic species. In my opinion, there are too many questions about genetic disorders, which are very rare in practice.

Some areas of knowledge are important but don't translate directly into what one does on a day to day basis; instead they inform our understanding of what we do and the decisions we make.

Some items are important to have knowledge and understanding of, even if you rarely perform those tasks

Some knowledge domains are more relevant to one species over another, eg toxic causes of abortion in livestock > companion animals. Exam questions should reflect that.

Some of the topics listed are things that I expect my students to know. While they are important, they don’t make you a specialist. The depth of knowledge is more important, and there is no way of assessing depth from this survey

Surgery - good to have a requirement for this, otherwise the universities will not stand up and listen.

Thank you for doing this!
Thank you for taking the time to gather input from members of the College with regard to the knowledge a new Diplomate should have. I supported several candidates for the examination this year. Some passed the exam while others did not. I honestly believe that the ACT examination process is very fair which is the message I gave to the individuals that did not pass. They will pass. They are smart and great clinicians. They belong in our College, but it will require deeper study to get there. That is ok. I appreciate all that the ACT Examination committee does to ensure that our College remains the vibrant area of expertise that it is today. thank you.

PS - the slider question adding up to 100 needs to go...it did not reflect my view on importance in my work world and it was too fiddly to devote time to.

Thanks for the survey. I will include the previous subjects already mentioned.

The fact that I don't use every single one of these competencies on a daily basis does not detract from their importance as part of the DACT knowledge base.

The field is so broad and deep that it is difficult to address the basic sciences and the clinical application thereof in one survey which is to translate into one exam. Tough choices.

The last question (slider) was difficult for me. the choices should have been condensed for example eutocia/dystocia should be one, normal male/breeding soundness exam male should be one. In fact all normal anatomy should be included in clinical approach to disorders... I would not trust an analysis of the percentage allocation as it is know

The last question regarding how often I am required to perform a specific task was wrongly formulated because for many of them, I would have answered 100% because they are things I do every day, several times a day.

The percentage allocation question is impossible to answer adequately as so many of these skills overlap.

The percentage allocations are hard. In my day to day interactions normal physiology/anatomy is not used per se but this knowledge is the basis for clinical management and recognition of abnormalities.

I think there is a distinct difference training ACT members for academia and private practice. Until this concept is applied well to this exam expansion of this college will be difficult. For example production of a viable sperm- why should an ACT member memorize the days of development and key morphological changes during spermatogenesis? Really they should be well trained to recognized the abnormalities/presentation of clinical cases and have an understanding of spermatogenesis. The true number of days involved iwth each step and well documented in many text books and can be looked up. I feel too much emphasis is spent memorizing the chart in the text book vs the clinical ramifications of issues of spermatogenesis.

The percentage sliders at the very end were not that useful.

The point of a specialist is to know how to recognize diagnose and treat uncommon conditions The questions sometimes are very general and ambiguous.
The remote exam format should be removed entirely as an option. I feel very strongly about this. The slider totaling 100% is not a good scale and by necessity forced me to appear like everything I do is less than 10% of my time, which is slightly erroneous.

The use of sliders to answer this question was confusing: "Please use the sliders below to indicate how often you are required to use each competency. Your choices must total 100%.”

There are many areas that are the foundation to be able to do our job. For example, anatomy and physiology is not directly the condition that owner brings animals to us to treat but knowing them is essential. Same as embryology, genetics, pharmacology/toxicology, etc. I assume the diplomates will understand that the percentages are going to be used for making the exam and not exactly the presenting complaints of their day-to-day caseload when putting down percentages for this JTA.

Theriogenology has to gain more respect as a specialty. After 42 years in practice I have seen a steady decline. Many cases that I had seen as a young theriogenologist have been recently taken over by our colleagues, mainly internal medicine, surgery and emergency and in large animal therio by frozen semen companies, nutritionists or agronoms. To put Theriogenology to its value has to begin in the veterinary curriculum, i.e. the DVM students have to understand that our specialty is important. Faculties should put more consideration on our specialty and we should become again a strong discipline. We can only be strong if we have the number of representatives in academia...in most vet colleges the first position to remove in the Clinical Department is in Theriogenology and the ones who stay serve as 'consultants' to other specialties. Therefore, the ACT should only pass students with excellent knowledge, so we can stand out.

Also, the ACT College puts a lot of their energy to do continuing education of the general practitioner (non boarded SFT members) I wish, there would be a better offer to give that continuing education to us Diplomates. Which other College has their annual meeting to promote continuing education to the general practitioner or is this just specific to us?

This is great for knowledge. But does not measure competency.

This survey would have been much easier to complete if it were in tabular form so that a respondent could replicate same answers for multiple questions. Otherwise, good job!

Time spent on some aspects may not necessarily be an indicator of importance. Although some things may occur rarely it still may be very important for a specialist to be able to have a knowledge of the condition and be able to provide advice and/or identify it and manage the condition.

Very well thought out survey.

We need to be realistic about our job. Exotic animals, llamas/alpacas, pigs, and small ruminants are not the main focus of the majority of our colleagues.
Appendix M: Final content outline (dual phase)

Phase 1:

1. Normal male reproductive anatomy and physiology (17%)
   1. Comparative anatomical structure and function (e.g., vasculature, innervation, accessory sex glands, scrotum, spermatic cords, testes, epididymides, penis, prepuce)
   2. Reproductive endocrinology (e.g., hypothalamic-pituitary-gonadal axis, steroidogenesis, pheromones)
   3. Testicular descent/migration
   4. Puberty (e.g., definition, factors affecting onset)
   5. Spermatogenesis (e.g., spermatogenic cycle, spermatocytogenesis, spermiogenesis, spermiation, testicular thermoregulation)
   6. Ejaculate constituents (e.g., sperm, seminal plasma, accessory sex glands and epididymal contributions)
   7. Sperm structure and function (e.g., morphology, concentration, motility)
   8. Erection, emission, ejaculation, detumescence
   9. Sexual behavior (e.g., pubertal, peripubertal)
   10. Reproductive senescence

2. Normal female reproductive anatomy and physiology (20%)
   1. Comparative anatomical structure and function (e.g., vasculature, innervation, ovaries, oviducts, ovarian bursa, uterus, cervix, vagina, vestibule, vulva, mammary gland)
   2. Reproductive endocrinology (e.g., hypothalamic-pituitary-gonadal axis, steroidogenesis, pheromones)
   3. Puberty (e.g., definition, factors affecting onset)
   4. Oogenesis (e.g., oocyte recruitment, oocyte differentiation, folliculogenesis, follicular dynamics, ovulation)
   5. Estrous cycle (e.g., stages, corpus luteum formation and function, luteolysis)
   6. Behavior (e.g., estrous, peri-pubertal, maternal)
   7. Reproductive immunology
   8. Reproductive microbiology and microbiome
   9. Reproductive senescence
   10. Lactation
3. **Fertilization, embryology, and sexual differentiation (9%)**
1. Fertilization process (e.g., sperm capacitation and acrosome reaction, oocyte maturation and activation)
2. Embryonic stages of development (e.g., cytula, zygote, morula, blastocyst, hatched blastocyst, parthenogenesis)
3. Cytogenetics (e.g., DNA, mitosis, meiosis, diploid, haploid, karyotypes, chromosome)
4. Chromosome anomalies (e.g., aneuploid, monosomic, trisomic, chimeras, mosaics, translocations, inheritance)
5. Embryonic anatomy and differentiation (e.g., sex determination, system differentiation)

4. **Pregnancy (21%)**
1. Maternal recognition of pregnancy
2. Pregnancy diagnosis methods (e.g., palpation, ultrasonography, radiography, blood tests)
3. Comparative placentation (e.g., deciduate, adeciduate, epitheliochorial, syndesmochorial, interspecies pregnancy)
4. Fetal development
5. Polytocous pregnancy (e.g., prolificacy, embryo migration, uterine capacity, spontaneous embryo reduction, twin pregnancy in monotocous species)
6. Fetal circulation
7. Endocrinology of pregnancy
8. Maternal hematologic changes (e.g., hematocrit, neutrophilia)
9. Gestational length (e.g., seasonality, fetal sex, nutrition, fetal numbers)
10. Fetal well-being (e.g., fetal stress signs, combined thickness of the uterus and placenta)

5. **Eutocia (9%)**
1. Endocrinology of parturition (e.g., fetal stress, ACTH, Ferguson's reflex)
2. Stages of parturition (e.g., definition, timing, behavior, maternal and fetal physiological changes)
3. Techniques for monitoring parturition (e.g., temperature drop, waxing, milk electrolytes, tocodynamometry)
4. Multiple births (e.g., monozygotic, dizygotic, conjoined twins)
5. Obstetric nomenclature (e.g., fetal presentation, position, and posture)
6. Breeding management and population control (15%)
1. Normal breeding behavior
2. Analysis of animal and herd breeding records (e.g., per cycle pregnancy rate, calving interval, fecundity rate)
3. Estrous cycle manipulation (e.g., supplemental light, hormones, male-effect, estrus induction)
4. Estrous cycle monitoring (e.g., estrus behavior, estrus detection aids, ultrasonography, cytology, hormone levels, timing breeding)
5. Estrus suppression (e.g., indications and limitations, hormones, vaccines, gonadectomy)
6. Nutrition management (e.g., nutritional requirements according to sex, age and physiological status, male and female, pre-pubertal, gestating, post-partum, body condition scoring and recommendations, micronutrients, excessive dietary protein, “flushing”)
7. Nutritional deficiency and toxicity (e.g., vitamin A deficiency, selenium deficiency, mycotoxins)
8. Disease prevention programs (e.g., venereal disease testing, vaccination program)
9. Genetic counseling (e.g., common genetic conditions, recessive vs dominant genetic conditions, polygenic vs single gene conditions, pedigree analysis, common breed predispositions)
10. Contraception (e.g., hormonal implants, chemical castration, vaccines)

7. Pharmacology (MOA, hormones, analgesics, etc.) (9%)
1. Pharmacological analogs of reproductive hormones (e.g., mechanisms of action, clinical uses, toxicity)
2. Hormones of diagnostic utility (e.g. progesterone vs progestogens, inhibin, AMH, testosterone, estrogen, estrogenic compounds)
3. Antimicrobials and non-antimicrobials (e.g. antibiotic classes, antifungals, antivirals, chelators, biofilm disruptors, mechanisms of action, mechanism of resistance, bioavailability and penetration of the reproductive tract, pharmacokinetics and pharmacodynamics)
4. Anesthetics (e.g., local, regional, general, choice for gravid and non-gravid animals, contraindications)
5. Analgesics, antipyretics, anti-inflammatories (mechanisms of action, penetration)
6. Animal Medicinal Drug Use Clarification Act and use of prescription agents to improve reproductive performance
Phase 2:

1. Clinical approach to conditions of the male (diagnostics, therapeutics, management, prognosis) (12%)
   1. Exam of the reproductive tract (e.g., palpation, ultrasonography, endoscopy, cytology, histopathology, culture)
   2. Reproductive hormones in health and disease (e.g., testosterone with cryptorchidism, steroids with gonad neoplasia, gonadotropins with testicular degeneration)
   3. Congenital and acquired disorders affecting mating ability (e.g., behavior, neurologic, musculoskeletal)
   4. Congenital and acquired disorders of the scrotum and its contents (e.g., XXY syndrome, testicular hypoplasia, spermatic cord torsion, epididymitis; hydrocele)
   5. Congenital and acquired disorders of the prepuce and penis (e.g., persistent frenulum, coital exanthema, transmissible venereal tumor)
   6. Congenital and acquired disorders of accessory sex glands (e.g., benign prostatic hyperplasia, seminal vesiculitis, ampullary obstruction)
   7. Spermiogram analysis (e.g., methods of analysis, sperm production and output, CASA, flow cytometry, seminal plasma evaluation, hemospermia, urospermia, oligospermia, asthenospermia, teratospermia, obstructive/non-obstructive azoospermia)
   8. Genetic testing and assessment (species/breed-specific testing)
   9. Endocrine disruptors (e.g., effect of drugs on spermatogenesis, mycotoxins)

2. Clinical approach to conditions of the non-pregnant female (diagnostics, therapeutics, management, prognosis) (15%)
   1. Exam of the reproductive tract (e.g., palpation, ultrasonography, endoscopy, cytology, histopathology, culture)
   2. Reproductive hormones in health and disease (e.g., progesterone with anestrus, inhibin and AMH with gonad neoplasia, acquired endocrinological and metabolic disorders)
   3. Abnormal cyclicity (e.g., anestrus, persistent estrus, short/long interestrus interval)
   4. Congenital and acquired disorders of the ovaries (e.g., XO syndrome, granuloma cell tumor, cystic ovarian disease)
   5. Congenital and acquired disorders of the uterine tubes and uterus (e.g., hydrosalpinx, uterus unicornis, leiomyoma, endometritis, pyometra)
   6. Congenital and acquired disorders of the vulva, vestibule and vagina (e.g., persistent hymen, coital exanthema, prepubertal and peripubertal vaginitis)
   7. Congenital and acquired disorders of the bladder and urethra (e.g., ruptured bladder, urethral mass)
   8. Genetic testing and assessment (species/breed-specific testing)
3. Clinical approach to conditions of the pregnant and postpartum female (diagnostics, therapeutics, management, prognosis) (16%)
1. Exam of the reproductive tract (e.g., palpation, ultrasonography, culture; hormone levels, CMT)
2. Disorders of pregnancy (e.g., vaginal prolapse, hydropic conditions, abdominal hernia, placentitis, pregnancy toxemia)
3. Dystocia causes (e.g., primary/secondary uterine inertia, fetomaternal disproportion, abnormal presentation)
4. Dystocia management (e.g., obstetrical maneuvers, controlled vaginal delivery, fetotomy, cesarean section)
5. Fetal monsters (e.g., Schistosomus reflexus, arthrogryposis, anasarca)
6. Disorders of the postpartum period (e.g., recto-vaginal trauma, uterine prolapse, uterine artery rupture, hypocalcemia, retained fetal membranes, metritis, eclampsia, lactational anestrus)
7. Disorders of the mammary gland (e.g., agalactia, mastitis, neoplasia)
8. Induction abortion/parturition (e.g., indications and limitations, non-hormonal methods, hormone actions and dosage/protocol)
9. Endocrine disruptors and metabolic diseases (e.g., effect of drugs on pregnancy, lactation, diabetes, PPID, insulin disregulation, mycotoxins)

4. Clinical approach to pregnancy wastage (8%)
1. Pregnancy wastage investigation (e.g., epidemiological record analysis, exam of aborting female, necropsy findings of aborted/stillbirth animals, collection of samples for laboratory tests, laboratory test options)
2. Embryonic death (e.g., occurrence and causes, clinical signs)
3. Bacterial causes (e.g., brucellosis, leptospirosis, campylobacteriosis)
4. Viral causes (e.g., PRRS virus, feline panleukopenia virus, equine herpes virus)
5. Protozoal causes (e.g., trichomoniasis, toxoplasmosis, neosporosis)
6. Fungal causes (e.g., Aspergillus, Mucor)
7. Teratogens and toxins (e.g., drugs, toxic plants, mycotoxins)
8. Other non-infectious causes (e.g., iatrogenic, nutritional deficiencies, heat stress, hypoluteoidism, twinning in mares, endometrial health)
5. Neonatology (9%)
1. Assessment of neonates (e.g., postpartum and neonatal viability scoring, passive transfer evaluation, limb deformities, conditions caused by the birthing process, congenital conditions, hernias)
2. Neonatal care (e.g., resuscitation, colostrum/plasma supplementation orphan neonates, husbandry, assessment of environment)
3. Neonatal development (e.g., suckling reflex, body weight doubling, eyes opening)
4. Clinical assessment and management for neonatal disease and surgery (sepsis, neonatal isoerythrolysis, cleft palate, patent urachus, intestinal obstruction/colic, septic joints, angular limb deformities)

6. Urogenital surgery (female) (7%)
1. Vaginal vestibular surgery (e.g., urine pooling, hymenal remnant, Buhner's vulvar suture technique, vaginal septum)
2. Cervical surgery (e.g., lacerations, fibrosis, cervical wedge resection)
3. Uterine surgery (e.g., Cesarean section, hysterectomy, mass removal)
4. Ovarian surgery (e.g., ovariectomy, ovarian remnant syndrome, colpotomy, cyst removal)
5. Routine desexing surgeries (OHE, OVX)
6. Perineal surgery (e.g., Caslick's, episiotomy, perineal repair)
7. Effects of gonadectomy on general health and welfare, growth performance

7. Urogenital surgery (male) (5%)
1. Penile surgery (e.g., amputation, reefing, urethrostomy, trauma)
2. Testicular surgery (e.g., hemicastration, adult castration, prepuberal castration, testicular biopsy)
3. Teaser preparation (e.g., penile translocation, vasectomy, epididymectomy, penopexy)
4. Prepuce surgery (e.g., diverticulectomy, amputation)
5. Effects of gonadectomy on general health and welfare, growth performance
8. **Artificial insemination** (17%)
1. Semen collection techniques and procedures
2. Requirements for sanitation, hygiene and quality control
3. Producing fresh and cooled extended semen doses (e.g., semen extenders, processing, packaging, and transporting, breeding dose quantity/quality, sperm cold shock)
4. Producing frozen semen doses (e.g., semen extenders, processing and packaging, breeding dose quantity/quality, sperm cryobiology)
5. Insemination techniques (e.g., choice of method according to species/semen type, deep-horn insemination, endoscopy-guided insemination)
6. Processing epididymal sperm (e.g., sperm harvest, semen extenders, processing and packaging)
7. Sexed semen production and use (e.g., X- and Y-chromosome bearing sperm differences, flow cytometry cell sorting, pregnancy rate and gender bias)
8. Disease transmission through semen (e.g., potential pathogens, semen donor testing, control with semen antibiotics, import/export regulations)

9. **Embryo technologies** (11%)
1. In vivo embryo production (e.g., indications, limitations, expected outcomes)
2. Requirements for sanitation, hygiene and quality control
3. Superovulation (e.g., hormone treatment protocols and basis)
4. Embryo recovery and transfer techniques (e.g., surgical and non-surgical)
5. Recipient synchronization (e.g., hormone treatment protocols and basis, pregnancy rates according to synchrony)
6. Oocyte aspiration techniques (e.g., excised ovaries, ultrasound-guided aspiration)
7. In vitro embryo production (e.g., indications, limitations, and expected outcomes, media requirements, timing, oocyte maturation, sperm selection, in vitro fertilization, embryo culture)
8. Intracytoplasmic sperm injection (e.g., indications, limitations, and expected outcomes, equipment, sperm selection, oocyte injection procedures)
9. Embryo evaluation and classification (e.g., stage of development, morphology/quality)
10. Embryo cryopreservation (e.g., in-vivo vs in-vitro embryos, processing and packaging, embryo cryobiology, vitrification)
11. Disease transmission through embryos (e.g., potential pathogens, oocyte and semen donor testing, control through processing, import/export regulations)
12. Somatic cell nuclear transfer (e.g., indications, limitations, and expected outcomes, procedures overview)
Appendix N: Final content outline (intermediate single phase)

1. Non-pregnant female anatomy, physiology and clinical reproduction (18%)

- **Normal female reproductive anatomy and physiology**
  1. Comparative anatomical structure and function (e.g., vasculature, innervation, ovaries, oviducts, ovarian bursa, uterus, cervix, vagina, vestibule, vulva, mammary gland)
  2. Reproductive endocrinology (e.g., hypothalamic-pituitary-gonadal axis, steroidogenesis, pheromones)
  3. Puberty (e.g., definition, factors affecting onset)
  4. Oogenesis (e.g., oocyte recruitment, oocyte differentiation, folliculogenesis, follicular dynamics, ovulation)
  5. Estrous cycle (e.g., stages, corpus luteum formation and function, luteolysis)
  6. Behavior (e.g., estrous, peri-pubertal, maternal)
  7. Reproductive immunology
  8. Reproductive microbiology and microbiome
  9. Reproductive senescence
  10. Lactation

- **Clinical approach to conditions of the non-pregnant female (diagnostics, therapeutics, management, prognosis)**
  1. Exam of the reproductive tract (e.g., palpation, ultrasonography, endoscopy, cytology, histopathology, culture)
  2. Reproductive hormones in health and disease (e.g., progesterone with anestrus, inhibin and AMH with gonad neoplasia, acquired endocrinological and metabolic disorders)
  3. Abnormal cyclicity (e.g., anestrus, persistent estrus, short/long interestrus interval)
  4. Congenital and acquired disorders of the ovaries (e.g., XO syndrome, granuloma cell tumor, cystic ovarian disease)
  5. Congenital and acquired disorders of the uterine tubes and uterus (e.g., hydrosalpinx, uterus unicornis, leiomyoma, endometritis, pyometra)
  6. Congenital and acquired disorders of the vulva, vestibule and vagina (e.g., persistent hymen, coital exanthema, prepubertal and peripubertal vaginitis)
  7. Congenital and acquired disorders of the bladder and urethra (e.g., ruptured bladder, urethral mass)
  8. Genetic testing and assessment (species/breed-specific testing)
2. **Fertilization, embryology, and sexual differentiation (4%)**
1. Fertilization process (e.g., sperm capacitation and acrosome reaction, oocyte maturation and activation)
2. Embryonic stages of development (e.g., cytula, zygote, morula, blastocyst, hatched blastocyst, parthenogenesis)
3. Cytogenetics (e.g., DNA, mitosis, meiosis, diploid, haploid, karyotypes, chromosome)
4. Chromosome anomalies (e.g., aneuploid, monosomic, trisomic, chimeras, mosaics, translocations, inheritance)
5. Embryonic anatomy and differentiation (e.g., sex determination, system differentiation)

3. **Pregnancy (11%)**
1. Maternal recognition of pregnancy
2. Pregnancy diagnosis methods (e.g., palpation, ultrasonography, radiography, blood tests)
3. Comparative placentation (e.g., deciduate, adeciduate, epitheliochorial, syndesmochorial, interspecies pregnancy)
4. Fetal development
5. Polytocous pregnancy (e.g., prolificacy, embryo migration, uterine capacity, spontaneous embryo reduction, twin pregnancy in monotocous species)
6. Fetal circulation
7. Endocrinology of pregnancy
8. Maternal hematologic changes (e.g., hematocrit, neutrophilia)
9. Gestational length (e.g., seasonality, fetal sex, nutrition, fetal numbers)
10. Fetal well-being (e.g., fetal stress signs, combined thickness of the uterus and placenta)

4. **Clinical approach to the pregnant and postpartum female (16%)**
   - **Eutocia**
     1. Endocrinology of parturition (e.g., fetal stress, ACTH, Ferguson's reflex)
     2. Stages of parturition (e.g., definition, timing, behavior, maternal and fetal physiological changes)
     3. Techniques for monitoring parturition (e.g., temperature drop, waxing, milk electrolytes, tocodynamometry)
     4. Multiple births (e.g., monozygotic, dizygotic, conjoined twins)
     5. Obstetric nomenclature (e.g., fetal presentation, position, and posture)
   - **Clinical approach to conditions of the pregnant and postpartum female (diagnostics, therapeutics, management, prognosis)**
     1. Exam of the reproductive tract (e.g., palpation, ultrasonography, culture; hormone levels, CMT)
     2. Disorders of pregnancy (e.g., vaginal prolapse, hydropic conditions, abdominal hernia,
placentitis, pregnancy toxemia)
3. Dystocia causes (e.g., primary/secondary uterine inertia, fetomaternal disproportion, abnormal presentation)
4. Dystocia management (e.g., obstetrical maneuvers, controlled vaginal delivery, fetotomy, cesarean section)
5. Fetal monsters (e.g., Schistosomus reflexus, arthrogryposis, anasarca)
6. Disorders of the postpartum period (e.g., recto-vaginal trauma, uterine prolapse, uterine artery rupture, hypocalcemia, retained fetal membranes, metritis, eclampsia, lactational anestrus)
7. Disorders of the mammary gland (e.g., agalactia, mastitis, neoplasia)
8. Induction abortion/parturition (e.g., indications and limitations, non-hormonal methods, hormone actions and dosage/protocol)
9. Endocrine disruptors and metabolic diseases (e.g., effect of drugs on pregnancy, lactation, diabetes, PPID, insulin disregulation, mycotoxins)

- Clinical approach to pregnancy wastage
  1. Pregnancy wastage investigation (e.g., epidemiological record analysis, exam of aborting female, necropsy findings of aborted/stillbirth animals, collection of samples for laboratory tests, laboratory test options)
  2. Embryonic death (e.g., occurrence and causes, clinical signs)
  3. Bacterial causes (e.g., brucellosis; leptospirosis, campylobacteriosis)
  4. Viral causes (e.g., PRRS virus, feline panleukopenia virus, equine herpes virus)
  5. Protozoal causes (e.g., trichomoniasis, toxoplasmosis, neosporosis)
  6. Fungal causes (e.g., Aspergillus, Mucor)
  7. Teratogens and toxins (e.g., drugs, toxic plants, mycotoxins)
  8. Other non-infectious causes (e.g., iatrogenic, nutritional deficiencies, heat stress, hypoluteoidism, twinning in mares, endometrial health)

5. Male anatomy, physiology and clinical reproduction (14%)

- Normal male reproductive anatomy and physiology
  1. Comparative anatomical structure and function (e.g., vasculature, innervation, accessory sex glands, scrotum, spermatic cords, testes, epididymides, penis, prepuce)
  2. Reproductive endocrinology (e.g., hypothalamic-pituitary-gonadal axis, steroidogenesis, pheromones)
  3. Testicular descent/migration
  4. Puberty (e.g., definition, factors affecting onset)
  5. Spermatogenesis (e.g., spermatogenic cycle, spermatocytogenesis, spermiogenesis, spermiation, testicular thermoregulation)
6. Ejaculate constituents (e.g., sperm, seminal plasma, accessory sex glands and epididymal contributions)
7. Sperm structure and function (e.g., morphology, concentration, motility)
8. Erection, emission, ejaculation, detumescence
9. Sexual behavior (e.g., pubertal, peripubertal)
10. Reproductive senescence

- **Clinical approach to conditions of the male (diagnostics, therapeutics, management, prognosis)**
  1. Exam of the reproductive tract (e.g., palpation, ultrasonography, endoscopy, cytology, histopathology, culture)
  2. Reproductive hormones in health and disease (e.g., testosterone with cryptorchidism, steroids with gonad neoplasia, gonadotropins with testicular degeneration)
  3. Congenital and acquired disorders affecting mating ability (e.g., behavior, neurologic, musculoskeletal)
  4. Congenital and acquired disorders of the scrotum and its contents (e.g., XXY syndrome, testicular hypoplasia, spermatic cord torsion, epididymitis; hydrocele)
  5. Congenital and acquired disorders of the prepuce and penis (e.g., persistent frenulum, coital exanthema, transmissible venereal tumor)
  6. Congenital and acquired disorders of accessory sex glands (e.g., benign prostatic hyperplasia, seminal vesiculitis, ampullary obstruction)
  7. Spermiogram analysis (e.g., methods of analysis, sperm production and output, CASA, flow cytometry, seminal plasma evaluation, hemospermia, urospermia, oligospermia, asthenospermia, teratospermia, obstructive/non-obstructive azoospermia)
  8. Genetic testing and assessment (species/breed-specific testing)
  9. Endocrine disruptors (e.g., effect of drugs on spermatogenesis, mycotoxins)
6. Breeding management and population control (8%)
1. Normal breeding behavior
2. Analysis of animal and herd breeding records (e.g., per cycle pregnancy rate, calving interval, fecundity rate)
3. Estrous cycle manipulation (e.g., supplemental light, hormones, male-effect, estrus induction)
4. Estrous cycle monitoring (e.g., estrus behavior, estrus detection aids, ultrasonography, cytology, hormone levels, timing breeding)
5. Estrus suppression (e.g., indications and limitations, hormones, vaccines, gonadectomy)
6. Nutrition management (e.g., nutritional requirements according to sex, age and physiological status, male and female, pre-pubertal, gestating, post-partum, body condition scoring and recommendations, micronutrients, excessive dietary protein, “flushing”)
7. Nutritional deficiency and toxicity (e.g., vitamin A deficiency, selenium deficiency, mycotoxins)
8. Disease prevention programs (e.g., venereal disease testing, vaccination program)
9. Genetic counseling (e.g., common genetic conditions, recessive vs dominant genetic conditions, polygenic vs single gene conditions, pedigree analysis, common breed predispositions)
10. Contraception (e.g., hormonal implants, chemical castration, vaccines)

7. Artificial insemination (9%)
1. Semen collection techniques and procedures
2. Requirements for sanitation, hygiene and quality control
3. Producing fresh and cooled extended semen doses (e.g., semen extenders, processing, packaging, and transporting, breeding dose quantity/quality, sperm cold shock)
4. Producing frozen semen doses (e.g., semen extenders, processing and packaging, breeding dose quantity/quality, sperm cryobiology)
5. Insemination techniques (e.g., choice of method according to species/semen type, deep-horn insemination, endoscopy-guided insemination)
6. Processing epididymal sperm (e.g., sperm harvest, semen extenders, processing and packaging)
7. Sexed semen production and use (e.g., X- and Y-chromosome bearing sperm differences, flow cytometry cell sorting, pregnancy rate and gender bias)
8. Disease transmission through semen (e.g., potential pathogens, semen donor testing, control with semen antibiotics, import/export regulations)

8. Embryo technologies (6%)
1. In vivo embryo production (e.g., indications, limitations, expected outcomes)
2. Requirements for sanitation, hygiene and quality control
3. Superovulation (e.g., hormone treatment protocols and basis)
4. Embryo recovery and transfer techniques (e.g., surgical and non-surgical)
5. Recipient synchronization (e.g., hormone treatment protocols and basis, pregnancy rates according to synchrony)
6. Oocyte aspiration techniques (e.g., excised ovaries, ultrasound-guided aspiration)
7. In vitro embryo production (e.g., indications, limitations, and expected outcomes, media requirements, timing, oocyte maturation, sperm selection, in vitro fertilization, embryo culture)
8. Intracytoplasmic sperm injection (e.g., indications, limitations, and expected outcomes, equipment, sperm selection, oocyte injection procedures)
9. Embryo evaluation and classification (e.g., stage of development, morphology/quality)
10. Embryo cryopreservation (e.g., in-vivo vs in-vitro embryos, processing and packaging, embryo cryobiology, vitrification)
11. Disease transmission through embryos (e.g., potential pathogens, oocyte and semen donor testing, control through processing, import/export regulations)
12. Somatic cell nuclear transfer (e.g., indications, limitations, and expected outcomes, procedures overview)

9. Urogenital surgery (6%)
    - Urogenital surgery (female)
      1. Vaginal vestibular surgery (e.g., urine pooling, hymenal remnant, Buhner's vulvar suture technique, vaginal septum)
      2. Cervical surgery (e.g., lacerations, fibrosis, cervical wedge resection)
      3. Uterine surgery (e.g., Cesarean section, hysterectomy, mass removal)
      4. Ovarian surgery (e.g., ovariectomy, ovarian remnant syndrome, colpotomy, cyst removal)
      5. Routine desexing surgeries (OHE, OVX)
      6. Perineal surgery (e.g., Caslick's, episioplasty, perineal repair)
      7. Effects of gonadectomy on general health and welfare, growth performance
    - Urogenital surgery (male)
      1. Penile surgery (e.g., amputation, reefing, urethrostomy, trauma)
      2. Testicular surgery (e.g., hemicastration, adult castration, prepuberal castration, testicular biopsy)
      3. Teaser preparation (e.g., penile translocation, vasectomy, epididymectomy, penopexy)
      4. Prepuce surgery (e.g., diverticulectomy, amputation)
      5. Effects of gonadectomy on general health and welfare, growth performance

10. Neonatology (5%)
    1. Assessment of neonates (e.g., postpartum and neonatal viability scoring, passive transfer evaluation, limb deformities, conditions caused by the birthing process, congenital conditions, hernias)
    2. Neonatal care (e.g., resuscitation, colostrum/plasma supplementation orphan neonates, husbandry, assessment of environment)
3. Neonatal development (e.g., suckling reflex, body weight doubling, eyes opening)
4. Clinical assessment and management for neonatal disease and surgery (sepsis, neonatal isoerythrolysis, cleft palate, patent urachus, intestinal obstruction/colic, septic joints, angular limb deformities)

11. Pharmacology (MOA, hormones, analgesics, etc.) (3%)
1. Pharmacological analogs of reproductive hormones (e.g., mechanisms of action, clinical uses, toxicity)
2. Hormones of diagnostic utility (e.g. progesterone vs progestogens, inhibin, AMH, testosterone, estrogen, estrogenic compounds)
3. Antimicrobials and non-antimicrobials (e.g. antibiotic classes, antifungals, antivirals, chelators, biofilm disruptors, mechanisms of action, mechanism of resistance, bioavailability and penetration of the reproductive tract, pharmacokinetics and pharmacodynamics)
4. Anesthetics (e.g., local, regional, general, choice for gravid and non-gravid animals, contraindications)
5. Analgesics, antipyretics, anti-inflammatories (mechanisms of action, penetration)
6. Animal Medicinal Drug Use Clarification Act and use of prescription agents to improve reproductive performance