

Year-one knowledge and skills in theriogenology: a preliminary study

Margaret Root Kustritz,^a Patricia Sertich,^b Aime Johnson,^c Scott Madill^d

^aDepartment of Veterinary Clinical Sciences, University of Minnesota College of Veterinary Medicine, St. Paul, MN, USA,

^bDepartment of Clinical Studies – New Bolton Center, University of Pennsylvania School of Veterinary Medicine,

Philadelphia, PA, USA, ^cDepartment of Clinical Sciences, Auburn University College of Veterinary Medicine,

Auburn, AL, USA, ^dDepartment of Veterinary Population Medicine, University of Minnesota College of Veterinary Medicine, St. Paul, MN, USA

Abstract

Veterinary practitioners who had just completed their first postgraduate year of work were surveyed to determine what knowledge and skills in theriogenology were used in that first year with the goal of helping veterinary schools prioritize components of the model core curriculum in their curricular offerings. The survey was based on a core curriculum created by the American College of Theriogenologists. Forty-eight surveys were returned; response rate could not be calculated. The majority of participants were in small animal practice but a wide range of employment experiences was represented. The only component listed as very commonly used in all practice types was ‘reproductive anatomy in any species.’ Reproductive work in general was not managed by small animal practitioners, reflecting current caseload in most small animal primary care clinics in the United States, which focuses on sterilized small animal patients. Reproductive work was more common among large animal practitioners, particularly those in mixed and food animal practices. The core curriculum is comparative and in this study many of the components rated as being used very commonly required input from disciplines outside of theriogenology for training, including anesthesia, surgery, and medical imaging. It is important for those teaching theriogenology to be an active part of all conversations about curriculum at academic institutions and that the comparative nature of theriogenology be stressed to ensure all necessary components are being taught to prepare graduates for theriogenology work in practice.

Keywords: Curriculum, theriogenology, competencies

Introduction

There is a growing interest in use of competencies to guide medical education. Competency frameworks for veterinary medical education have been created locally and as part of an international consortium.^{1,2} The American Association of Veterinary Medical Colleges endorses the competency-based veterinary education framework of 32 competencies divided into 9 domains.³ The domains are clinical reasoning and decision-making, individual animal care and management, animal population care and management, public health, communication, collaboration, professionalism and professional identity, financial and practice management, and scholarship.

Competencies of this type are general and do not address what specific content and skills should be included for each

discipline in veterinary medical training. Individual educational researchers and colleges and organized medicine cooperatives have created lists of knowledge and skills required of veterinary students at graduation.^{b,3,4} Often these are created with extensive input from practicing veterinarians.

The American College of Theriogenologists has developed a model core curriculum (Appendix) and completed a survey of veterinarians across the United States to determine what knowledge and which skills in theriogenology were most commonly used in all types of veterinary practice.⁵ The model core curriculum was the basis of this study that surveyed veterinary school graduates who had just completed a year of veterinary practice. The survey attempted to determine what knowledge and skills in theriogenology were used in that first year with the goal of helping veterinary schools prioritize

^a <https://www.aavmc.org/programs/cbve/>

^b <https://aaep.org/core-competencies>

components of the model core curriculum in their curricular offerings.

Materials and methods

Graduates from the veterinary class of 2021 from Auburn University, University of Minnesota, and University of Pennsylvania were invited to complete a survey based on the model core curriculum. Surveys were anonymous. Graduates were asked from which school they had graduated and what kind of veterinary employment they had in their first year after

graduation (May 2021–May 2022). For each component of the model core curriculum, participants were asked to identify how frequently they used that information or skill in their first year of practice with ratings of never, rarely (less than once a month), commonly (at least once a month), and very commonly (at least weekly). For basic science components, participants were asked to extrapolate how frequently they used that information as clinicians. For those who do reproductive work seasonally, they were asked to select the option that was most accurate during the breeding season. Descriptive data are presented, with no statistical analysis.

Results

Forty-eight surveys were returned, with 40 from University of Minnesota, 6 from University of Pennsylvania, and 2 from Auburn University. The survey was offered to multiple schools for distribution and the authors do not know the complete population to which this may have been distributed so response rate cannot be calculated. The majority of participants were in small animal practice, but a wide range of employment experiences was represented (Table 1).

Frequency of use of information or skill by employment type is tabulated (Tables 2–9). Components are listed by category

Table 1. Employment during the first year of veterinary practice

Designation	Number of responses
Small animal practice	17
Internship – small animal	10
Mixed animal practice with common domestic species	4
Internship – equine	3
Equine practice	2
Food animal practice	2
Residency	2
Equine and food animal practice	1
Internship – large animal	1
Internship – small animal in shelter medicine	1
Small animal, equine and food animal practice	1
Small animal, equine, food animal, and exotics practice	1
Small animal and exotics practice	1
Small animal and food animal practice	1
Small animal and mixed animal practice	1

Table 2. Small animal clinician* – general content

Very commonly used
Reproductive anatomy in any species
Commonly used
—
Rarely used
Reproductive endocrinology in any species
Reproductive biology in any species (folliculogenesis, spermatogenesis, fertilization, placentation, mammary gland development)
Histology of reproductive tissues in any species

* Small animal = Small animal practice, internship – small animal, internship – small animal in shelter medicine, small animal and mixed practice, small animal and exotics practice (n = 30).

Table 3. Small animal clinician* – theriogenology content

Very commonly used
Small animal general anesthesia
Commonly used
Small animal sterilization – surgical
Small animal ovariohysterectomy/ovariectomy/hysterectomy
Small animal castration (descended or cryptorchid)
Small animal mammary neoplasia
Small animal estrous cycle
Rarely used
Small animal pregnancy diagnosis/pregnancy management
Small animal dystocia management/obstetrics
Small animal infectious diseases of the reproductive tract
Small animal breeding management
Small animal mastitis
Small animal female neoplasia of the reproductive tract
Small animal male neoplasia of the reproductive tract
Small animal neonatal resuscitation
Small animal cesarean section
Small animal periparturient disorders (metritis, hypocalcemia/eclampsia, subinvolution of placental sites)
Small animal pregnancy termination
Small animal male infectious diseases of the reproductive tract
Small animal testing for heritable disorders, breeding planning

* Small animal = Small animal practice, internship – small animal, internship – small animal in shelter medicine, small animal and mixed practice, small animal and exotics practice (n = 30).

Table 4. Equine clinician** – general content

Very commonly used
Reproductive anatomy in any species
Reproductive endocrinology in any species
Reproductive biology in any species (folliculogenesis, spermatogenesis, fertilization, placentation, mammary gland development)
Commonly used
Histology of reproductive tissues in any species

** Equine = equine practice, internship – equine (n = 5).

Table 5. Equine clinician** – theriogenology content

Very commonly used
Equine standing anesthesia
Equine breeding management
Equine manipulation of estrus (pharmacologic, lighting, etc.)
Equine pregnancy diagnosis/pregnancy management
Equine artificial insemination/embryo transfer
Equine transrectal palpation
Equine ultrasound
Equine passage of pipette/biopsy instrument/insemination pipette into uterus
Commonly used
Equine estrous cycle
Equine causes of abnormal cycling including anestrus
Equine periparturient disorders (metritis, retained fetal membranes)
Equine castration (descended or cryptorchid)
Equine Caslick’s surgery
Equine endometritis
Equine breeding soundness examination/semen collection and evaluation
Equine recumbent (general) anesthesia
Rarely used
Equine abortion
Equine female infectious diseases of the reproductive tract
Equine dystocia management/obstetrics
Equine herd health/performance goals/economic / record-keeping
Equine mastitis
Equine male infertility
Equine neoplasia of the male reproductive tract
Equine perineal reconstruction
Equine male infectious diseases of the reproductive tract
Equine testing for heritable disorders, creating a breeding plan
Equine neoplasia of the female reproductive tract
Equine neonatal resuscitation
Equine cesarean section
Equine ovariectomy

** Equine = Equine practice, internship – equine (n = 5).

Table 6. Food animal clinician† – theriogenology content

Very commonly used
Bovine estrous cycle
Bovine breeding management
Bovine pharmacologic manipulation of estrus
Bovine causes of abnormal cycling including anestrus
Bovine pregnancy diagnosis/pregnancy management
Bovine dystocia management (obstetrics, fetotomy)
Bovine periparturient disorders (hydrops, vaginal/uterine prolapse, metritis, retained fetal membranes, endometritis, hypocalcemia)
Bovine female infectious diseases of the reproductive tract
Bovine mastitis
Bovine male infertility
Bovine male infectious diseases of the reproductive tract
Bovine herd health / performance goals / economics / record-keeping
Bovine transrectal palpation
Bovine ultrasonography
Bovine breeding soundness examination / Semen collection and evaluation
Bovine standing anesthesia
Bovine artificial insemination / embryo transfer
Bovine testing for heritable disease / breeding planning
Bovine neonatal resuscitation
Small ruminant parturition / obstetrics
Commonly used
Bovine teat surgery
Bovine castration
Small ruminant breeding management
Small ruminant pregnancy diagnosis / pregnancy management
Small ruminant abortion
Bovine neoplasia of the female reproductive tract
Bovine neoplasia of the male reproductive tract
Bovine cesarean section
Small ruminant estrous cycle
Small ruminant breeding soundness examination / Semen collection and evaluation
Rarely used
Bovine passage of pipette / biopsy instrument / insemination pipette into uterus
Bovine Caslick’s surgery
Bovine ovariectomy

† Food animal = Food animal practice (n = 2).

Table 7. Food animal clinician – theriogenology content

Very commonly used
Bovine estrous cycle
Bovine breeding management
Bovine pharmacologic manipulation of estrus
Bovine causes of abnormal cycling including anestrus
Bovine pregnancy diagnosis/pregnancy management
Bovine dystocia management (obstetrics, fetotomy)
Bovine periparturient disorders (hydrops, vaginal/uterine eversions, metritis, retained fetal membranes, endometritis, hypocalcemia)
Bovine female infectious diseases of the reproductive tract
Bovine mastitis
Bovine male infertility
Bovine male infectious diseases of the reproductive tract
Bovine herd health/performance goals/economics/record-keeping
Bovine transrectal palpation
Bovine ultrasonography
Bovine breeding soundness examination/semen collection and evaluation
Bovine standing anesthesia
Bovine artificial insemination/embryo transfer
Bovine testing for heritable disease/breeding planning
Bovine neonatal resuscitation
Small ruminant parturition/obstetrics
Commonly used
Bovine teat surgery
Bovine castration
Small ruminant breeding management
Small ruminant pregnancy diagnosis/pregnancy management
Small ruminant abortion
Bovine neoplasia of the female reproductive tract
Bovine neoplasia of the male reproductive tract
Bovine cesarean section
Small ruminant estrous cycle
Small ruminant breeding soundness examination/semen collection and evaluation
Rarely used
Bovine passage of pipette/biopsy instrument/insemination pipette into uterus
Bovine Caslick's surgery
Bovine ovariectomy

† Food animal = Food animal practice (n = 2).

and from highest to lowest weighted score within that category.

The only component listed as very commonly used in all practice types was 'reproductive anatomy in any species.' Seven

Table 8. Mixed animal clinician†† – general content

Very commonly used
Reproductive anatomy in any species
Commonly used
Reproductive endocrinology in any species
Reproductive biology in any species (folliculogenesis, spermatogenesis, fertilization, placentation, mammary gland development)
Rarely used
Histology of reproductive tissues in any species

†† Mixed animal = Mixed animal practice with common domestic species; small animal, equine and food animal practice; small animal, equine, food animal and exotics practice; small animal and food animal practice; equine and food animal practice; internship – large animal; residency (n = 11).

components were listed as never used in any practice type; these were 'small animal male infertility', 'small animal artificial insemination', small animal contraception – pharmacologic', 'small animal breeding soundness examination/semen collection and evaluation', 'porcine breeding management', 'porcine breeding soundness examination/semen collection and evaluation', and 'porcine artificial insemination'. Two or more participants suggested that more should be taught about ovariohysterectomy and castration in rabbits, reproductive issues including dystocia in small mammals and reptiles, egg binding in birds (including commercial poultry) and reptiles, and small animal ultrasonography. Several small animal participants spontaneously noted that dystocia was the most common clinical presentation managed.

Discussion

Variation in use of knowledge and skills by employment type was similar to other studies. A study describing veterinarians' perceptions of skills, knowledge, and attributes of new veterinary graduates suggested that large animal theriogenology was not considered valuable by small animal practitioners whereas canine and large animal theriogenology were considered valuable by large animal practitioners.⁶ This is likely because only a few small animal practitioners do any large animal work whereas many large animal practitioners do some small animal work. Within small animal, only 1 participant noted that they worked in a practice that worked with dog breeders so the scoring in this study was reflective of the average small animal practitioner, with a much greater focus on sterilization and treatment of disease of spayed female dogs than on breeding work. That large animal practice was much more likely to have a significant focus on breeding work (only in some species) was reflected in the ratings provided by mixed animal and food animal practitioners. Ratings for large animal topics may reflect ability of nonveterinarians to perform some of this work.

A survey of over 1,000 veterinarians representing training at all but 3 schools in North America identified basic procedures as most valuable in training (e.g. transrectal palpation in cows and mares and interpretation of vaginal cytology specimens in dogs).⁵ In that survey, dystocia management

Table 9. Mixed animal clinician †† – theriogenology content

Very commonly used

Commonly used
Bovine estrous cycle
Bovine pharmacologic manipulation of estrus
Bovine pregnancy diagnosis/pregnancy management
Bovine transrectal palpation
Bovine breeding management
Bovine dystocia management (obstetrics, fetotomy)
Bovine periparturient disorders (hydrops, vaginal/uterine eversions, metritis, retained fetal membranes, endometritis, hypocalcemia)
Bovine castration
Small animal general anesthesia
Small animal ovariohysterectomy/ovariectomy/hysterectomy
Small animal castration (descended or cryptorchid)
Bovine causes of abnormal cycling including anestrus
Bovine ultrasonography
Bovine standing anesthesia
Small animal sterilization – surgical
Small ruminant parturition/obstetrics
Rarely used
Bovine female infectious diseases of the reproductive tract
Bovine mastitis
Small animal estrous cycle
Small animal mammary neoplasia
Bovine breeding soundness examination/semen collection and evaluation
Bovine neonatal resuscitation
Equine estrous cycle
Equine standing anesthesia
Small ruminant pregnancy diagnosis/pregnancy management
Bovine male infertility
Bovine cesarean section
Equine periparturient disorders (metritis, retained fetal membranes)
Small animal pregnancy diagnosis /pregnancy management
Bovine herd health/performance goals/economics/record-keeping
Bovine artificial insemination/embryo transfer
Equine pregnancy diagnosis/pregnancy management
Small animal periparturient disorders (metritis, hypocalcemia/eclampsia, subinvolution of placental sites)
Small ruminant abortion
Bovine passage of pipette/biopsy instrument/insemination pipette into uterus
Equine transrectal palpation

Equine ultrasound
Equine castration (descended or cryptorchid)
Small animal dystocia management/obstetrics
Small animal male neoplasia of the reproductive tract
Small animal cesarean section
Small ruminant estrous cycle
Bovine male infectious diseases of the reproductive tract
Equine breeding management
Equine manipulation of estrus (pharmacologic, lighting, and others)
Small animal infectious diseases of the reproductive tract
Small animal mastitis
Small animal female neoplasia of the reproductive tract
Small animal neonatal resuscitation
Small ruminant breeding management
Equine artificial insemination/embryo transfer
Small animal breeding management
Small ruminant breeding soundness examination/semen collection and evaluation
Bovine testing for heritable disease / breeding planning
Bovine neoplasia of the female reproductive tract
Equine causes of abnormal cycling including anestrus
Equine endometritis
Small animal pregnancy termination
Small animal testing for heritable disorders, breeding planning
Equine dystocia management/obstetrics
Equine female infectious diseases of the reproductive tract
Equine passage of pipette/biopsy instrument/insemination pipette into uterus
Equine recumbent (general) anesthesia
Porcine parturition/obstetrics
Bovine neoplasia of the male reproductive tract
Bovine teat surgery
Bovine Caslick's surgery
Equine neoplasia of the female reproductive tract
Equine breeding soundness examination / Semen collection and evaluation
Equine neonatal resuscitation
Equine Caslick's surgery
Small animal spontaneous abortion
Porcine estrous cycle
Porcine infectious causes of reproductive loss

†† Mixed animal = Mixed animal practice with common domestic species; small animal, equine and food animal practice; small animal, equine, food animal and exotics practice; small animal and food animal practice; equine and food animal practice; Internship – large animal; residency (n = 11).

was rated as highly important in all species and a paucity of training in small animal and in exotics was noted. The latter still appears to be true.

Among basic science topics, reproductive anatomy in any species was identified as very commonly used regardless of type of employment in the first year. Reproductive biology and reproductive endocrinology were commonly or very commonly used in all large animal employment and were rarely used in small animal; this again reflects lack of regular breeding work in most small animal practice situations. Knowledge of reproductive tissue histology was less common in all employment types. The core curriculum on which this was based (Appendix) clearly demonstrated the comparative nature of theriogenology teaching. In a survey of dairy veterinarians, reproductive knowledge and skills for individual animals in theriogenology, surgery, and nutrition were noted as valuable.⁷ In this study, many of the components rated as being used very commonly required input from disciplines outside of theriogenology for training, including anesthesia, surgery, and medical imaging. It is important for those teaching theriogenology to be an active part of all conversations about curriculum at academic institutions and that the comparative nature of theriogenology is stressed to ensure all necessary components are taught to prepare graduates for theriogenology work in practice.

A recent publication reported that 95% of students surveyed felt that their clinical development was negatively impacted due to restrictions imposed by the COVID-19 pandemic.⁸ The students in the current study were in a cohort that completed their training under those restrictions and that may have altered results of this survey. The other obvious limitation of this study was the relative lack of response from dedicated large animal practitioners. Further research must be conducted to fully understand the impacts of tracking on capabilities of new graduates and to provide a more accurate list of required knowledge and skills in the first year by practice type.

Competency frameworks include many aspects of veterinary medicine outside of clinical knowledge and skills, including teamwork, communications, and lifelong learning (footnote a). Recent graduates in a study noted that a focus purely on veterinary knowledge was less important in practice than were nontechnical attributes, when comparing their employment to their clinical training.⁹ Graduates must be employable at graduation and must also have skills that will permit them to be successful and satisfied as veterinary practitioners.¹⁰ Data from this study can be used to guide curriculum development, with incorporation of work from other disciplines and nontechnical skill development to help create new graduates who can perform all the aspects of theriogenology required in their chosen employment.

Conflict of interest

None.

Authors' contribution

Dr. Root Kustritz conceptualized the study, created the survey and sent it out to graduates of the University of Minnesota, drafted the paper, and completed revisions requested by the reviewer.

Drs. Sertich and Johnson sent out the survey to graduates at their respective schools. Drs. Sertich, Johnson, and Madill reviewed the draft and provided input for improvement of the manuscript. All authors have read and approved the final version of the manuscript and have agreed to the submission.

References

1. Bok HGJ, Jaarsma DADC, Teunissen PW, et al: Development and validation of a competency framework for veterinarians. *J Vet Med Educ* 2011;38:262–268. doi: 10.3138/jvme.38.3.262
2. Matthew SM, Bok HGJ, Chaney KP, et al: Collaborative development of a shared framework for competency-based veterinary education. *J Vet Med Educ* 2020;47:579–593. doi: 10.3138/jvme.2019-0082
3. Duncan C, Dale VHM, Peard MJ: Clinical veterinary students' perceptions of a 'Day one' skills guide. *Vet Rec* 2011;169:13–18. doi: 10.1136/vr.d1437
4. Welsh PJK, Jones LM, May SA, et al: Approaches to defining day-one competency: a framework for learning veterinary skills. *Rev Sci Tech Off Int Epiz* 2009;28:771–777. doi: 10.20506/rst.28.2.1921
5. Root Kustritz MV, Chenoweth PJ, Tibary A: Efficacy of training in theriogenology as determined by a survey of veterinarians. *J Amer Vet Med Assoc* 2006;229:514–521. doi: 10.2460/javma.229.4.514
6. Kreisler RE, Stackhouse NL, Graves TK: Arizona veterinarians' perceptions and consensus regarding skills, knowledge, and attributes of day one veterinary graduates. *J Vet Med Educ* 2020;47:365–377. doi: 10.3138/jvme.1117-166r2
7. Luby CD, McIntyre K, Jelinski MD: Skills required of dairy veterinarians in western Canada: A survey of practicing veterinarians. *Can Vet J* 2013;54:267–270.
8. Thompson JL, Mackay J, Blacklock KB: Veterinary students' views on surgical entrustable professional activities and the impact of COVID-19 on clinical competence development. *Vet Rec* 2022;191(9):e1978. doi: 10.1002/vetr.1978
9. Rhind SM, Baillie S, Kinnison T, et al: The transition into veterinary practice: Opinions of recent graduates and final year students. *BMC Med Educ* 2011;11:64–73. doi: 10.1186/1472-6920-11-64
10. Bell MA, Cake MA, Mansfield CF: Beyond competence: Why we should talk about employability in veterinary education. *J Vet Med Educ* 2018;45:27–37. doi: 10.3138/jvme.0616-013r1

Appendix

Theriogenology core curriculum for nontracking or mixed animal track students

Suggested prerequisites to veterinary school

- Medical terminology
- Endocrinology
- Genetics

Topics in veterinary curriculum

Basic sciences

Anatomy

- Male and female, representative large and small animal species
- Histology
- Gonads
- Uterus
- Uterine tubes
- Mammary tissue

Endocrinology

- Hypothalamus
- Pituitary
- Gonads
- Uterus
- Placenta
- Thyroid
- Adrenal

Embryology and placentation

Reproductive biology

- Sex determination and differentiation
- Estrous cycle, representative species (cow?)
- Folliculogenesis/oogenesis/ovulation/luteinization
- Seasonal, environmental, nutritional effects
- Puberty
- Pharmacologic manipulation of estrus
- Introduction to advanced reproductive technologies (e.g. semen cryopreservation, cloning, and embryo manipulation)
- Spermatogenesis/sperm maturation
- Emission/ejaculation
- Fertilization/embryo movement /maternal recognition of pregnancy
- pregnancy/parturition
- Artificial insemination
- Contraception – surgical, pharmacological, immunological
- Mammary gland development/lactation/milk biology

Pharmacology

- Use of reproductive hormones and analogues
- Use of antibiotics/withdrawal times

Behavior

Clinical sciences

Bovine

Female

- Estrous cycle/breeding management
- Pharmacologic manipulation of estrus
- Anestrus
- Cyclical aberrations
- Pregnancy diagnosis/pregnancy management
- Dystocia management/obstetrics, fetotomy
- Abortion
- Periparturient disorders – hydrops, vaginal/uterine eversion, metritis, retained fetal membranes, endometritis

Infectious diseases/disorders of the reproductive tract
Mastitis

Male

Infertility, male
Infectious diseases/disorders of the reproductive tract

General

Herd health/reproductive performance goals/economics/record keeping
Artificial insemination, embryo transfer
Testing for heritable disorders/creation of breeding plans to minimize genetic disorders
Neoplasia of the reproductive tract

Techniques

History taking/physical examination/creation of a diagnostic and treatment scheme
Transrectal reproductive examination
Ultrasonography
Breeding soundness examination/semen collection and evaluation
Passage of pipette/biopsy instrument/insemination pipette into uterus
Neonatal resuscitation
Anesthesia
Surgery
Cesarean surgery
Teat surgery
Caslick's surgery
Ovariectomy
Castration

Equine

Female

Estrous cycle/breeding management
Manipulation of estrus
Anestrus
Cyclical aberrations
Pregnancy diagnosis/pregnancy management
Dystocia management/obstetrics
Abortion
Periparturient disorders – metritis, retained fetal membranes
Endometritis
Infectious diseases/disorders of the reproductive tract
Mastitis

Male

Infertility, male
Infectious diseases/disorders of the reproductive tract

General

Herd health/reproductive performance goals/economics/record keeping
Artificial insemination, embryo transfer
Testing for heritable disorders/creation of breeding plans to minimize genetic disorders
Neoplasia of the reproductive tract

Techniques

History taking/physical examination/creation of a diagnostic and treatment scheme
Transrectal reproductive examination
Ultrasonography
Breeding soundness examination/semen collection and evaluation
Passage of pipette/biopsy instrument/insemination pipette into uterus
Neonatal resuscitation
Anesthesia
Surgery
Cesarean surgery

- Castration (descended and cryptorchid)
- Caslick's surgery
- Perineal reconstruction
- Ovariectomy

Small animal

Female

- Estrous cycle/breeding management
- Pregnancy diagnosis/pregnancy management
- Dystocia management/obstetrics
- Abortion
- Periparturient disorders – metritis, SIPS, eclampsia
- Infectious diseases/disorders of the reproductive tract
- Mastitis
- Mammary neoplasia

Male

- Infertility, male
- Infectious diseases/disorders of the reproductive tract

General

- Artificial insemination
- Contraception
- Testing for heritable disorders/creation of breeding plans to minimize genetic disorders
- Neoplasia of the reproductive tract

Techniques

- History taking/physical examination/creation of a diagnostic and treatment scheme
- Breeding soundness examination/semen collection and evaluation
- Neonatal resuscitation
- Anesthesia
- Surgery
- Cesarean section
- Ovariohysterectomy/ovariectomy
- Castration (descended and cryptorchid)

Porcine

- Estrous cycle/breeding management
- Parturition/obstetrics
- Infectious causes of reproductive loss
- Breeding soundness examination, male
- Artificial insemination

Ovine/caprine

- Estrous cycle/breeding management
- Pregnancy diagnosis/pregnancy management
- Abortion
- Parturition/obstetrics
- Breeding soundness examination, male