IDS 2935: Reproduction: A User's Manual
Quest 2

I. General Information

Class Meetings

- Fall 2024
- Tuesday 3rd Period (9:35 – 10:25 am); Thursday 3rd & 4th Period (9:35 – 11:30 am)
- ANS 155, Field Trips to the Horse Teaching Unit and ICBR

Instructor

- Justin Callaham
- Animal Sciences, BLDG 459, 211E
- Office Hours: W, F 8:30 – 10:30 AM | Before and after class | By Appointment
- callaham@ufl.edu, 352-294-6754

Course Description

Reproductive biology is at the core of existence on earth, and nothing spurs the imagination more than quiet contemplation of a new life and sciences ability to alter the course of biological development. We can plan the sex of our children, store gametes for indefinite periods, test for the presence of certain genes during embryo selection, isolate stem cells that generate new transplant tissues, cure diseases by altering genes, bring species back from the brink of extinction, and develop highly efficient food animal systems. These scientific advancements allow us to alter mammalian development in ways unthinkable 20 years ago resulting in vigorous scientific and ethical debates.

Discussions will explore the questions – How such things work? Should we permit such things? Do we want to support such efforts? How far are we willing to let the research take us? What policy and ethical guardrails should guide future developments in reproductive science? And, how does a foundational knowledge of applied reproduction influence one's own analysis of modern hot button issues?

Students will gain knowledge in reproductive physiology and endocrinology that will be applied in experiential learning activities throughout this course to further enhance their understanding of basic reproductive functions and understanding of their own reproductive viewpoints. This course will present topics in anatomy, physiology, and biotechnology that relates to livestock breeding management, assisted reproductive techniques, and the human condition.

Quest and General Education Credit

- Quest 2
- Biological Sciences

This course accomplishes the Quest and General Education objectives of the subject areas listed below. A minimum grade of C is required for Quest and General Education credit. Courses intended to satisfy Quest and General Education requirements cannot be taken S-U.

Course Goals

1. Present enough science to help students better understand comparative reproductive anatomy and the underlying mechanisms that regulate (fe)male reproductive physiology.
2. Examine applied livestock breeding systems and assisted reproductive technologies to help students make an informed analysis of modern issues.
3. Examine modern reproductive techniques using guided experiential learning activities that help students build bench top skills and reinforce what science dictates.
4. Evaluate concepts in reproductive physiology and biotechnology that influences modern policies and social constructs (i.e. sustainable food systems, species preservation/overpopulation, genetic modification, and effects of reproductive advancements on society).
5. Cultivate positive group work environments capable of research collaboration and communication using clear, concise communications.
6. Help students better understand their own reproductive functions and viewpoints by evaluating popular issues in modern society.

Required Textbook and Other Readings

Required Textbook and Resources

1. Gilbert, Scott F., et al. *Bioethics and the new embryology: springboards for debate*. W. H. Freeman, 2005. (You do not need to buy this textbook. It will be provided to you.)
2. Packback (Requires a paid subscription ($29). See Packback section for instructions.)
3. Journal of Animal Sciences Literature Citation Guidelines (Website link)
4. Materials and Supplies Fees: n/a

Packback Deep Dives

Packback Deep Dives will be used to assess independent research skills and improve academic communication through long-form writing assignments. While completing the summative writing prompts on Deep Dives, you will interact with a Research Assistant that will help you gather your notes and cite your sources, and Digital Writing Assistant for in-the-moment feedback and guidance on your writing.

How to Register on Packback

Note: Only access Packback through **Canvas** in order to ensure your grades sync properly.

1. Click "Packback" within **Canvas** to access the community.
2. Follow the instructions on your screen to finish your registration.
3. **In order for your grade to be visible in Canvas**, make sure to only access Packback via **Canvas**.
4. Packback requires a $29 paid subscription.

Learning Accessibility

Your success in this class is important to me. We all come from diverse backgrounds and experiences that influence how we learn. Students at all levels learn in very different ways, and together we will develop strategies to meet both your needs and the requirements of the course. This course seeks ways to provide a working and collaborative workspace where you may advocate for your success. Individuals with disabilities of any kind (including learning disabilities, ADHD, depression, health conditions) who require instructional, curricular, or test accommodations are responsible for making such needs known to the instructor as early as possible. Every possible effort will be made to accommodate students in a timely and confidential manner. Individuals who request accommodations must be registered with the Disability Resource Center (https://disability.ufl.edu/).

Sometimes life gets in the way. Students are encouraged to approach Justin Callaham with any other life circumstances that may affect their participation in the course. These may be personal, health-related, family-related issues, or other concerns. The sooner your instructor knows about these, the earlier we can discuss possible adjustments or alternative arrangements as needed for homework, exams, or class.

I believe in advancing your educational success and professional development through mentorship. I strive to provide an environment that is equitable and conducive to achievement and learning for all students. It is important to me that every student learns to adapt in ways that promotes well-adapted professional advancement. I ask that we all be respectful of diverse opinions and of all class members. Your honesty and engagement are important, so please make every effort to engage with me throughout the term.

II. Graded Work

Grading Scale

For information on how UF assigns grade points, visit: https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/

A	94 – 100%		B	84 – 86%		C	74 – 76%		D	64 – 66%
A-	90 – 93%		B-	80 – 83%		C-	70 – 73%		D-	60 – 63%
B+	87 – 89%		C+	77 – 79%		D+	67 – 69%		E	<60%

Late Assignments

Please refer to Canvas for due dates. **Due dates are set to help you stay on pace and allow for timely feedback that will help you complete subsequent assignments.** The expectation is that you submit work or are prepared for class by the assigned deadlines. The course goals and related assignments are designed to scaffold and build on one another to enhance your learning. However, **life happens**, and I am more than happy to work with you. Please communicate with me if you won't be able to get something done in time as a courtesy and as a signal of your professional dispositions.

This does not permit a free pass to chronically miss dates and deadlines. This policy is meant to provide flexibility (when possible) in helping you navigate and prioritize important institutional demands. This is not an indicator that all instructors observe dates and deadlines the same way so be informed by each instructor's class policies concerning deadlines.

II. Graded Work Continued

Assignment Types and Weighting

	Assignment Type	Description	Total Points	% of Grade
1.	Self-Reflections	These assignments are **essay, medium stakes** assignments. Self reflection assignments provide students the opportunity to analyze and review course content in relation to their own experiences over time.	100/each	15%
2.	Experiential Activities	These assignments are **hands on, low stakes activities**. Experiential learning involves a laboratory activity coupled with a reading and take home message worksheet to help students summarize important concepts.	50/each	20%
3.	Exams	There are **2 high stakes exams** in this course. A **mid-term and final exam** are given in a laboratory practical format that includes short answer, multiple choice, and mastery diagraming.	200/each	30%
4.	Capstone Proposal, Collaborative Project, and Panel Presentation	This is a **high stakes collaborative writing assignment** with 4-6 group members that identify a reproductive issue of social, economic, and/or ethical importance to our society. This assignment is designed to guide students through a **collaborative research writing process and literature review** on a topic of interest.	Proposal 100 points Collaborative Project 200 points Panel Presentation 100 points	30%
5.	Participation	A **low stakes** assignment to encourage daily attendance. Grades will not be curved in the course. This assignment serves as an easy +/- booster at the end of term. The amount of information in this course is diverse and expansive. Daily attendance will determine your success in the course.	100	5%
6.	Level Up Bonus Quizzes	These are **no stakes** interactive lecturer questions and quizzes. These assignments do not calculate into the student's course grade. Bonus points from these activities may be used to help level out scoring on other graded assignments **except exams**.	N/A	N/A

Capstone Project Overview

The capstone project involves collaborative self-reflection and debate, requiring you to create an informed positional hypothesis on a socially significant reproductive topic. This hypothesis will analyze topics that influence societal viewpoints like policymaking, cultural norms, ethics, socioeconomic status, conservation efforts, and food security. Students will examine the interplay between personal beliefs and the larger societal and institutional structures that shape perceptions and regulations of reproductive technologies.
Participants will read and reflect both individually and collaboratively on a chosen topic. Groups of at least three will write and present a literature-reviewed paper and present a short presentation addressing the project prompt. This collaborative project spans the entire term, resulting in a final printed report and panel presentation.

Project Prompt

You are a member of a university policy committee advising the non-partisan Reproductive Ethics and Biotechnology Legislation (REBL) committee for the country 'Gator Nation'. Your task is to research, evaluate, and present factual findings to the REBL committee. You must provide a collaboratively written report and a PowerPoint presentation to guide the country's policymaking efforts in an approved topic of choice.

Final Document Submission

Due Date: Thursday, November 14, 2024 by End of Class

Capstone Project Writing Components

1. Group Composition:
    - Each group should consist of 3-5 members.
    - Project management will be done using Microsoft Teams.
2. Word Contribution:
    - Each member must contribute 1,500-2,000 words over the term.
3. Research and Writing:
    - Explore the use of AI platforms that help guide your research and writing.
4. Peer Evaluations:
    - Participate in 3 Project Participation Peer Evaluations.
5. Ensure collaboration and participation from all group members.
6. Adhere to deadlines and maintain clear communication within the group.
7. Maintain academic integrity while using AI platforms.
8. Engage in peer evaluations to provide and receive constructive feedback.

Final Project Document Requirements

1. Title Page:
    a. Include group members listed.
2. Table of Contents
3. Group Member Biography:
    a. Include a picture for each member
    b. Use Chat GPT or CoPilot to write a short biographical sketch from personal resume data.
4. Project Proposal:
    a. Group topic and positional hypothesis.
    b. List of key questions to address.
    c. Dates and deadlines.
    d. Description of group member responsibilities and topics.
    e. Copy of Self-reflection #1 for each group member.
    f. Weekly summaries of individual accomplishments.
    g. Group meeting minutes (minimum of 4).
    h. Collaborative note-taking space.
5. Capstone Self-Reflections:
    a. 700-word literature-reviewed self-reflection per member using MLA format.
    b. Each reflection in its own document section.
6. Final Findings and Recommendations (300-600 words):
    a. Summary of the group's final debate on the topic.
    b. Challenges faced in reaching a consensus.
    c. Collective and compromised final recommendation for the REBL committee.
    d. Positives and negatives of the final recommendation.
    e. Notable sticking points during the formulation of the final recommendation.
7. PowerPoint Slides:
    a. Insert copies of your presentation slides into the final document.

PowerPoint Project Summary and Instructions

1. Group Presentation:
    a. Duration: 15-20 minutes
    b. Purpose: Summarize findings of your Capstone Project Document

2. Visual Aids:
    a. Use demographic graphics to support points (e.g., common contraceptives, gender responsibility in contraception, societal roles).
    b. Source data from Statista.com.
    c. Include pictures of products to explain functionality.
3. Slides to Include:
    a. Significance of Topic:
        i. Impact on society
        ii. Socioeconomic factors
        iii. Affected demographics
        iv. Advantages and disadvantages
    b. Technical Aspects:
        i. Explanation of how it works
        ii. Methods and Procedures:
            1. Types of procedures (e.g., chemical vs. physical, lab-grown vs. in vivo)
        iii. Factors Affecting Success:
            1. Influential factors
    c. Ethical and Moral Arguments:
        i. Arguments for and against
    d. Group's Recommendation:
        i. Collective recommendation to the REBL panel
        ii. Present perspectives of both advantage and disadvantage viewpoints
    e. Tips:
        i. Ensure each slide is clear and concise.
        ii. Maintain a balance between text and visuals.
        iii. Practice timing to ensure the presentation fits within the 20 – 30 minute timeframe.
        iv. Engage with your audience by explaining the significance of the data and visuals you present.

III. Annotated Weekly Schedule

Schedule and topics are subject to change.

Module 1							
Week #	**Date**	**Topic(s)**	**Readings**	**Activities**	**Assignments**		**Learning Objectives**
					What's Due	**Due Date**	
1	H 8/22	Course Introduction and Expectations History of Reproduction	• Syllabus • Gilbert, G, et al. 2005. Bioethics and the New Embryology. Sinauer Associates, Sunderland, MA. **Read: Chapter 2: Philosophical, Theological, and Scientific Arguments (Pages 32-45)**		• Self-Reflection #1	9/3 9:35 am	• Recognize important course requirements and deadlines. • Examine and assess initial perspectives of basic reproductive functions and self-reflections of one's own viewpoints.
2	T 8/27	Finish History of Reproduction Introduction to the Capstone Project Start Fertilization if time permits		• Ice Breaker Activity • Establish working groups.	Assign Early Embryology Take Home Message	9/10 11:59 pm	• Summarize the influence of historical ideologies on modern reproductive perspectives and practices.
Module 2							
Week #	**Date**	**Topic(s)**	**Readings**	**Activities**	**Assignments**		**Learning Objectives**
					What's Due	**Due Date**	
	H 8/29	Fertilization	Gilbert, G, et al. 2005. Bioethics and the New Embryology. Sinauer Associates, Sunderland, MA. **Chapter 3: Fertilization and Assisted Reproduction**	• Wet Lab: In Vitro Fertilization of Sea Urchins	• Set Up a Shared Document Space in Google Drive		• Describe the 4 major events that must occur for fertilization to occur. • List the 8 critical events of fertilization. • Explain 3 reasons sperm fail to fertilize an egg. • Explain the significance of haploid vs diploid gametes. • Define the acronym IVF. • Explain common factors that result in (fe)male infertility. • Discuss how IVF can aid mammals and humans to address fertilization failures. • Define the role of ART in species preservation. • Identify the early stages of embryological development.

Module 3							
Week #	**Date**	**Topic(s)**	**Readings**	**Activities**	**Assignments**		**Learning Objectives**
					What's Due	**Due Date**	
3	T 9/3	Female Reproductive Anatomy & Physiology	Handout: Summary of Female Reproductive Anatomy and Physiology. (Provided in Canvas)	• Project Proposal Group Organization Day	• Due Early Embryology Take Home Message • Assign Female Take Home Message WS		• Recognize important female reproductive tissues. • Describe the roles of female reproductive organs in fertilization and embryogenesis.
	H 9/5	Female Reproductive Anatomy & Physiology			• Project Proposal Dates and Deadlines Due	9/10	• Identify specific female structures and the influences of chemical hormones on reproductive tissues and cyclicity. • Explain the roles of ovarian structures and their roles in the process of ovulation.
4	T 9/10	Applied Female Reproductive Anatomy		Dissect female reproductive tracts.			• Identify female reproductive organs using dissection of preserved tissues. • Generalize female reproductive differences among different species. • Summarize important endocrine structures of the female reproductive tract.
	H 9/12	Hot Topics: Contraception	Gorvett, Zaria. "The Weird Reasons There Still Isn't a Male Contraceptive Pill." *BBC Future*, 18 May 2023, www.bbc.com/future/article/20230216-the-weird-reasons-male-birth-control-pills-are-scorned . Read article.	Group Adverts Activity	• Take Home Message Worksheet	9/12 9:35 am	• Identify the various types of birth control available to humans. • Describe the 3 basic ways contraceptives work? • Explain how birth control can be used to aid animal breeding management for timed artificial insemination programs (TAI's) and population control. • Examine the availability of birth control on socioeconomic status. • Distinguish the differences between female and male birth controls

Module 4							
Week #	**Date**	**Topic(s)**	**Readings**	**Activities**	**Assignments**		**Learning Objectives**
					What's Due	**Due Date**	
5	T 9/12	Male Reproductive Anatomy & Physiology	Handout: Summary of Male Reproductive Anatomy and Physiology		• Assign Male Take Home Message		• Recognize important male reproductive tissues. • Identify specific male structures and the influences of chemical hormones on reproductive tissues.
	H 9/17	Male Reproductive Anatomy & Physiology					• Explain why spermatogenesis creates challenges in male contraception. • Summarize important endocrine structures of the male reproductive tract.
		Applied Male Anatomy & Physiology		• Perform a vasectomy. • Identify male anatomy using cadaver tissues.			• Explain all major components of the male reproductive system. • Generalize male reproductive differences among different species.

Module 5							
Week #	**Date**	**Topic(s)**	**Readings**	**Activities**	**Assignments**		**Learning Objectives**
					What's Due	**Due Date**	
6	T 9/24	Introduction to the Endocrine System	Handout: Hypothalamic & Pituitary Anatomy in Reproduction		• Male Take Home Message WS Due • Assign Brain Take Home Message	9/24 9:35 am	• Identify the major brain structures associated with reproductive endocrinology. • List the important reproductive hormones that control cyclicity.
	H 9/26	Deep Dive into Mammalian Cyclicity		Dissect Cow Skulls and Sheep Brains			• Illustrate the roles of brain hormones on reproductive cyclicity and control. • Compare the 2 cyclic patterns that separate mammals and humans. • Identify what is meant by positive and negative feedback in endocrinology. • Examine the influence of reproductive hormones on +/- feedback. • Identify methods in which cyclic patterns can be manipulated for timed artificial insemination (TAI).

Module 6							
Week #	**Date**	**Topic(s)**	**Readings**	**Activities**	**Assignments**		**Learning Objectives**
					What's Due	**Due Date**	
7	T 10/1	Sexual Behavior and Estrus Detection	Miller, Geoffrey, Joshua M Tybur, and Brent D Jordan. "Ovulatory Cycle Effects on Tip Earnings by Lap Dancers: Economic Evidence for Human Estrus?" *Evolution and human behavior* 28.6 (2007): 375–381. Web.	Assign Horse Breeding Mgmt Take Home Message	• Brain Take Home Message Due	10/1 9/35 AM	• Explain the fundamental purpose of sexual behavior. • Define the terms estrous, estrus, and diestrus. • Illustrate the use of the estrous cycle in timed artificial insemination programs. • Interpret physical signs of estrous behaviors in natural mating. • Explain why aggression is an integral part of male mating behavior. • Describe the different types of consent.
	H 10/3	Horse Unit Visit #1		• Demonstrate stallion collections. • Introduce semen analysis techniques.			• Identify estrus behaviors in live animals. • Explain timed artificial insemination programs. • Illustrate the breeding process of artificial insemination. • Introduction to Ultrasonography for Breeding Decisions

Module 7							
Week #	**Date**	**Topic(s)**	**Readings**	**Activities**	**Assignments**		**Learning Objectives**
					What's Due	**Due Date**	
8	T 10/8	Reproductive Biotechnologies: Its Role in Our Society	Gilbert, G, et al. 2005. Bioethics and the New Embryology. Sinauer Associates, Sunderland, MA. **Chapter 4: Assisted Reproductive Technologies: Safety and Ethical Issues**	Prepare for your mid-term exam.			• Identify the available reproductive technologies available in animals and humans. • Explain the benefits of reproductive biotechnology on the world around us.
	H 10/10	Mid-Term Exam – Material from First Half of Semester					
9	T 10/15	• Principles of Ultrasonography		• Discuss the building of practice ultrasound molds.			• Explain the theoretical principles of how ultrasound technology works. • Define the scientific terminology used in ultrasonography. • Build practice ultrasound gel models that can be used to learn ultrasound techniques in the lab.
	H 10/17	• Horse Unit Visit #2		Wet Lab: Image analysis using ultrasound technology.	• Assign Augmented Reality – Semen Densimeter Tutorial		• Discuss mare breeding management on the farm. • Investigate the applications of ultrasound technology in reproductive management. • Is she pregnant? • Demonstrate and practice the use of ultrasound to detect novel objects in homemade practice gelatins.
10	T 10/22	• Principles of Semen Analysis in Reproduction			Due Augmented Reality – Semen Densimeter Tutorial Due Horse Breeding Mgmt Take Home Message	10/22 9:35 am	• Objectives intentionally left blank.
	H 10/24	• Gamete Cryopreservation		Wet Lab: • Groups will participate in freezing sperm cells. • Practice using a semen densimeter to determine sperm cell concentration			• Outline and demonstrate the steps required to cryogenically preserve sperm cells. • Practice using technology of sperm cell cryopreservation in livestock. • Outline the mathematical steps in determining breeding doses of animals. • Practice using mathematical functions to determine sperm concentrations and breeding doses.

Module 8							
Week #	**Date**	**Topic(s)**	**Readings**	**Activities**	**Assignments**		**Learning Objectives**
					What's Due	**Due Date**	
11	T 10/29	Collaborative Project Workday					
	H 10/31	Contraception	Gorvett, Zaria. "The Weird Reasons There Still Isn't a Male Contraceptive Pill." *BBC Future*, 18 May 2023, www.bbc.com/future/article/20230216-the-weird-reasons-male-birth-control-pills-are-scorned . Read article.	• Group Adverts Activity	Assign Placentation Take Home Message	9/12 9:35 am	• Identify the various types of birth control available to humans. • Describe the 3 basic ways contraceptives work? • Explain how birth control can be used to aid animal breeding management for timed artificial insemination programs (TAI's) and population control. • Examine the availability of birth control on socioeconomic status. • Distinguish the differences between female and male birth controls

Module 9							
Week #	**Date**	**Topic(s)**	**Readings**	**Activities**	**Assignments**		**Learning Objectives**
					What's Due	**Due Date**	
12	T 11/5	Early Embryological Development		How do pregnancy tests work?			• List the primary stages of early embryological development. • Describe the embryonic structures used to classify and grade embryos. • Describe the 2 cell types that differentiate into embryo proper and placenta. • Illustrate the cell division process in early embryonic development that results in highly specialized cell types.
	H 11/7	Placentation and fetal development.		• Dissection of Pregnant Cow Tracts			• Define the term placenta and placentation. • Describe the 4 scientific characteristics used to classify placental function between species. • List the 4 placental functions required for maternal-fetal connections. • Dissect and examine bovine fetal membranes.

Module 10							
Week #	**Date**	**Topic(s)**	**Readings**	**Activities**	**Assignments**		**Learning Objectives**
					What's Due	**Due Date**	
13	T 11/12	Visit the ICBR	Jones, Richard E. and Kristin H. Lopez. 2014. Human Reproductive Biology. 4th ed. Elsevier, San Diego, CA. Chapter 14: Induced Abortion	Tour the high-tech biotechnology center at UF – Flow cytometry, fluorescent and scanning microscopy, proteomics.	DUE Early Embryology Take Home Message	11/12 9:35AM	• Observe the operation of the biotechnologies discussed in class. • Examine fluorescently stained sperm cells prepared in cryopreservation wet lab. • Discover potential employment pathways in the biotechnology sector.
	H 11/14	To Be Announced			Collaborative Capstone Projects Due by end of class 11/14.		
14	T 11/19	Group Presentations					• Present capstone project to the mock panel.

Presentations							
Week #	**Date**	**Topic(s)**	**Readings**	**Activities**	**Assignments**		**Learning Objectives**
					What's Due	**Due Date**	
15	H 11/21	Group Presentations				11/21 9:35 AM	
	11/25-11/29	**Thanksgiving Holiday**					
	T 12/3	Class Wrap Up		• Discuss Final Exam	• Self Reflection 2		
	H 12/5	**NO CLASS – READING DAYS**					
17	F 12/13	**FINAL EXAM DATE – FRIDAY, 12/13 | 10:00 AM – 12:00 PM**					

Writing Assignment Rubric Criteria

It is my intention to help you develop a clear, concise writing style that reflects professional research or business communication. All writing assignments will follow the MLA (8th edition) style with proper paraphrasing and citation. You will be coached through the writing assignments to help you become a more effective writer. I will evaluate and provide feedback on all writing assignments with respect to grammar, punctuation, clarity, and citations at your request.

Writing assignments will be graded using some or all of the following grading requirements.

	Multiplier	*4 points Accomplished*	*3 points Effective*	*2 points Adequate*	*1 points Inadequate*	*0 points Do Not Meet Expectation*
Concise Writing Style Where Used: Self Reflections, Capstone Project	Yes	Accomplished Includes all Effective writing elements + Writing flows smoothly from 1 idea to another and integrates all necessary components to create a compelling work that is logical, clear, cohesive, and focused. The writer has taken pains to assist the reader in following the logic of the ideas expressed.	Effective Sentences are structured and words are chosen to communicate ideas clearly and integrates all necessary components to create a logical, clear, and cohesive flow of ideas. Sequencing of ideas within paragraphs and transitions between paragraphs make the writer's points easy to follow.	Adequate Needs to improve sequencing of ideas within paragraphs and transitions between paragraphs to make writing easier to follow. The paper may include all necessary components, but they are not fully developed or presented logically, diminishing clarity and cohesion of some ideas.	Inadequate Lack of transitions and/or sequencing of ideas make reading and understanding difficult. Ideas are not presented separately, lack a logical flow, are sometimes ambiguous or non-specific.	No submission
Critical Thinking and Insight Where Used: Self Reflections, Capstone Project	Yes	Conclusions are insightful or provide a unique viewpoint. Evidence provides rationale for the conclusion and is comprehensive-covers diverse viewpoints, and includes a powerful evaluation of context, perspectives of self and sources, and limitations.	Conclusions are logical and address all important ideas. Evidence provides rationale for the conclusion, covers multiple viewpoints, and includes an adequate evaluation of context, perspectives of self and sources, and limitations.	Near Target. Conclusions are logical and address the most important ideas. Lacks incorporation of a key perspective or adequate evaluation thereof.	Conclusions may be logical but not necessarily focused on primary ideas. Lacks incorporation of some key perspectives or adequate evaluation thereof.	*No submission*

Writing Mechanics Where Used: Self Reflections, Capstone Project	Yes	Paper is free of grammatical and punctuation errors. Writing is free or has limited use of run on sentences. All sentences are well constructed and easily followed. The choice and placement of words seems accurate, natural, and not forced.	There are 1 - 4 grammatical, punctuation, and spelling errors. Writing demonstrates regular use of run on sentences that appear to influence the understanding of the paper but do not distract the reader from understanding the overall purpose of the paper. The choice and placement of words is inaccurate at times and/or seems overdone.	There are 5-10 grammatical, spelling, and/or run on sentence errors noted throughout the paper. Mechanical errors distract the reader and interferes with the understanding of the papers purpose. The author uses words that communicate clearly but the writing lacks variety. The writer uses contractions in the writing that are not appropriate for research writing.	There are more than 10 grammatical, spelling, and/or run on sentence errors noted throughout the paper. Sentences sound awkward, are distractingly repetitive, or are difficult to understand. The writer uses a limited vocabulary, jargon, clichés, or contractions that are not appropriate for research writing.	*No submission*
Thesis Statement Where Used: Capstone Project	Yes	Formulates a clear and precise point of viewpoint and develops fresh insight that challenges the readers thinking. Thesis is clear to the reader and closely matches the writing topic.	Formulates a clear and precise point of view with an original and clear statement that matches the writing topic. Thesis is vague and may not help the reader understand the point of view.	Formulates an indecisive point of view that is somewhat vague to the reader and is only loosely related to the writing topic.	Fails to formulate and clearly express a point of view. The thesis statement has no relation to the writing topic.	No submission
Paraphrasing and In Paragraph Citations Where Used: Capstone Project	Yes	Paraphrasing from original manuscripts appear original to the author in all instances with correct in paragraph citation.	Limited instances where writing appears to attempt original paraphrasing in the author's own words but shows instances where plagiarism was unintended. All original sources have correct in paragraph citations.	Limited instances where writing appears to attempt original paraphrasing in the author's own words but shows instances where plagiarism was unintended. 2 or more sources have incorrect in paragraph citations.	Numerous instances where paraphrasing shows unoriginal or plagiarized work. Instances where in paragraph citations are missing in the document.	Clear evidence of plagiarism of original manuscripts.

Works Cited Page Where Used: Capstone Project	Yes	All cited articles are listed and formatted correctly.		1-4 cited articles appear incorrectly.		5 or more articles appear incorrectly.
Report Style and Formatting (Word count, title page, headers, page numbers, margins, font, font size, line spacing, project proposal inclusion, etc.) Where Used: Self Reflections, Capstone Project	Yes	Final manuscript has all the required components listed in the assignment directions, follows MLA style, and meets the minimum word count.	Final manuscript has 1 formatting error, follows MLA style, and meets minimum word count.	Final manuscript follows MLA style but has numerous formatting errors or does not meet minimum word count.	Final manuscript does not follow MLA style, has numerous formatting errors. May or may not meet minimum word count.	No submission
Collaborative Group Participation Where Used: Capstone Project	Yes	Met all group deadlines, attended all group meetings, and was highly engaged with project design, research, and writing of the final document. Demonstrates a positive collaborative effort to work with others, responds with original insights, and engages with collaborative leadership.	Missed 1 group deadline or meeting but was highly engaged with the project design, research, and writing of the final collaborative document. Demonstrates a positive collaborative effort to work with others, responds with pertinent insights and contributes to the conversation.	Missed 2 or more group deadlines or meetings. Seems unaware or uninterested in responding to the collaborative nature of the project. May dominate conservation or denigrate others' point of view. Shows a moderate effort to help with project design and research. Contributes little to the writing and submission of the final document.	Missed 2 or more group deadlines or meetings. Offers inadequate responses or new ideas to the collaborative nature of the project. Shows no effort in participating in project design, research, and writing of the final document.	Absent from all group participation functions. No manuscript submission.
Peer Project Participation Evaluation Completed Where Used: Capstone Project	No	Complete				Not submitted

Literature Reviewed Articles Where Used: Capstone Project	Yes		3 peer reviewed research articles were used as part of the final document.	2 peer reviewed research articles were used as part of the final document	1 peer reviewed research article was used in the final document.	
Capstone Project met all self-imposed deadlines Where Used: Capstone Project	No	Met all due dates as listed in the groups project proposal.		Project segments were submitted late on more than 1 occasion.		Project segments were late throughout the project
On Time Points Where Used: Self Reflections, Capstone Project	No	On Time				Late

IV. Student Learning Outcomes

At the end of this course, students will be expected to have achieved the Quest and General Education learning outcomes as follows:

- **Content**: *Students demonstrate competence in terminology, concepts, theories, and methodologies used within the discipline(s).*
    - Identify, describe, and explain the basic concepts, applications, and terminology of reproductive physiology to illustrate how the intrinsic reproductive system is affected by the interrelationship of hormones, cyclicity, and the environment (Quest 2, B). **Assessments:** Homework assignments, level up quizzes, and exams.
    - Discuss and demonstrate important biotechnology techniques; and evaluate how rapid advancements in assisted reproductive technologies affects social constructs and policies in a modern world (Quest 2, B). **Assessments:** Homework assignments, level up quizzes, and exams.
    - Connect experiential learning activities using comparative physiology, biotechnologies, and applied breeding management to reinforce what science tells us about sustainable food animal systems, assisted reproductive techniques, and the human condition (Quest 2, B). **Assessments:** Homework assignments, level up quizzes, and exams.
- **Critical Thinking**: Students carefully and logically analyze information from multiple perspectives and develop reasoned solutions to problems within the discipline(s).
    - Critically evaluate and examine the methods used to improve husbandry methods in animals, how exogenous hormones influence cyclicity and mating success, and how timed artificial insemination programs improve reproductive efficiency in sub fertile populations. **Assessments:** Homework assignments, level up quizzes, exams, self-reflections, and final paper.
    - Critically analyze pressing reproductive issues and viewpoints facing modern society and draw reasonable conclusions on how social constructs challenge what the science tells us about the impacts reproduction has on the world around us (Quest 2, B). **Assessments:** Homework assignments, level up quizzes, exams, self-reflections, and final paper.
    - Hypothesize and evaluate solutions to important reproductive scenarios important to our society and draw conclusions on the ethics and social implications of the technologies required to support such theories (Quest 2, B)
      Assessments: Self-reflections, presentation, final paper.
- **Communication**: Students communicate knowledge, ideas, and reason clearly and effectively in oral and written forms appropriate to the discipline(s).
    - Develop a clear, concise collaborative literature reviewed research article on a debatable topic of reproductive significance. Students will analyze the scientific, socioeconomic, social, and ethical arguments to help guide a mock scientific ethics and policy panel at *the* Swampy University on practices in animal agriculture and public health **(Quest 2, B)**.
      Assessments: Project Proposal and Final Paper

  - Present a collaborative presentation to a mock research panel for further classroom discussion and self-reflection **(Quest 2, S).**
    Assessments: Presentation and Debate

- **Connection***: Students connect course content with meaningful critical reflection on their intellectual, personal, and professional development at UF and beyond.*
  - Identify what modern reproductive issues, ethics, and policies are important to you. Then, reflect on what science tells you about these issues to make an informed analysis of your views that may or may not be consistent with modern social constructs. **(Quest 2)**. **Assessments:** Self Reflections, Presentation and Debate

V. Quest Learning Experiences

1. Details of Experiential Learning Component

- **Visit to UF Horse Teaching Unit.** The Horse Teaching Unit provides animal science students experiential learning experiences in reproduction, nutrition, animal behavior, and farm management. As an active equine enterprise and educational facility, the unit integrates the scientific curriculum with a practical skills environment. We will visit the horse unit once during the semester to discuss and demonstrate applied breeding management and some ART techniques. Our time at the unit will allow students to observe stallion semen collection, mare artificial insemination, embryo transfer techniques, and application of ultrasound in live animals.
- **Visit to Interdisciplinary Center for Biomedical Research.** The ICBR is a collaborative support unit that hosts 7 interdisciplinary biotechnology cores that are designed to enhance researchers' ability to access state of the art equipment. During the field trip, students will visit 3 cores that relate to our course discussions to see biotechnology in action. Students will have the opportunity to interact with center scientists to help them understand what career opportunities exist in the biotechnology field.
- **Wet lab experiential learning.** This course integrates various hands-on learning wet lab activities to help students connect the science to actual application. This will help reinforce scientific knowledge and better help students to understand their own points of view on reproductive technologies. Exercises include tissue dissections, IVF fertilization, ultrasound techniques, semen cryopreservation, and computer assisted semen analysis techniques.

2. Details of Self-Reflection Component

- You will be completing 2 self-reflections this semester. As mentioned in the course description, we will be exploring the science as well as the bioethics of modern reproductive technologies. We will discuss relevant scientific knowledge that allows you to better explore and understand your own viewpoints and any potential bioethics that may go with it. The first self-reflection is meant to get you thinking about your current thoughts related to reproduction and the second will ask you to reevaluate those thoughts after studying the subject matter.

VI. Required Policies

Attendance Policy

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at:

https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

The amount of information presented in this course is diverse and expansive. If you regularly attend class, turn in assignments, and interact with me and your classmates, you will do well in this course.

There are no makeup opportunities for the hands-on experiential learning activities in this course. You will be provided the Take Home Message materials as an alternative assignment to ensure you get the required information.

Working with Livestock

Working with livestock will require students to adhere to handling practices provided by the instructor either in written or verbal format. Animals are capable of injuring people, especially when they are in the flight or fight mode inspired by a stressful situation. The instructors will work to provide students with the ability to manage livestock with minimal stress, thus lowering the risk of injury to people and animals.

Biosafety and Security

The biosafety and biosecurity of animals and students is a top priority for laboratory activities. Disease transmission can have severe negative consequences on animal and human health that can also be fiscally taxing. The use of cell phones or cameras at animal facilities is not permitted without receiving written permission. Instructors and TA's may dismiss students from class for violation of biosecurity procedures.

Students Requiring Accommodation

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

UF Evaluations Process

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Counseling and Wellness Center

Contact information for the Counseling and Wellness Center: http://www.counseling.ufl.edu , 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

The Writing Studio

The writing studio is committed to helping University of Florida students meet their academic and professional goals by becoming better writers. Visit the writing studio online at http://writing.ufl.edu/writing-studio/ or in 2215 Turlington Hall for one-on-one consultations and workshops.

In-Class Recordings

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third-party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

Software Use and Privacy Policies

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Software Privacy Policies:

1. Canvas (Instructure) - https://sonicfoundry.com/privacy-policy/
2. Packback - https://www.packback.co/site/privacy/
3. PlayPosit - https://api.playposit.com/privacy/
4. Mediasite - https://sonicfoundry.com/privacy-policy/
5. Zoom - https://zoom.us/privacy
6. Honorlock - https://honorlock.com/student-privacy-statement/
7. You Tube - https://policies.google.com/privacy
8. Meta (Facebook/Instagram) - https://privacycenter.instagram.com/policy/

Books, Journals, and Press for Research and Discussion Topics

1. Barras, Colin. "Do animals know that sex leads to babies?" New Scientist, Oct 20, 2023. Do animals know that sex leads to babies? | New Scientist
2. Belluck, Pam. "The Father of the Abortion Pill." *The New York Times*, 17 Jan. 2023, www.nytimes.com/2023/01/17/health/abortion-pill-inventor.html.
3. Capoot, Ashley. "Reproductive startup launches test to identify an embryo's genetic defects before an IVF pregnancy begins." CNBC, Dec 5, 2023. Startup Orchid launches test to identify genetic defects in IVF embryos (cnbc.com)
4. Chasan, Aliza. "21 species removed from endangered list due to extinction, U. S. wildlife officials say." CBS News, Oct 18, 2023. 21 species removed from endangered list due to extinction, U.S. wildlife officials say - CBS News
5. Dunham, Will. "Scientists solve the genetic puzzle of sex-related Y chromosome. Reuters, Aug 23, 2023. Scientists solve the genetic puzzle of sex-related Y chromosome | Reuters
6. Farah, Troy. "Meet MGen, a new STI going around that no one is talking about." Salon, Jan 9, 2023. Meet MGen, a new STI going around that no one is talking about | Salon.com
7. Fairbank, Rachel. "What every type of birth control costs." Life Hacker, Sep 1, 2023. What's the Cheapest Form of Birth Control in 2023? | Lifehacker
8. Funnell, Rachael. "Well-Endowed Bat Becomes First Mammal Known to Reproduce Without Penetration." IFL Science, Nov 20, 2023. Well-Endowed Bat Becomes First Mammal Known To Reproduce Without Penetration | IFLScience
9. Ford, Celia. "An Ancient Battle Is Playing Out in the DNA of Every Embryo." Wired, July 7, 2023. https://www.wired.com/story/an-ancient-battle-is-playing-out-in-the-dna-of-every-embryo/
10. Galagher, James. "Scientists grow whol model of human embryo, without sperm or egg." BBC, Sep 6, 2023. Scientists grow whole model of human embryo, without sperm or egg (bbc.com)
11. Ghadigaonkar, Deepak S. and Pratima Murthy. *Sexual Dysfunction in Persons with Substance Use Disorders*. J. of Psychosexual Health, 1:2: Jun 17, 2019. Sexual Dysfunction in Persons With Substance Use Disorders - Deepak S. Ghadigaonkar, Pratima Murthy, 2019 (sagepub.com)
12. Gorvett, Zaria. "The Weird Reasons There Still Isn't a Male Contraceptive Pill." *BBC Future*, 18 May 2023, www.bbc.com/future/article/20230216-the-weird-reasons-male-birth-control-pills-are-scorned.
13. Graves, Jenny. "The Y Chromosome Is Vanishing. A New Sex Gene Could Be the Future of Men." *ScienceAlert*, 2 June 2023, www.sciencealert.com/the-y-chromosome-is-vanishing-a-new-sex-gene-could-be-the-future-of-men.

14. Guy, Jack. "Microplastics discovered in human penises for the first time." *Live but Better*, June 19, 2024. Microplastics discovered in human penises for the first time | CNN

15. Hayba, Grace. UNC-born, Durham-based company trying to develop birth control pill for men. WRAL Tech Wire, Jan 11, 2024. UNC-born, Durham-based company trying to develop birth control pill for men | WRAL TechWire

16. Heidt, Amanda. "Scientists grow humanized kidneys in pig embryos." Science News, Sep 7, 2023. Scientists grow humanized kidneys in pig embryos (sciencenews.org)

17. Heidt, Amanda. "Meet 'Fanzor,' the 1st CRISPR-like system found in complex life." Live Science, June 30, 2023. Meet 'Fanzor,' the 1st CRISPR-like system found in complex life | Live Science

18. Hopkins, Caroline. "Male birth control gel is safe and effective, new trial findings show." *NBC News*, June 2, 2024. Male birth control gel is safe and effective, new trial findings show (nbcnews.com)

19. Huet, Natalie. "Expecting a Boy? Pollution May Already Be Harming His Future Fertility." *Euronews*, 7 Oct. 2022, www.euronews.com/next/2022/10/07/pollution-can-affect-unborn-babies-and-their-future-sperm-counts-new-research-suggests.

20. Hurst, Luke. "Scientists Believe These Are the Reasons for Falling Sperm Counts." *Euronews*, 15 June 2023, www.euronews.com/next/2023/05/20/sperm-counts-are-declining-scientists-believe-they-have-pinpointed-the-main-causes-why.

21. Institute for Bioengineering of Catalonia. "New technology visualizes embryo metabolism to improve IVF success." *Medical Press*, July 1, 2024, New technology visualizes embryo metabolism to improve IVF success (medicalxpress.com)

22. Karlis, Nicole. "Sexually transmitted diseases are on the rise – so why are fewer Americans using condoms?" Salon, Aug 3, 2023. Sexually transmitted diseases are on the rise — so why are fewer Americans using condoms? | Salon.com

23. Lawler, Daniel. "Lab-grown human embryo models spark calls for regulation." Phys.org, June 20, 2023. Lab-grown human embryo models spark calls for regulation (phys.org)

24. Lamm, Ben and Eriona Hysolli. "We're Bringing the Wooly Mammoth Back to Life." Newsweek Magazine, Feb 8, 2024. We're Bringing the Woolly Mammoth Back to Life - Newsweek

25. LaMotte, Sandee. "It's a Myth That Women Don't Want Sex as They Age, Study Finds." *CNN*, 20 May 2023, www.cnn.com/2020/09/28/health/sexual-desire-older-women-study-wellness/index.html.

26. Lancet. "Levonorgestrel emergency contraceptive pill found to be more effective when taken with an anti-inflammatory medication." Medical Press, Aug 16, 2023. Levonorgestrel emergency contraceptive pill found to be more effective when taken with an anti-inflammatory medication (medicalxpress.com)

27. Ledford, Heidi. "How Menopause Reshapes the Brain." *Nature News*, 3 May 2023, www.nature.com/articles/d41586-023-01474-3.

28. Le Page, Michael. "Sickle cell CRISPR cure is the start of a revolution in medicine." New Scientist, Nov 16, 2023. Casgevy: Sickle cell CRISPR 'cure' is the start of a revolution in medicine | New Scientist

29. Limehouse, Jonathon. 'Giant hybrid sheep' created on Montana ranch could bring prison time for 80-year-old breeder. USA Today, Mar 15, 2024. Montana rancher pleads guilty to creating 'giant hybrid sheep' (usatoday.com)

30. Martin, Emily. "The Egg and the Sperm: How Science Has Constructed a Romance Based on Sterotypical Male-Female Roles." *Signs J Women Cult Soc*, vol. 16, no. 31, 1991, pp. 485–501.

31. Master, Farah, and Angus MacSwan. "China's fertility rate drops to record low 1.09 in 2022- state media." *Reuters*, 15 August 2023, https://www.reuters.com/world/china/chinas-fertility-rate-drops-record-low-109-2022-state-media-2023-08-15/. Accessed 16 August 2023.

32. Mcrae, Mike. "Human Embryos Have a Mysterious Yolk Sac, And We Finally Know Why." Science Alert, Aug 22, 2023. Human Embryos Have a Mysterious Yolk Sac, And We Finally Know Why : ScienceAlert

33. Miller, Geoffrey, Joshua M Tybur, and Brent D Jordan. "Ovulatory Cycle Effects on Tip Earnings by Lap Dancers: Economic Evidence for Human Estrus?" *Evolution and human behavior* 28.6 (2007): 375–381. Web.

34. Mitchell, Alex. ""Holy Grail' Male Contraceptive Drug Could Revolutionize Birth Control." *New York Post*, 14 Feb. 2023, nypost.com/2023/02/14/holy-grail-male-birth-control-drug-could-be-a-game-changer/.

35. Motluk, Alison. "The perils of putting off fatherhood: why it poses risks to children's physical and mental health." The Guardian, Oct 22, 2023. The perils of putting off fatherhood: why it poses risks to children's physical and mental health | Reproduction | The Guardian

36. Molteni, Megan. "New definition of a human embryo proposed amid rapid scientific advances." STAT, Aug 17, 2023. New definition of a human embryo proposed amid rapid advances (statnews.com)

37. Muckherjee, Sy. "CRISPR chickens hint at what's next for the gene-modified food chain." Fast Company, Oct 20, 2023. CRISPR chickens hint at what's next for the gene-edited food chain (fastcompany.com)

38. Oregon Health & Science University. "Mature sperm lack intact mitochondrial DNA, study finds." Sep 18, 2023. Mature sperm lack intact mitochondrial DNA, study finds (phys.org)

39. Palmer, Christopher. "Contraceptives and Mental Health." Psychology Today, Oct 24, 2023. Contraceptives and Mental Health | Psychology Today

40. Page, Michael Le. "Old Tom Cats Have More Mutations in Their Sperm like Older Human Males." *New Scientist*, 27 Apr. 2021,

www.newscientist.com/article/2275606-old-tom-cats-have-more-mutations-in-their-sperm-like-older-human-males/.

41. Pathways to Pregnancy and Parturition. 3rd Edition 2012. P. L. Senger, Current Conceptions, Inc, Pullman, W. V.

42. Palmgren, Gorm. "The Dawn of Precision Gene editing with Programmable Recombinases." CRISPR Medicine News, May 18, 2024. News: The Dawn of Precision Gene Editing with Programmable Recombinases - CRISPR Medicine (crisprmedicinenews.com)

43. Ramsey, Lily from Nature Genetics. Review: New research offers insight about the reason mitochondrial DNA is maternally inherited. Medical Life Sciences News, Sep 19, 2023. New research offers insight about the reason mitochondrial DNA is maternally inherited (news-medical.net)

44. Regalado, Antonio. "Three people were gene-edited in an effort to cure their HIV. The result is unknown." MIT Technology Review, Oct 24, 2023. Three people were gene-edited in an effort to cure their HIV. The result is unknown. | MIT Technology Review

45. Roberts, Michelle. "Scientists: Allow forbidden 28-day embryo experiments." BBC, Oct 24, 2023. Scientists: Allow forbidden 28-day embryo experiments (bbc.com)

46. Seay, Stephanie. "Revolutionizing CRISPR: Quantum Biology and AI Merge to Enhance Genome Editing. SciTechDaily, Nov 11, 2023. Revolutionizing CRISPR: Quantum Biology and AI Merge to Enhance Genome Editing (scitechdaily.com)

47. "Sickle Cell Gene Therapy Using CRISPR." Synthego. CRISPR Sickle Cell Gene Therapy: Approaches, Challenges, and Progress (synthego.com)

48. Stein, Rob. "Creating a Sperm or Egg from Any Cell? Reproduction Revolution on the Horizon." *NPR*, 27 May 2023, www.npr.org/sections/health-shots/2023/05/27/1177191913/sperm-or-egg-in-lab-breakthrough-in-reproduction-designer-babies-ivg.

49. Stein, Rob. "A reproduction revolution is on the horizon: vitro gametogenesis or IVG." NPR, Sep 27, 2023. A reproduction revolution is on the horizon: vitro gametogenesis or IVG : NPR

50. Stein, Rob. "Scientists near a Breakthrough That Could Revolutionize Human Reproduction." *NPR*, 25 May 2023, www.npr.org/2023/05/25/1178103188/scientists-near-a-breakthrough-that-could-revolutionize-human-reproduction.

51. Szabó, Anett, et al. "Lifestyle-, Environmental-, and Additional Health Factors Associated with an Increased Sperm DNA Fragmentation: A Systematic Review and Meta-Analysis - Reproductive Biology and Endocrinology." *BioMed Central*, 18 Jan. 2023, rbej.biomedcentral.com/articles/10.1186/s12958-023-01054-0.

52. Thaler, Shannon. 80% of Americans test positive for chemical found in Cheerios, Quaker Oats that may cause infertility, delayed puberty:study. New York Post, Feb 15, 2024. 80% of Americans test positive for chemical found in Cheerios that may cause infertility (nypost.com)

53. Shao, Tzu-Yu et al. "Reproduction outcomes after pregnancy-induced displacement of preexisting microchimeric cells." Science, Sep 21, 2023. Reproductive outcomes after pregnancy-induced displacement of preexisting microchimeric cells | Science

54. University of California-Davis. "The First Step to Life: Hitting Reset To Start a New Embryo." *SciTechDaily*, 27 July 2023, https://scitechdaily.com/the-first-step-to-life-hitting-reset-to-start-a-new-embryo/. Accessed 1 August 2023.

55. University of Montreal. "Veterinary scientists find decrease in protein may contribute to infertility in women." Phys.org, Aug 3, 2023. Veterinary scientists find decrease in protein may contribute to infertility in women (phys.org)

56. WJCB Staff. Tech Tuesday: Rare Disease Treatments. WCJB News, Feb 6, 2024. Tech Tuesday: Rare Disease Treatments (wcjb.com)

57. Wu, Edlyn and Nadine L. Vastenhouw. "Sleeping embryonic genomes are awoken by OBOX proteins." Nature, July 17, 2023. Sleeping embryonic genomes are awoken by OBOX proteins (nature.com)

58. You, Jae Bem, et al. "Machine Learning for Sperm Selection." *Nature News*, 17 May 2021. http://www.nature.com/articles/s41585-021-00465-1?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A%2Bnrurol%2Frss%2Fcurrent%2B%28Nature%2BReviews%2BUrology%2B-%2BIssue%29