3. Regulation is an important aspect of all biological processes.

   For FOUR of the following processes, **describe** the specific role of the regulator and **discuss** how the process will be altered if the regulation is disrupted.

Process	**Regulator**
Cell cycle	Cyclin
Metabolic rate	Thyroxine
Ovarian cycle	Follicle-stimulating hormone (FSH)
Prey population dynamics	Predators
Ecological succession	Fire

4. Flowering plants have evolved various strategies for fertilization.

   (a) **Describe** the process of fertilization in flowering plants.

   (b) **Discuss** TWO mechanisms of pollen transfer and the adaptations that facilitate each mechanism.

   Some species of flowering plants have evolved mechanisms to prevent self-fertilization.

   (c) **Discuss** an evolutionary advantage of preventing self-fertilization.

   (d) **Describe** TWO mechanisms that prevent self-fertilization.

STOP

END OF EXAM

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Question 3

3. Regulation is an important aspect of all biological processes.

For FOUR of the following processes, **describe** the specific role of the regulator and **discuss** how the process will be altered if the regulation is disrupted.

SCORING RUBRIC FOR EACH PROCESS **(1 point per bullet; 3 points maximum per process)**

Role of regulator **(2 points)**
- Cause and effect
- Effecting mechanism

How process is disrupted **(2 points)**
- Increase in regulator
- Decrease in regulator

Cell Cycle/Cyclin

Role of regulator
- Allows cell cycle to proceed OR get past checkpoint from one phase to next: G_1, S, G_2
- Works/combines with Cdk, S-phase, MPF, APC; OR how concentration fluctuates

How process is disrupted
- Decrease in cyclin: no mitosis/not past checkpoints/G_1, cell in G_0; examples: nerve and muscle cells
- Increase in cyclin: cancer/uncontrolled growth/cell division

Metabolic Rate/Thyroxine

Role of regulator
- Stimulates/increases metabolic rate
- Discuss negative feedback, TSH OR hypothalamus-releasing hormone—anterior pituitary—TSH OR metamorphosis in frog OR conversion $T_4 \rightarrow T_3$ discussion

How process is disrupted
- Decrease in thyroxine: weight gain, lethargy, no negative feedback (altered), hypothyroidism, osteoporosis OR decrease in iodine: decrease in thyroxine—goiter
- Increase in thyroxine: weight loss, increase in heart rate, increase in blood pressure, hyperthyroidism, Grave's disease

Ovarian Cycle/FSH

Role of regulator
- Stimulates maturation/development of follicle/egg OR stimulates estrogen production OR leads to (not causes or triggers) ovulation
- Continuation of meiosis OR completion of meiosis 1 OR discuss negative feedback, FSH/estrogen

How process is disrupted
- Decrease in FSH: sterile, no possibility of fertilization/pregnancy—no ovulation
- Increase in FSH: multiple eggs develop, multiple births

Question 3 (continued)

Prey Population Dynamics/Predators

Role of regulator

- Predator decreases (consumes, eats, etc.) prey population in size/number
- Negative feedback discussion: graph/lag elaboration, cyclic fluctuation or equilibrium leads to stabilizing size or carrying capacity

How process is disrupted

- Decrease in predators: prey population increases, exceeds carrying capacity, increased competition for resources—decrease in prey
- Increase in predators: prey population decreases, boom/bust as result of more prey being captured/eaten causing decrease in prey population; may cause predator decrease due to lack of food

Ecological Succession/Fire

Role of regulator

- Triggers/sets stage for succession; OR maintains a stable community
- Returns/releases nutrients into soil; OR triggers germination in some plant species; OR changes community makeup, allows for pioneer species, eliminates some species

How process is disrupted

- Decrease in fire: leads to invasive species opportunity, lack of nutrient recycling, leads to detritus build-up (may lead to catastrophic fire)
- Increase in fire: never achieves stable/climax community, succession is suspended, increase/decrease in biodiversity (with explanation)