



Introduction to Systems Thinking

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Where are you from?

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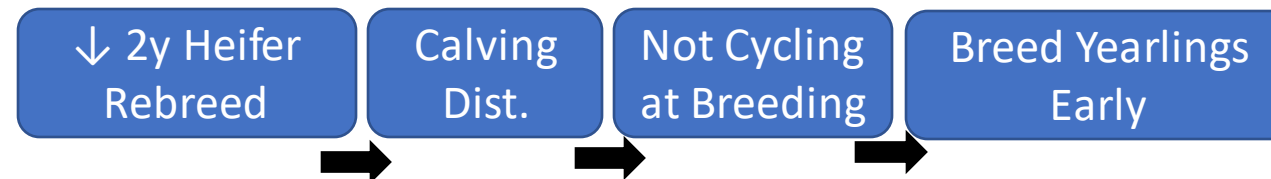
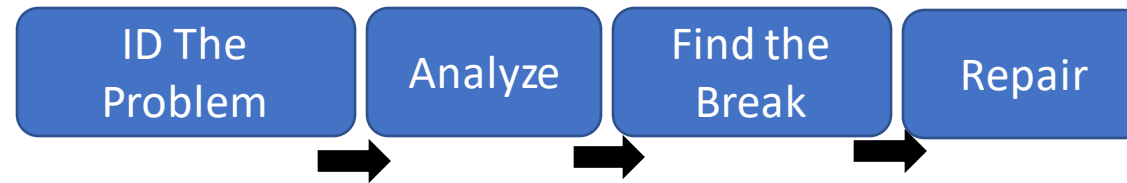
Answering an Important Question

Why, despite my best efforts, can't I get this
_____ to work the way I want it to?

Traditional Problem Solving

- Linear

- Language
- Education
- Problem-solving skills



A Real Example

- Met a new client, “William”, who want to improve his herd.
 - Stated objective was to “make more money.”
- Heifer development and AI were selected as two primary methods of improvement.





The Process

- Improve reproductive efficiency (calves weaned/cow exposed for breeding) and growth potential by:
 - Improving calving distribution (more cows calving earlier)
 - Allowing ample time for return to estrus post-calving (more cows cycling and beginning of breeding)
 - Maximizing 1st calf heifer rebreed (fewer hold overs/early repro culls)
 - **Calving heifers early to allow extra time to resolve post-partum anestrus**



The Evidence Behind the Plan

- “Heifers born in the first 21 days of the calving season had greater weaning, prebreeding, and precalving BW; greater percent cycling before breeding; and greater pregnancy rates compared to heifers born in the third calving period” (Funston, et al. 2012)
- Timing of calving for heifer, within the calving season, impacts cow longevity (Cushman, et al. 2013; Daalkhaijav, et al. 2018)
- Heifers have a much longer (2x or more) post-partum anestrus period than mature cows
- Breeding heifers earlier than cows gives them more time to return to estrus



The Evidence-Continued

- Heifers need to reach puberty to breed; hence, early breeding requires early puberty which can be achieved through nutrition (Patterson, et al. 1992)

The Plan

- Heifer selection:
 - Heifers born in the first 42 days of calving
 - Heifers that needed to gain 2lbs or less/day from weaning to breeding to achieve 65% of mature weight by breeding
- Management:
 - Feed to gain 1.5 lbs/day from weaning to breeding
 - Breed heifers 30 days before cows
 - Synchronize and time AI to maximize early calving effect



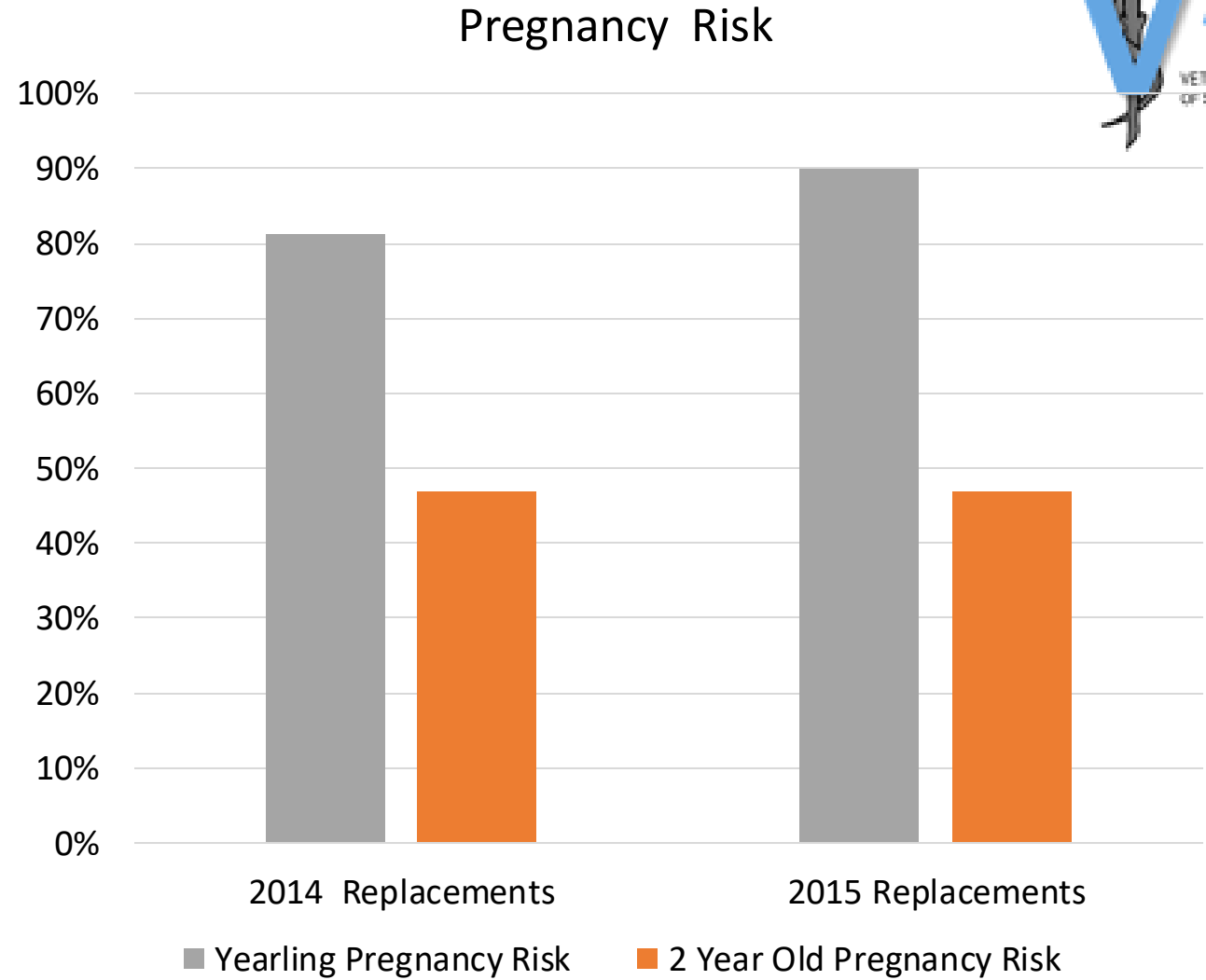
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Is there anything about this plan that concerns you?

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The Results





Why did our efforts to build momentum in heifers fail to create reproductive success in the cow herd?

System Changes



At the Ranch

- Increased emphasis on grazing management resulted in greater use of stockpile grazing
- Growing frustration with rolling 2-year-olds prompted a shift developing some heifers for 18 months

In Our Relationship

- I accepted a new job and moved to Nebraska
- My practice colleagues were not interested in developing the same role I held or committing the same amount of hours to a single operation
- I was exposed to a variety of new production systems



Summary of Changes

- Decreased emphasis heifer selection due to increased availability of winter forages
 - Also resulted in decreased supplementation
- Development of small cohorts of heifers to 18 months prior to breeding (usually the small end from cow lines that William liked)
- Decreased day to day interaction with me, but increased exposure to other cow/calf systems as a result of my new role.

What do you think happened?

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What do you think happened?

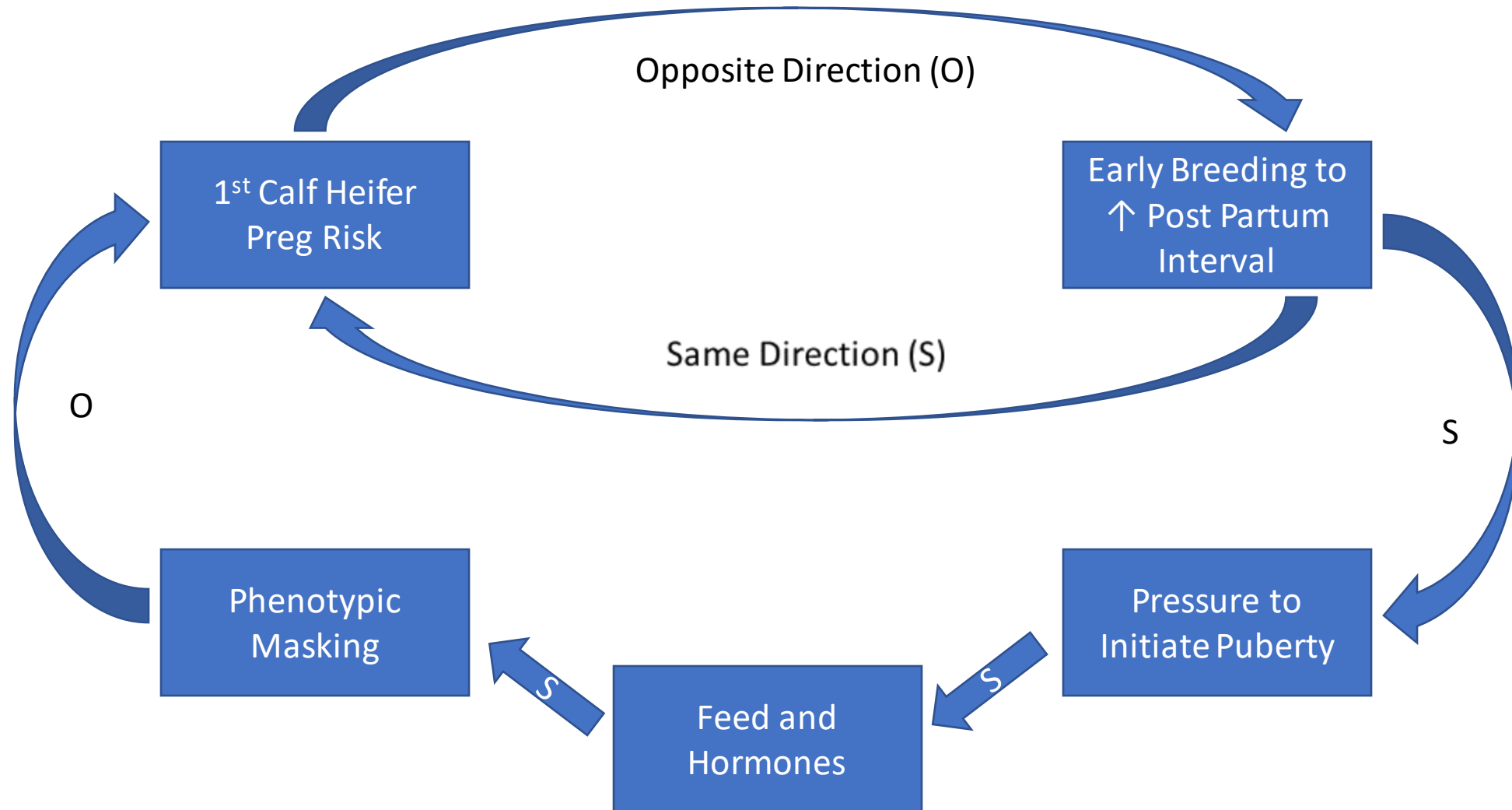
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A Pivotal Moment for Me

- Working with a ranch that was in expansion and wanted to get more heifers bred
 - Used a short heifer breeding season (30 days)
 - Retained all but completely unacceptable heifers
 - Ran on range for the winter
 - Bred on late summer forage
 - Average around 60% conception
- Remember my Mental Model: heifer development creates momentum. My assumption was 2-year-old pregnancy would be a wreck
- Averaged 95%. What?????

ST Problem Solving





Why is ST Important (To Me)



Introduction To Systems Thinking

- Definition

- A language to help us understand more deeply how organizations and complex systems really operate.
- The tools, processes, and principles enabling us to focus on the relationships among the parts, not just the parts.

- Described as the “mental effort to uncover endogenous sources of system behavior”
 - Primarily interested in how our behavior and design of the system account for the performance we observe
- Exogenous forces are important but offer little leverage for change

Mike Goodman, Innovation Associates



Introduction to Systems Thinking

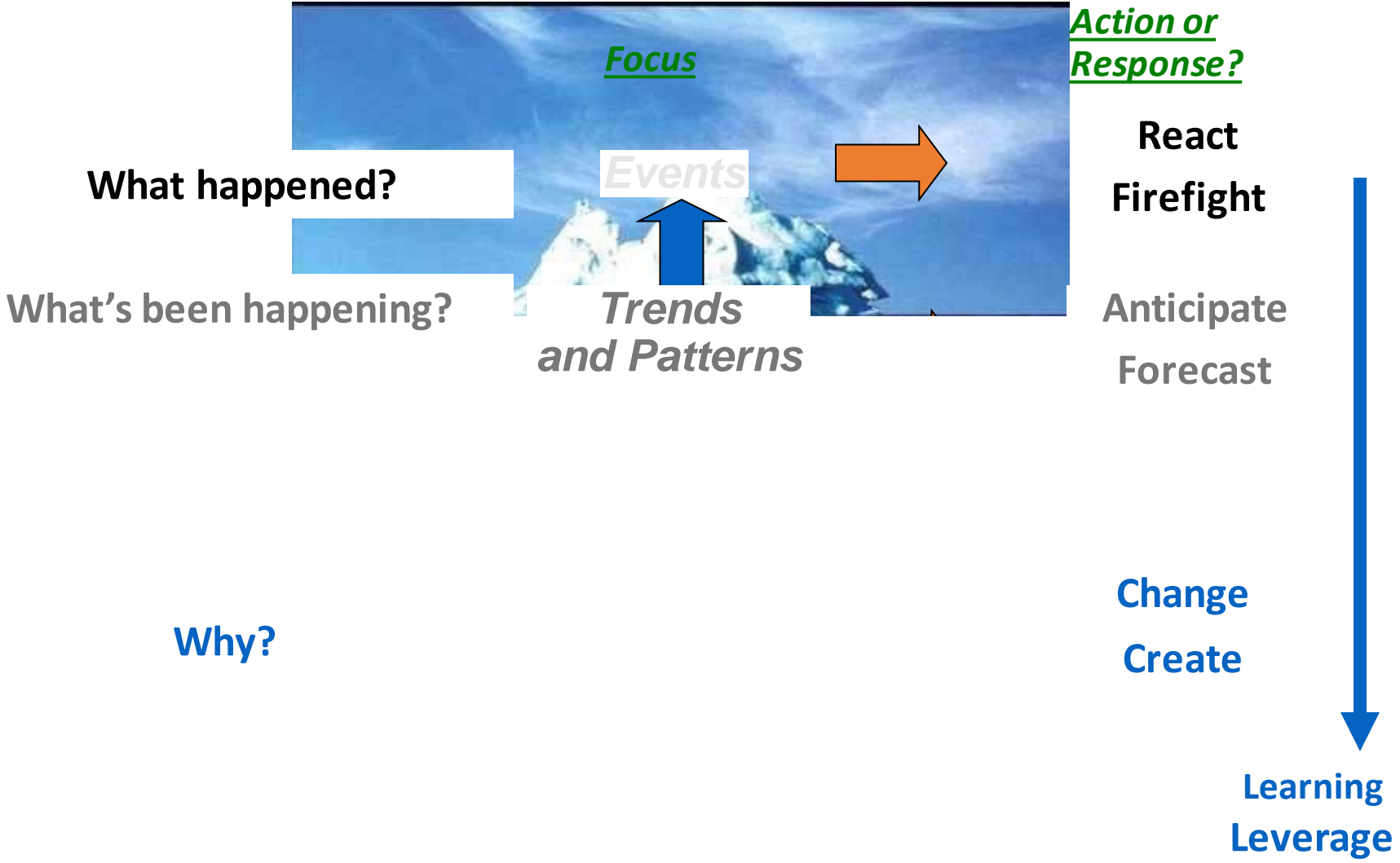
- What is a “system” – highly ordered, self-organizing, self-sustaining and self-repairing set of inter-connected things or elements and how they are related
- Have a function and purpose
- Nest
- Overlap
- Evolve



Introduction to Systems Thinking

- Living organism (and disease)
- Rainforest
- City
- Aquarium
- Team
- Production unit
- Business
- School

The Iceberg View



Sources of Pressures or Forces



Environmental Structures

- Regulatory/legal
- Economy
- Technology Advances
- Competition

Business Structures

- Market Positioning
- Customer Interface
- Product Strategy
- Distribution Strategy

Organizational Structures

- Management Structure/Hierarchy
- Business & Organizational Processes
- Reward System
- Information System
- Cultural Norms
- Written & Unwritten Rules

Interpersonal Structures

- Relational Skills
- Roles and Role Flexibility
- Ability to Recognize & Capitalize on Diversity
- Problem Solving/Decision Making

Individual Structures (Mental Models)

- How I Think
- How I View Myself and My Role
- My Beliefs and Assumptions
- Style/behavioral preferences



So Why Is It So Difficult To Make
Systems Behave The Way We
Want Them To?

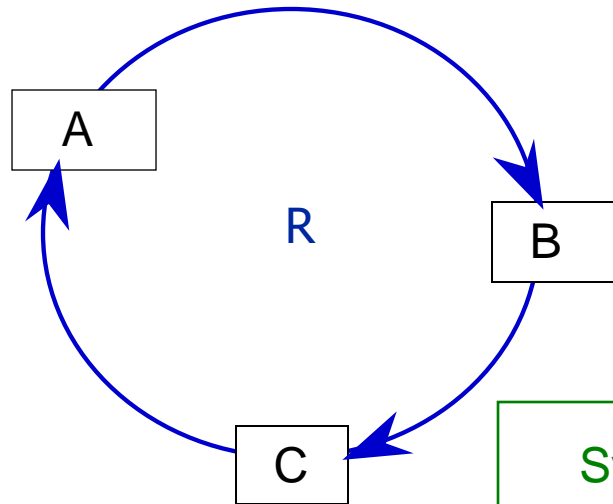
Observations about Systems



- Many of today's problems were yesterday's solutions.
- The Law of Unintended Consequences - Systems are seductive... what looks obvious to do often generates unintended consequences... but NOT right away.
- The Law of Worse Before Better - What works in the short term typically makes things worse in the long term and what works in the long term often makes things worse in the short term.
- The Law of Compensating Feedback – The harder you push on the system the harder the system pushes back.
- We are prisoners of systemic forces to the extent we are unaware of their existence and don't appreciate their power.

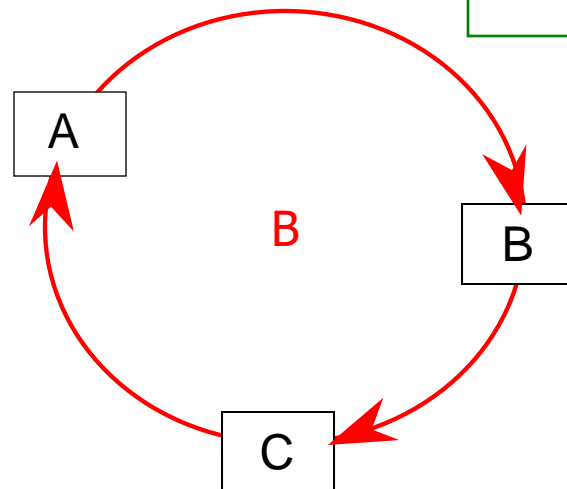
**“Every system is perfectly designed to get the results it gets.” –W.
Edwards Deming**

The Language of Systems Thinking: Feedback



R= Reinforcing

Systems are complex webs of interconnected Reinforcing and Balancing processes.



B= Balancing

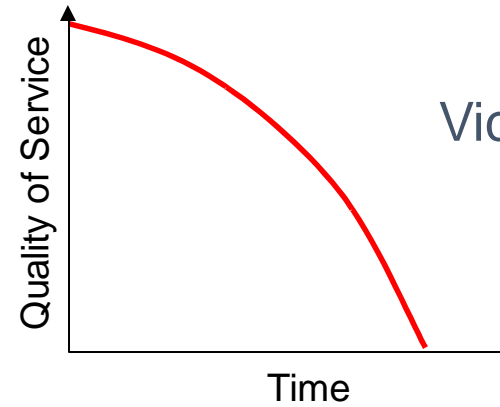
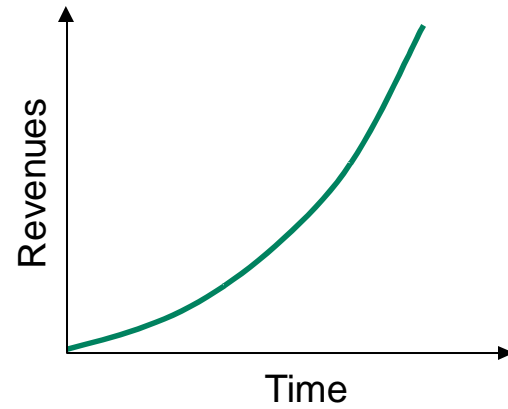
- Most common loop
- Contains odd number of O's

Reinforcing processes

- Virtuous cycles that generate growth
- Vicious treadmills that create disaster



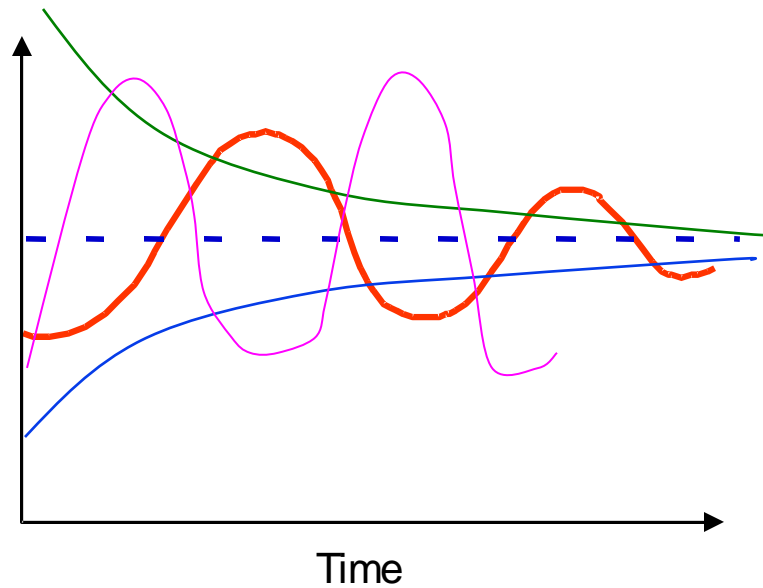
Virtuous



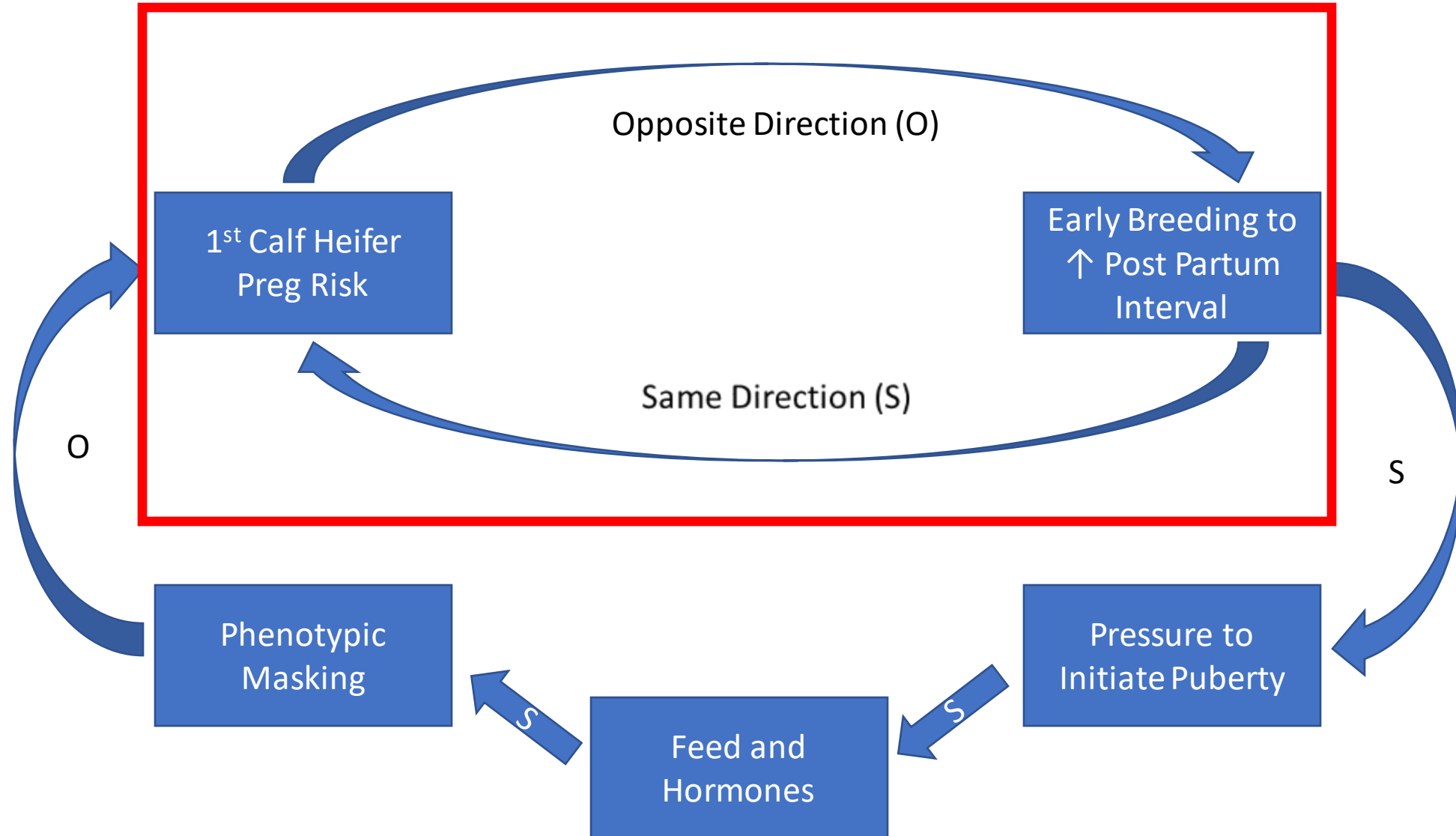
Vicious

Balancing processes

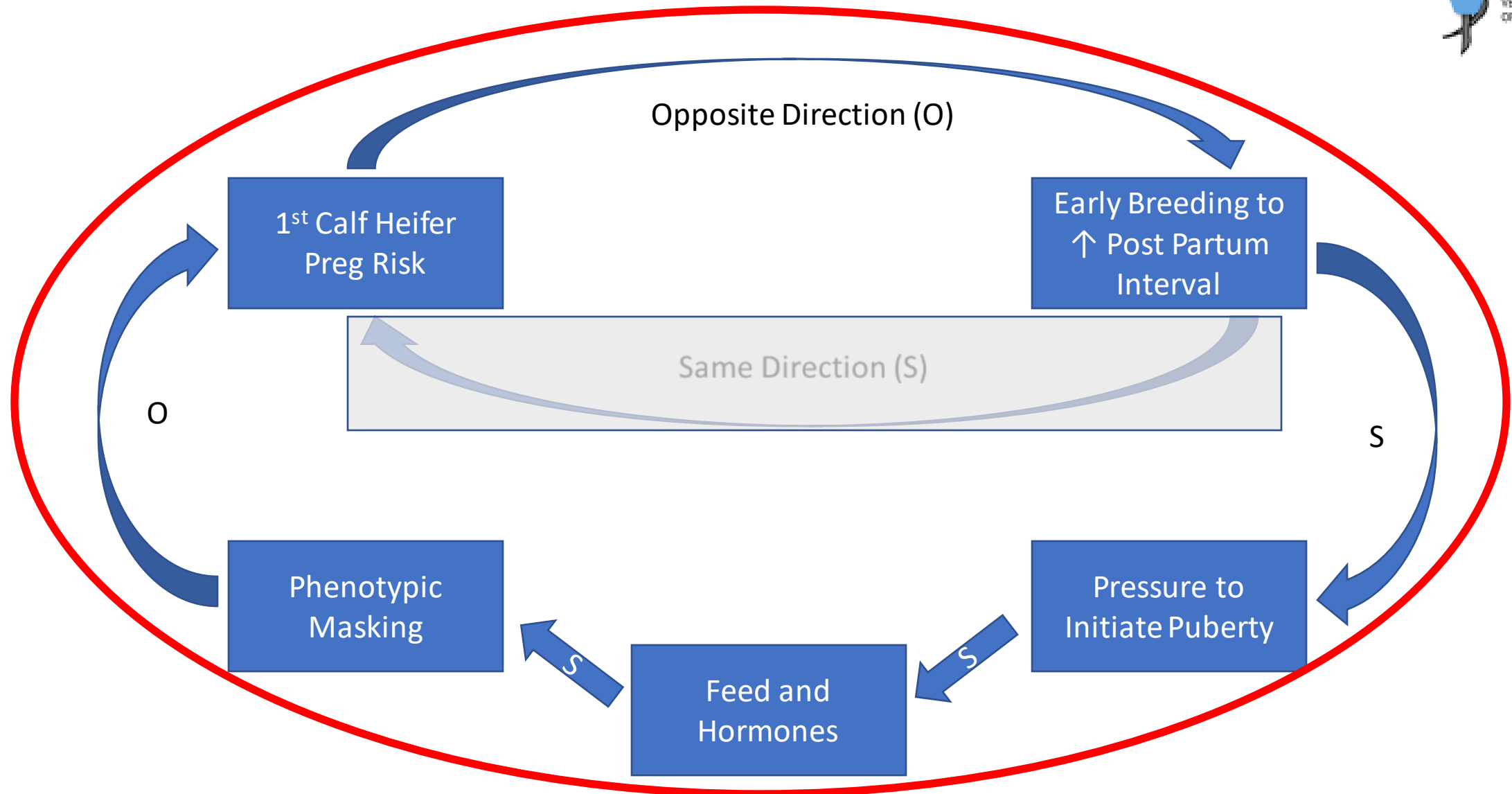
- The corrective mechanisms that sustain us
- The primary source of resistance to change



Intended Balancing Loop



Unintended Reinforcing Loop (Dominant)





Why is Phenotype Masking a Problem?

Vision/Goals

- Intervening to make the situation worse was out of line with what the rancher wanted
 - Yearling heifer pregnancy success was nice, but not really the goal
- What he really wanted wasn't clearly articulated
 - Goal was really to have reproductively capable cattle at all life stages
- Long-term vision is needed to reduce unintended consequences in systems
 - Imagine how the operation might function differently if our goal was to build a resilient, environmentally adapted cow-herd



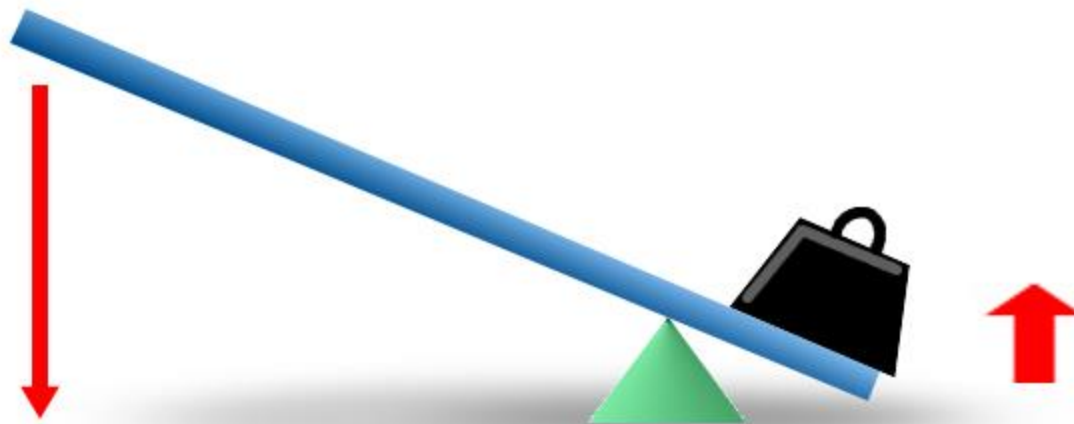


So What is Vision?

- Warning: Vision Building Takes Time (and it's hard).
- Often begins with a clear understanding of what you don't want
- Probably answers one of the following questions:
 - What do I want to create?
 - Why does my organization exist?
 - How do I want the world to look at the end of my career/life?
- Vision development (Suggested reading Start with Why by Simon Sinek)
 - Vision formula: I/We (what you do) so that (what you want to see happen)
- Vision is a powerful motivator

The Role of ST

- Understand current reality as clearly as possible
- Identify opportunities to make lasting changes to achieve vision without creating new problems (leverage)



Two Major Challenges

- Delays
 - Separation in time and space of cause and effect
- Exponential growth/decline



- Petri dish is empty at 11:00 am



- Petri dish is full at 12:00 noon



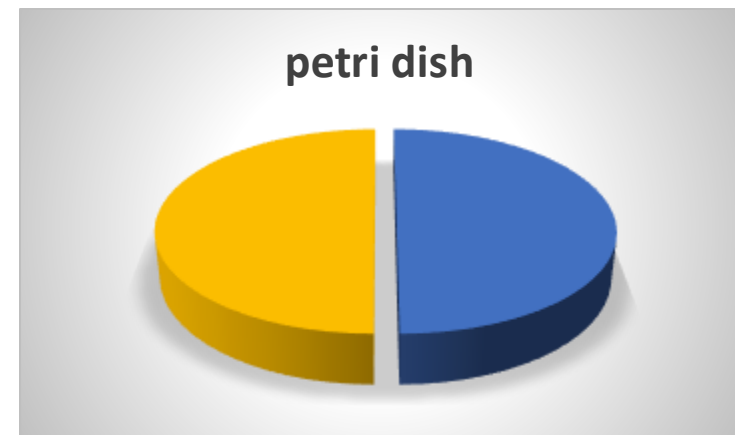
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When is the dish half covered?

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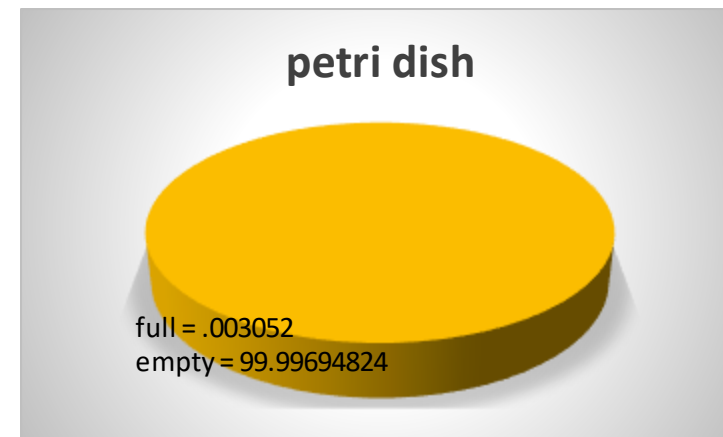
- Bacteria double in size every minute
- When is the dish half full
- **11:59am**



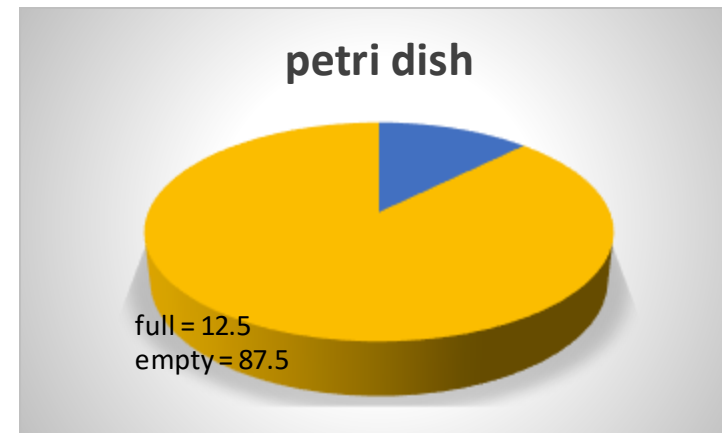
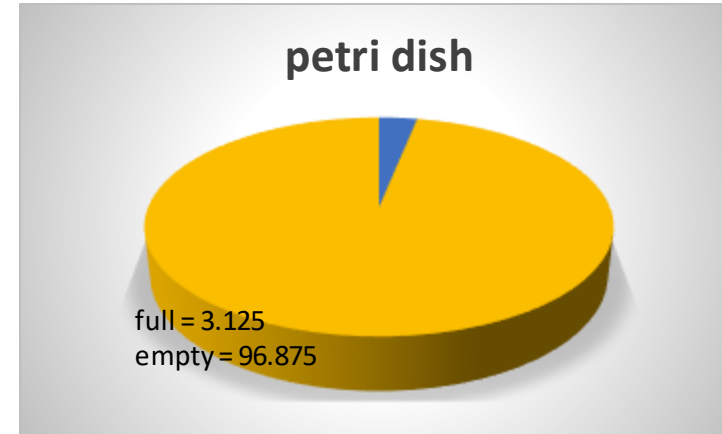
- How much of the dish full at 11:30



- How much of the dish is full at 11:45



When would 1st bacteria notice
11:55 (92% of time expired)
11:57 (95% of time expired)



What if some of the far-sighted bacteria anticipated the finite resources and went exploring to sites for future expansion

11:57



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How much extra time does the extra space create?

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12:00 noon
How much extra
time?



12:01



12:02



