

## UNIT Provisional notes

### 1 Introduction

- **Life history** refers to patterns of how organisms allocate resources to key components underlying reproductive success:
- Poll: Give a one-word example of a fundamental component of success.
  - **Answer:** Survival
  - **Answer:** Growth
  - **Answer:** Reproduction
  - **Answer:** Dispersal

### Diversity

- Differing life-history **strategies** are part of the reason for the remarkable diversity of life
  - Organisms that are too similar are not expected to co-exist
    - \* One will out-compete the other
  - But two organisms may be able to exploit the same resources using different life-history strategies

### Oaks and dandelions

- We can think of acorns as machines for making more acorns, and dandelion seeds as machines for making more dandelion seeds
- Both have access to very similar biochemical machinery. Both use the same resources.
  - **Answer:** Water, sunlight, nutrients
- Poll: What are some differences?
  - **Answer:** Oak trees are bigger
  - **Answer:** Oak trees wait longer to reproduce
  - **Answer:** Oak trees reproduce many times
  - **Answer:** Oak trees put much more energy into each seed
  - **Answer:** Dandelion seeds are dispersed by wind, acorns by animals

## Scales of competition

- Organisms compete with other individuals of the same species
- They also compete with other species
- We think about life history on different scales
  - Evolution within populations
  - Competition between populations

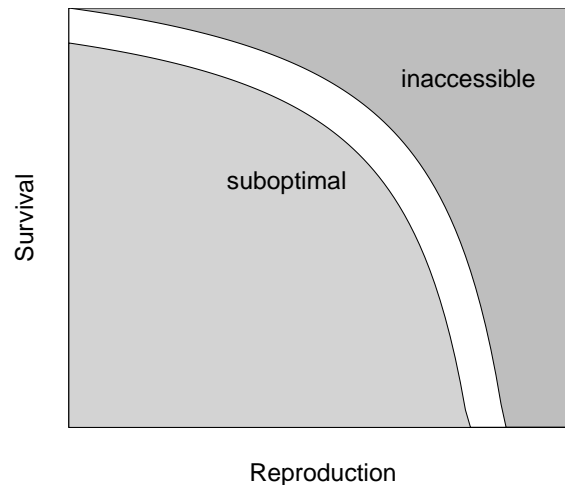
## 2 Tradeoffs

- Some evolutionary changes simply help organisms function better
  - Hemoglobin is highly evolved to bind and release oxygen
- Most have advantages and disadvantages
  - Building a strong immune system may reduce growth rates
  - A leaf that produces a lot of energy at high light may not be able to produce any at low light
- A **tradeoff** occurs when improvements in one area come at a cost of disadvantages in another area

## Optimization frontiers

- We expect tradeoffs because:
  - organisms have limited **resources**
  - organisms are under natural selection in a complex world

## Optimization frontiers



## Optimization frontiers

- Under natural selection, we expect organisms to be near the frontier of high fitness
- While they're near this frontier, it will be hard to improve one quality without a tradeoff that hurts another quality

## Evolution and optimization

- We often think of organisms as making “choices” that maximize their evolutionary fitness.
- Do oaks choose how big their acorns should be?
- Then what's going on?
  - **Answer:** Natural selection is selecting random variants
  - **Answer:** On average, variants which survive are better at producing offspring over the long-term than those which don't survive