I. Dispersal of organisms.
   A. Definition of dispersal – the movement of individuals from their natal area or their current home range. Can amend that with ‘to the place where it reproduces.’
      1. The term dispersal differs from that of migration. Both refer to certain aspects of the movement of organisms.
         a. Migration refers to periodic movement, generally from one climate or region to another for the purposes of breeding or feeding. It also infers that the organism returns to the place of origin.
         b. Dispersal is most often taken to mean a spreading of individuals away from others (e.g. from their parents or siblings) and infers that the movement is a one-way trip.

   B. Why disperse?
      1. Prevents inbreeding and the deleterious effects of deleterious or lethal homozygous genes.
      2. Avoid overcrowding – typically a problem for individuals that require nest sites.
      3. Avoid competing for resources with kin.
      4. Avoid changes in habitat. A habitat that is suitable for the parents may not be suitable for the offspring.

   C. Who disperses?
      1. Juveniles and subadults are the major dispersers.
      2. Young are the major dispersers among birds.
      3. Among birds, females tend to disperse more than males.
      4. Among mammals, males disperse more than females.
         a. The mating system in mammals is based on competition between males for mates, rather than for territories.
         b. Mammals are mainly polygamous, so males may travel and mate with several females. Birds on the other hand are monogamous. Male birds defend territories and attract a mate.
         c. Male mammals contribute less to the care of their progeny than is commonly the case with birds.
      5. Differences in dispersal between sexes are especially strong in some insects – e.g. bagworm.
      6. Among insects, dispersal is often undertaken by a polymorphic component of normally flightless insects that acquire wings.
      7. Seed dimorphism in flowering plants. Seed types are determined by the mother, not by genetic differences between the seeds.
         a. E.g. Desert annual, Gymnarrhena micrantha. Below ground seeds do not disperse. Above ground seeds do.

   D. How far do organisms disperse?
      1. Philopatry – the tendency to return to the same breeding area year after year.
      2. The Kettle Curve. The general pattern of dispersal is that most young animals, seeds or whatever, settle close to the homesite. There is then a rapid decline with distance, and only a few individuals reach very substantial distances.
         a. Example with Great tits (Parus major).
         a. Outbreeding brings the risk of breaking up genes coadapted for particular areas.
b. But, inbreeding can produce ‘inbreeding depression’, a reduction in offspring vitality.
c. The experiment to test this hypothesis. Flowers of Delphinium nelsoni (Larkspur).

➢ Has natural selection adjusted the degree of dispersal in a population to optimize the degree of outbreeding? Or, has the degree of outbreeding been selected to a level appropriate for a particular pattern or ability to disperse?

E. Modes of dispersal - Successful dispersal into an area not formerly occupied by the species is called **range expansion**.
There are two types of range expansion. **Diffusion** and **Jump dispersal**.
  1. **Diffusion** – is a gradual process in which the range boundary of a species advances by spreading into the previously unoccupied zone at the edge of the preceding generation’s range.
  2. **Jump dispersal** – is the long-range movement of individuals or groups that colonize and reproduce at sites far from the old boundary. The distance traveled is usually across (or over) unsuitable habitat.

F. Examples of dispersal
  1. Diffusion and the gypsy moth.
  2. Chestnut blight.

G. Physical dispersal and barriers to gene flow
  1. Populations of Monarchs and long-distance migration. Leads to high gene flow.
  2. Study of pocket gopher sub-populations in a study site of a few hundred hectares. Low gene flow.
### Potential Costs and Benefits of Dispersal Choices (G = genetic, S = Somatic)

#### Stay at Home: Philopatry

<table>
<thead>
<tr>
<th>Costs</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>• Inbreeding depression (G)</td>
<td>• Optimal inbreeding: maintain locally adapted genes (G)</td>
</tr>
<tr>
<td>• Reduced fitness because of resource shortage (S)</td>
<td>• Reduced physical risks: increased survivorship (S)</td>
</tr>
<tr>
<td>• Reduced indirect fitness: competition with kin (S)</td>
<td>• Familiarity with local terrain (S)</td>
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<tr>
<td></td>
<td>• Familiar with social environment (S)</td>
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<td></td>
<td>• Adaptive local traditions (S)</td>
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<td></td>
<td>• Maintain kin associations (S)</td>
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#### Disperse

<table>
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<tr>
<th>Costs</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>• Outbreeding depression (G): disrupt coadapted genes (G)</td>
<td>• Outbreeding enhancement</td>
</tr>
<tr>
<td>• Hybrid young not well adapted (G)</td>
<td>• Avoid overcrowding (S)</td>
</tr>
<tr>
<td>• Alleles less suited to the environment</td>
<td>• Avoid competing with kin (S)</td>
</tr>
<tr>
<td>• Greater risk in movement: predators, local diseases, unfamiliarity with terrain (S)</td>
<td>• Improve fecundity (S)</td>
</tr>
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From Smith (1996)