Feathers are a unique feature of birds and they serve an amazing variety of functions.

- **Flight**

- **Thermoregulation**

- **Swimming**
Water repellency

Tactile sensation

Water Transport

Support
Feathers are made of keratin. Keratin is produced in the stratum corneum and stratum granulosum of the epidermis.

Feathers are produced in a follicle, a highly vascularized pocket in the skin.
The uropygial, “preen” or “oil” gland is found at the base of the tail. Birds work oil from the gland over their feathers to keep them supple and waterproof.

The structure of the papilla is variable.

Preening keeps dead feathers "alive".

Feathers
Types of Feathers

Vaned or Contour Feathers
Down
Semiplumes
Filoplumes
Bristles
Powder Down

Parts of a typical contour or vaned feather
remige = wing
retrix = tail

Feather Barbs
attach to the rachis via the ramus
Barbules and barbicels hold the barbs together. They work like Velcro to give the feather vane strength and flexibility
Down and filoplumes are specialized feathers

Semiplumes (D) are intermediate between vaned feathers (B) and down (C). Their primary function is insulation.
Molt is the replacement of feathers

- New feathers pushed out from below by replacement feathers produced in the feather follicle
- Primary function is to replace worn feathers
  - Augmentation of breeding plumage is secondary
- Molt imposes high energy demands
  - Song birds, 2-4000 feathers
  - Tundra Swan, 25,000 feathers

Patterns of Molt
- Ascending
  - I - X
- Descending
  - X - I
- Synchronous
  - “eclipse plumage”
Molt patterns reflect many selective pressures

- Climate
- Migration
- Social system
- Food supplies
- Predators
- Competitors

Plumage terminology

- Non-breeding (winter) = Basic
- Breeding (summer) = Alternate = Nuptial

4 Molt Patterns

- **Primitive Basic**
  - a single complete molt each year

- **Modified Basic**
  - a single complete molt each year one addition partial molt in the first cycle

- **Simple Alternate**
  - One complete and one partial molt each year

- **Complex Alternate**
  - one complete and one partial molt each year with an additional partial molt in the first cycle

Molt Terminology

From: Sibley’s Birding Basics 2002

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A single complete molt each year

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**Complex Alternate**
One partial and one complete molt each year with an additional partial molt in the first cycle
Molt is an on-going, gradual process

Feather colors: derived from two sources
- Biochrome pigments
  - Melanins
    - Gray, black, buff, some browns
  - Carotenoids
    - Bright yellow, orange, red
  - Porphyrrins
    - Bright brown (owls), greens, magenta
- Structural characteristics
  - Iridescent green and blue colors
  - Parrots, Blue Birds, Hummingbirds
  - Structure of keratin acts as a prism

Feather color changes can also be due to wear