

# 22-4 Seed Plants



Seed plants are divided into two groups:

- **Gymnosperms** bear seeds directly on the surfaces of cones.
- **Angiosperms**, or flowering plants, bear seeds within a layer of tissue that protects the seed.

Gymnosperms include conifers, cycads, ginkgoes, and gnetophytes.

Angiosperms include grasses, flowering trees and shrubs, and all species of flowers.

## Reproduction Free From Water

Seed plants have a life cycle that alternates between a gametophyte stage and a sporophyte stage.

They do not need water for fertilization of gametes.

Seed plants can live just about anywhere.



**Adaptations that allow seed plants to reproduce without water include:**

- **flowers or cones**
- **the transfer of sperm by pollination**
- **the protection of embryos in seeds**

## Cones and Flowers

Gametophytes grow within sporophytes called **cones**, which are the seed-bearing structures of gymnosperms, and **flowers**, which are the seed-bearing structures of angiosperms.

Gametophyte generations live inside these structures.

## Pollen

The male gametophyte is called a **pollen grain**.

Sperm do not need water to fertilize eggs; instead the pollen grain is carried to the female reproductive structure by wind, insects, or small animals.

This transfer of pollen is called **pollination**.

## Seeds

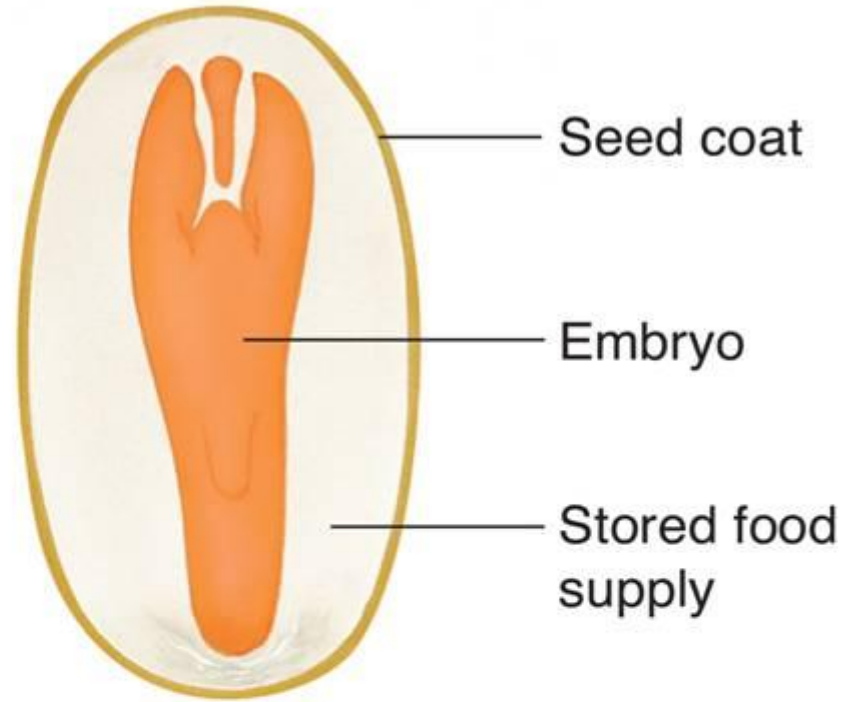
A **seed** is an embryo of a plant that is encased in a protective covering and surrounded by a food supply.

An **embryo** is an organism in its early stage of development.

The **seed coat** surrounds and protects the embryo and keeps contents of the seed from drying out.



# Internal Structures of a Seed



Seeds may have special tissues or structures that aid in their dispersal to other habitats.

- Some seed coats stick to the fur or feathers of animals.
- Other seeds are within tissues eaten and dispersed by animals.

After fertilization, the zygote grows into a plant—the embryo.

The embryo can stop growing while it is within the seed, and it can remain this way for a long time.

When it grows, it uses nutrients from the stored food supply.

Seeds can survive extreme cold or heat, or even drought.

## Evolution of Seed Plants

The fossil record indicates that ancestors of seed plants evolved adaptations enabling them to survive where most mosses and ferns could not.

The most important of these adaptations was the seed itself.

A seed can survive dry conditions and extreme temperatures.

# Gymnosperms—Cone Bearers



**The four groups of gymnosperms are:**

- **gnetophytes**
- **cycads**
- **ginkgoes**
- **conifers**

## Gnetophytes

About 70 present-day species of the phylum Gnetophyta are known, placed in just three genera.

Reproductive scales of these plants are clustered into cones.

## Cycads

Cycads are palmlike plants that reproduce with large cones.

They first appeared during the Triassic, 225 million years ago.

Today, only nine genera of cycads exist.

They grow naturally in tropical and subtropical places.

## Ginkgoes

Today the phylum Ginkgophyta contains only one species, *Ginkgo biloba*. The living *Ginkgo* species looks like its fossil ancestors.

Ginkgo trees are planted in U.S. cities because of their resistance to air pollution.



## Conifers

Conifers are the most common gymnosperms, with more than 500 known species.

Conifers include pines, spruces, firs, cedars, sequoias, redwoods, junipers, and yews.

## Ecology of Conifers

Conifer leaves have specific adaptations to dry conditions.

Most developed long, thin leaves, which reduce evaporation.

Their leaves have a thick, waxy layer.

Most conifers are “evergreens” and retain leaves all year.

## 22-4 Section QUIZ

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## 22-4 Section QUIZ

1

All of the following are adaptations that allow seed plants to reproduce without water EXCEPT

a. transfer of sperm by pollination.

A

b. production of spores.

c. protection of embryos in seeds.

d. supplying embryos with food.

**2** The early developmental stage of the sporophyte in seed plants is known as the

a. seed coat.

b. seed.

**A** c. embryo.

d. endosperm.

**3** Which of the following is a water-conserving adaptation in conifers?

a. presence of cones

**A** b. long, thin needles

c. no vascular tissue in the leaves

d. seed coats

## 22-4 Section QUIZ

**4** Each species of seed plant reproduces by means of

- a. cones only.
- b. flowers only.
- c. both cones and flowers.

**A** d. either cones or flowers.

- 5** The group of gymnosperms having the greatest number of species are the
- a. gnetophytes.
  - A** b. conifers.
  - c. cycads.
  - d. ginkgoes.



**END OF SECTION**