

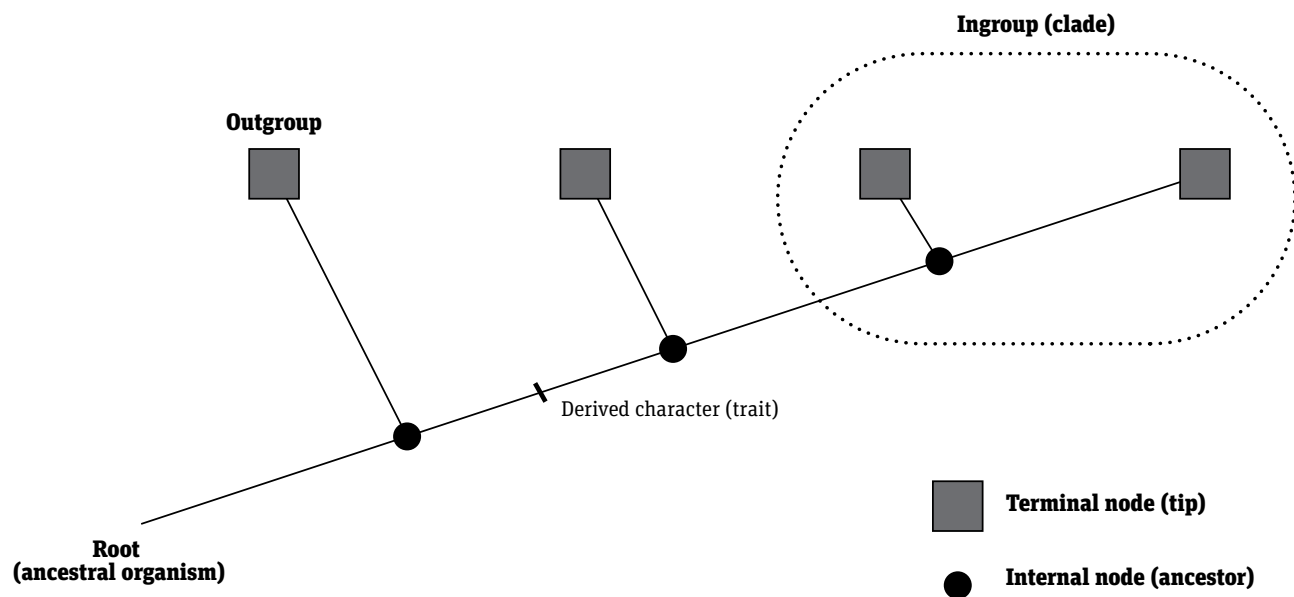
# Starting simple with cladistics

How can we group organisms with similar characteristics?

## Background

Cladistics is a method of placing species with similar characteristics into groups called **clades**. Clades can be grouped according to branching diagrams (*cladograms*) to show evolutionary relationships. Key features of cladograms are:

- **Root:** the initial ancestor common to all organisms within the cladogram
- **Nodes:** a hypothetical or last common ancestor
- **Outgroup:** the most distantly related species (ancestor) in the cladogram
- **Ingroups/clades:** a common ancestor and all of its descendants
- **Derived characters/traits:** evolutionary traits that only appear in some members of an evolutionary group

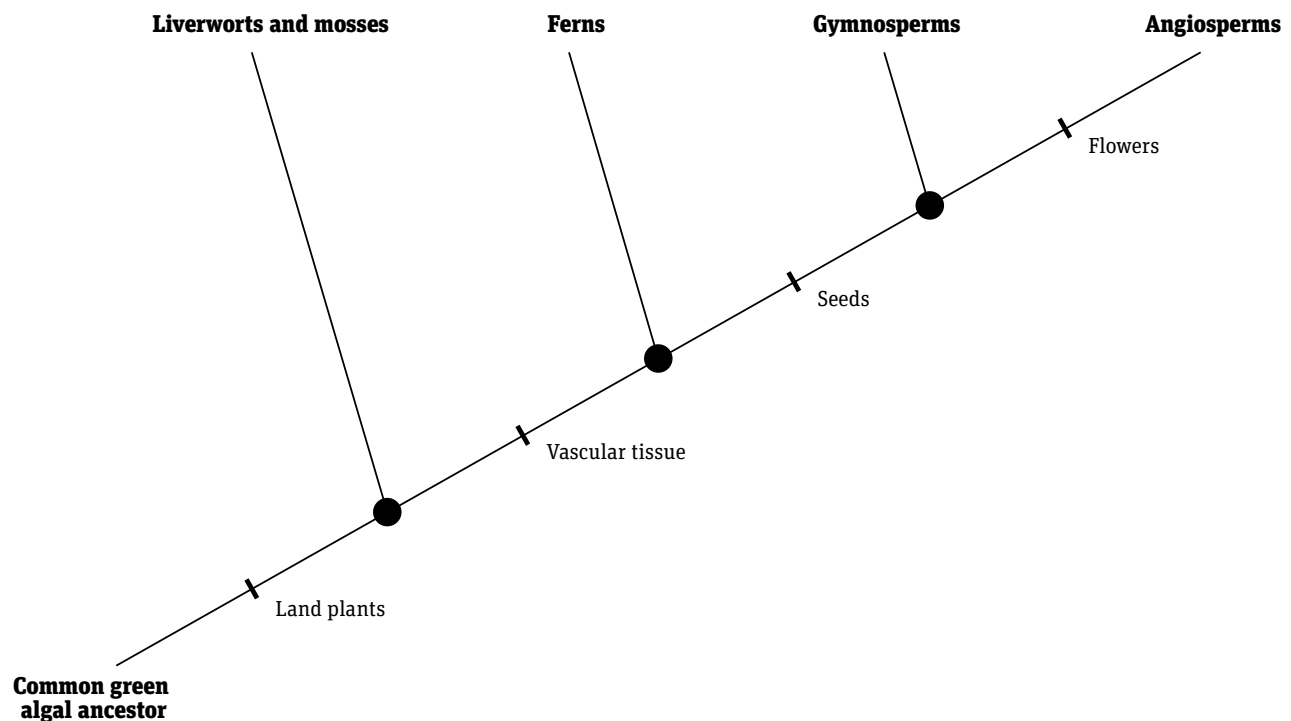


Land plants evolved from a group of green algae to become the complex plant kingdom that we know today. Take a look at the derived characters of the plant groups below and see where these traits are placed in the cladogram.

### Plant chart

Traits	Common green algae	Liverworts and mosses	Ferns	Gymnosperms	Angiosperms
Land plants		×	×	×	×
Vascular tissue			×	×	×
Seeds				×	×
Flowers					×

### Plant cladogram



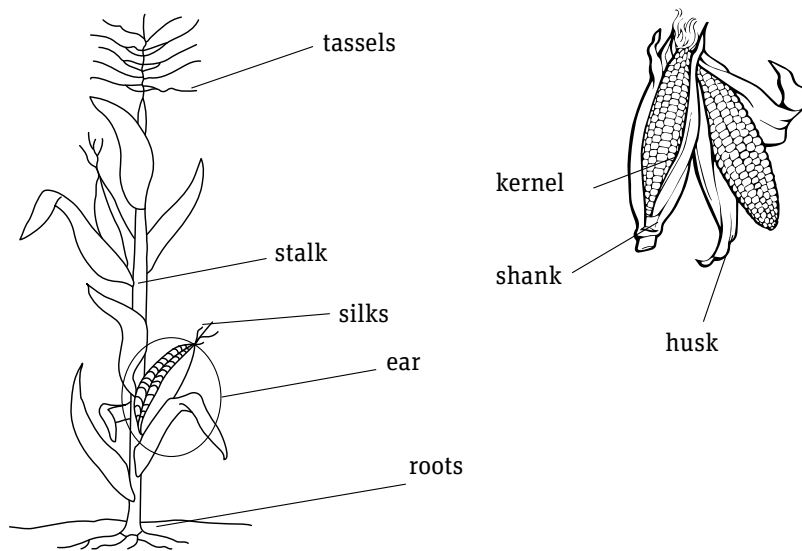
### Materials

- Taxa cards

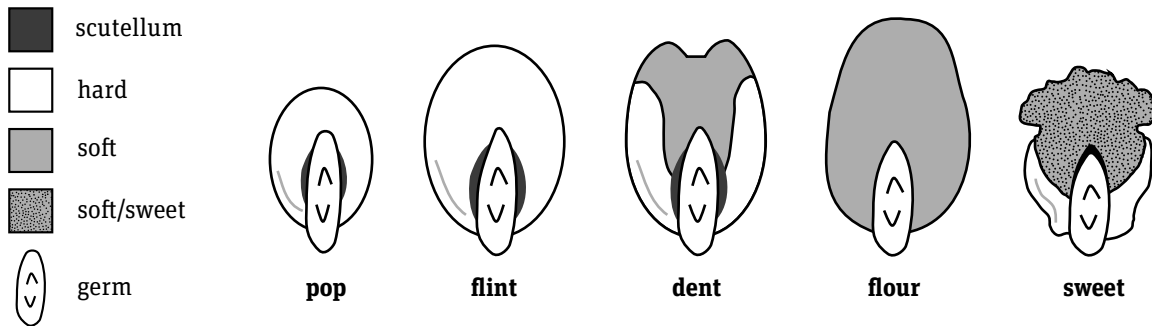
### Instructions

1. Begin by cutting out the cards provided and laying them out on your desk.
2. Complete the corn chart below using the trait information provided in the cards.
3. Use the traits to build your cladogram on the diagonal line below. The trait that is written first is the characteristic shared by most of the corn groups. The corn group that does not share that characteristic is called an outgroup and will be the first branch on your cladogram.
4. With the remaining groups, choose the next outgroup and so on until every group is represented on the cladogram.

## Plant anatomy



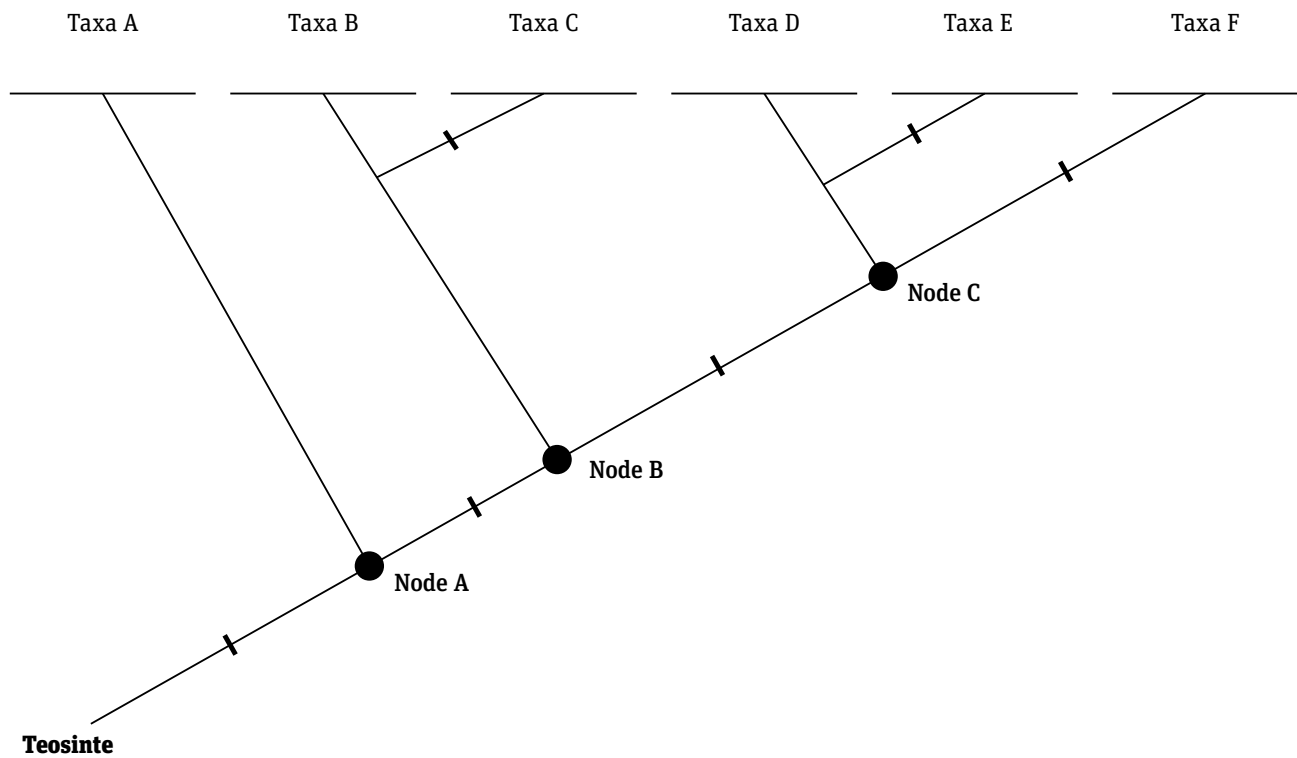
## Kernel anatomy



## Corn chart

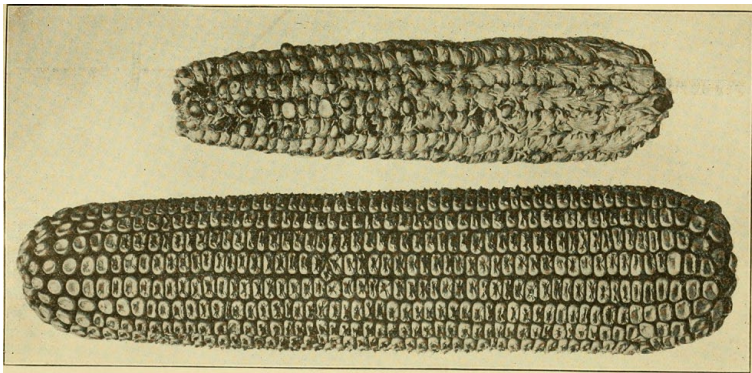
Traits		Flour	Flint	Dent	Popcorn	Sweet	Teosinte	Pod
Stalk	Multiple							
	Single							
Kernel	Husk							
	Large							
	Small							
Endosperm	Hard							
	Scutellum							
	Sweet							
	Soft							

## Corn cladogram



## Reflection

1. Explain what a derived character (trait) is in your own words.
2. Give an example of a clade in the cladogram above.
3. Which node separates the plants with hard endosperms from the rest of the plants?
4. Explain how a derived character created a change in the evolutionary relationship between clades in the cladogram.
5. How can cladograms help demonstrate evolutionary relationships between organisms?



## Popcorn

*Zea mays everta*

- Scutellum
- Single stalk
- Small kernel
- Hard endosperm

## Flint corn

*Zea mays indurata*

- Scutellum
- Single stalk
- Large kernel
- Hard endosperm

## Pod corn

*Zea mays tunicata*

- Scutellum
- Single stalk
- Large kernel
- Husk on kernel
- Hard endosperm

## Teosinte

*Zea mays parviglumis*

- Scutellum
- Multiple stalks
- Large kernel
- Husk on kernel
- Hard endosperm

## Flour corn

*Zea mays amylacea*

- Single stalk
- Large kernel
- Soft endosperm

## Sweet corn

*Zea mays rugosa*

- Scutellum
- Single stalk
- Large kernel
- Soft endosperm
- Sweet endosperm

## Dent corn

*Zea mays indentata*

- Scutellum
- Single stalk
- Large kernel
- Soft endosperm