Biology 20: Supermarket Botany: A rose is a rose but a root isn’t always a root. This exercise is designed to give you a chance to apply your basic knowledge of plant anatomy and determine the “organ of origin” of many common and uncommon vegetables. It also serves to introduce you to plant taxonomy by introducing you to some economically important angiosperm families. Examine the specimens provided. Fill in the sheet as we go.

Remember:

Root key features: central vascular cylinder, lateral roots emerge from the inside and tend to occur in rows.

Stem key features: vascular tissue in bundles either scattered or in an intact ring, presence of nodes and internodes and lateral branches and leaf emerging from the tip with lateral bud arrangement mirroring the leaf arrangement (phylotaxy)

Leaf key features: Presence of blade and petiole, lateral buds within in leaf axis.

Hypocotyl/crown key features: the junction of stem and root so has sort of a “half and half” anatomy: may have central vascular cylinder but also has lateral bud/leaf arrangement similar to stem tissue.

All of the major plant organs can be modified for storage of photosynthetic material. Most plant organs that are marketed as vegetables have some degree of storage tissue. All of the organs can be modified for other functions as well.

Common Vegetables:
The carrot family - the umbels or apiacea. This dicot plant family has many members that are common wildflowers (like queen Anne’s lace), several important vegetable crops and a number of important herbs and spices.

1. Carrot
   What organ is it and how can you tell? Root – central vascular cylinder
   What is history of cultivation and other fun facts? Good section in text: Originally cultivated in Mediterranean, wild relatives (Queen Anne’s lace) branched and tough. Originally, cultivated varieties were purple (due to water soluble red pigment – anthocyanin) – this made stews made with carrots muddy brown and unappetizing). A natural mutation of pale yellow appeared periodically – this was subject to continuous selection for bright orange color. Most popular US vegetable. All = biennial – one year growth, next year seed.

2. Celery
   What organ is it and how can you tell? Petiole (leaf stalk) – no buds in top, can see stem in long section.
   What is history of cultivation and other fun facts? Originally harvested from wild as medicinal plant – thought to be a herbal remedy for arthritis and as a digestive aide by Greeks and Romans. Cultivation began in 1500’s – some lines selected for fleshy hypocotyl (celery root or celeriac), some for petiole. Pale color obtained by keeping petiole in the dark (reduces chlorophyll production)

3. Parsnip
   What organ is it and how can you tell? Root – central vascular cylinder like carrot.
   What is history of cultivation and other fun facts? Cultivated in ancient Greece and Rome – the first of the “forgotten” root crops. Popular in 1500 and 1600’s but
grows too slowly (replaced by white potato). Often, harvested too early – tastes best if left in ground until after 1rst frost – triggers starch breakdown (sweeter).
The mustard family: Crucifers or brassicaceae: Characteristic cross shaped flowers (hence the old family name of cruciferea) along with the strong smell and taste, many species from this family have been domesticated for both food and flavoring use.

4. Radishes: Red and White
   What organ is it and how can you tell? Mostly root – some hypocotyl.
   What is history of cultivation and other fun facts? Long history of cultivation – 4000 years, possibly introduced to Asia 2500 years ago (maybe independent cultivation). White Asian radish (daikon) can reach huge size.

5. Turnip
   What organ is it and how can you tell? hypocotyl to root – mostly root (at distal end, can see vascular cylinder)
   What is history of cultivation and other fun facts? Gets its name because it looks as though it was “turned on a lathe”. Old world (European) starchy staple – cultivated for 4000 years and was harvested from wild prior to cultivation. Always reputation of “peasant food” – home cooking, not for guests (reject a suitor by serving him turnips). Second “forgotten” root crop – replaced by white potato (turnip has strong flavor). Was the original Jack-o-Lantern – carved into face by Irish (old trick the devil story – Jack fools the devil into letting him get his soul back and when Jack dies, heaven will not let him in nor will the devil but the devil give Jack a glowing ember to find his way).

6. Rutabagas
   What organ is it and how can you tell? hypocotyl to root – mostly root (at distal end, can see vascular cylinder)
   What is history of cultivation and other fun facts? Hybrid of cabbage and turnip. VERY strong flavor – either you love ‘em or hate ‘em. Third of forgotten root crop (why eat a turnip or rutabaga or parsnip when you can have a mild and higher yielding potato).

The wild kale descendents: Brassica oleracea var. X: There are a number of vegetable crops that actually are all members of the same species. All of these (cabbage, brussel sprouts, cauliflower, kohlrabi, broccoli and kale) are thought to share a common wide kale ancestor. All of these subject to bolting (in warm weather, may go to seed).

7. A myriad of cabbages (okay, so Chinese cabbage is a separate species - I figured you all have seen a head of cabbage).
   What organ is it and how can you tell? Leaf (easy to see stem remnant in section)
   What is history of cultivation and other fun facts? Origin thought to be Mediterranean – wild kale domesticated 2600 years ago (600 B.C.) thought to have given rise to all of the following: cabbage, broccoli, cauliflower, kohlrabi, Brussels sprouts and kale. Plant is tolerant to cold – made it very popular. 400+ varieties. Very high in vitamin C – keeps well in storage. Also shredded and preserved by pickling (sauerkraut, kim-chi, etc) – pickling cabbage popular world wide.
8. Kohlrabi
   What organ is it and how can you tell? **Swollen shoot base (obvious points of leaf attachment as leaves remain)**
   What is history of cultivation and other fun facts? **No real clear story of cultivation – maybe mentioned by Pliny the Elder (23 to 76 A.D.) but not certain. No clear evidence of cultivation until middle ages. Very odd but pretty tasty.**

9. Cauliflower
   What organ is it and how can you tell? **Aborted flower.**
   What is history of cultivation and other fun facts? **Recent addition to the kale group (cultivation not until 1600’s if not later). Researchers have run across gene for the aborted flower form when looking for genes that control flowering.**

The Lettuces: the composites, sunflowers or asteraceae. This vegetable is a member of the aster family, the largest of the dicot families of plants.

10. Leaf vs. head lettuce
   What organ is it and how can you tell? **Leaf – like cabbage.**
   What is history of cultivation and other fun facts? **Romans thought it had medicinal properties – opium like sedative (my hypothesis – with no data to back it up – is that it just added roughage to their diet and made them feel better after excess consumption). Lettuce, chicory and radicchio (looks sort of like a mini red cabbage) all closely related. Types of lettuce: head like iceberg (least tasty but most popular), loose leaf and cos (romaine lettuce – heads look like Chinese cabbage)**

An introduction to starchy staples: The “roots” that help feed the world (only one is really a root and an odd one at that!)

11. Sweet Potato
   What organ is it and how can you tell? **Root but hard to tell.**
   What is history of cultivation and other fun facts? **Unusual fibrous storage root. Native of Peru and made a world tour to Europe via Pacific, India, Asia, Africa and finally to Europe. Can be used for asexual propagation but must use the whole potato (cannot use a piece like white potato)**

12. White Potato
   What organ is it and how can you tell? **Stem: a tuber. Can see eyes (lateral buds) arranged in a spiral.**
   What is history of cultivation and other fun facts? **South American origin – much more on the white potato later in course.**

13. Cassava
   What organ is it and how can you tell? **Root – sometime can see central vascular cylinder (but not this time)**
   What is history of cultivation and other fun facts? **South American origin – the “tropical potato” - grows well in areas where it is too hot for potatoes. Some cultivars must be carefully treated to remove toxic compounds.**

14. Taro
   What organ is it and how can you tell? **Stem – look at buds**
   What is history of cultivation and other fun facts? **Domesticated in south pacific – important tropical pacific staple. brought everywhere by Polynesian settlers. Source of poi – Hawaiian dish. Must be boiled to remove/dissolve calcium oxalate crystals that would sting the mouth.**
Other common and uncommon vegetables

15. Asparagus
What organ is it and how can you tell? **Stem**
What is history of cultivation and other fun facts? **Monocot and perennial** (once established, can be harvest year after year). Cultivated in ancient Greece and Rome but forgotten in dark ages. **White** (covered like celery so that chlorophyll production is low/stopped).

16. Rhubarb
What organ is it and how can you tell? **Petiole**
What is history of cultivation and other fun facts? “**Root of the barbarians**” – originally medicinal (diuretic) then food. **Leave are toxic** (oxalic acid). Hard to get rid of the plant – once planted, hard to remove.

17. Onion and Garlic
What organ is it and how can you tell? **Storage leaves (can see stem in section)**
What is history of cultivation and other fun facts? **Cultivated and eaten prior to recorded history** – every culture has used wild forms of onion and garlic. Leaves have volatile sulfur compound that make you tear (two compound housed in different parts of cell, cut and combine = volatile tearing compound)

18. Ginger
What organ is it and how can you tell? **Stem (rhizome) can see branches**
What is history of cultivation and other fun facts? **Origin is south east Asia** – the hot in Asian food prior to peppers. Good for nausea as well.

19. Jimaca
What organ is it and how can you tell? **My best guess is root but hard to say – strange legume (bean relative) storage root.**
What is history of cultivation and other fun facts? **New world origin**. Name from **Aztec word (xicamalt) for vegetable**. Sweet and tasty.

20. Bamboo Shoots
What organ is it and how can you tell (sometimes, a shoot is just a shoot)? **Shoot**.
What is history of cultivation and other fun facts? **Over 200 types domesticated in Asia**. The plant itself = over 1000 uses,

21. Lotus
What organ is it and how can you tell? **Stem with modifications for underwater growth (can see buds/branches)**
What is history of cultivation and other fun facts? **A plant with religious significance for Buddhist, Hindu and ancient Egyptians**. All parts are edible (gift of god).

22. *Polygonatum ordaratum* – why knowing a scientific name is sometimes a good thing.
**Solomon’s seal – a common wildflower.** It is a stem and is used for deserts, medicinal properties and to make moonshine (used in production of home-fermented alcohol in Korea)