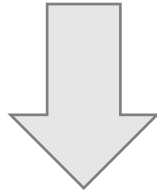
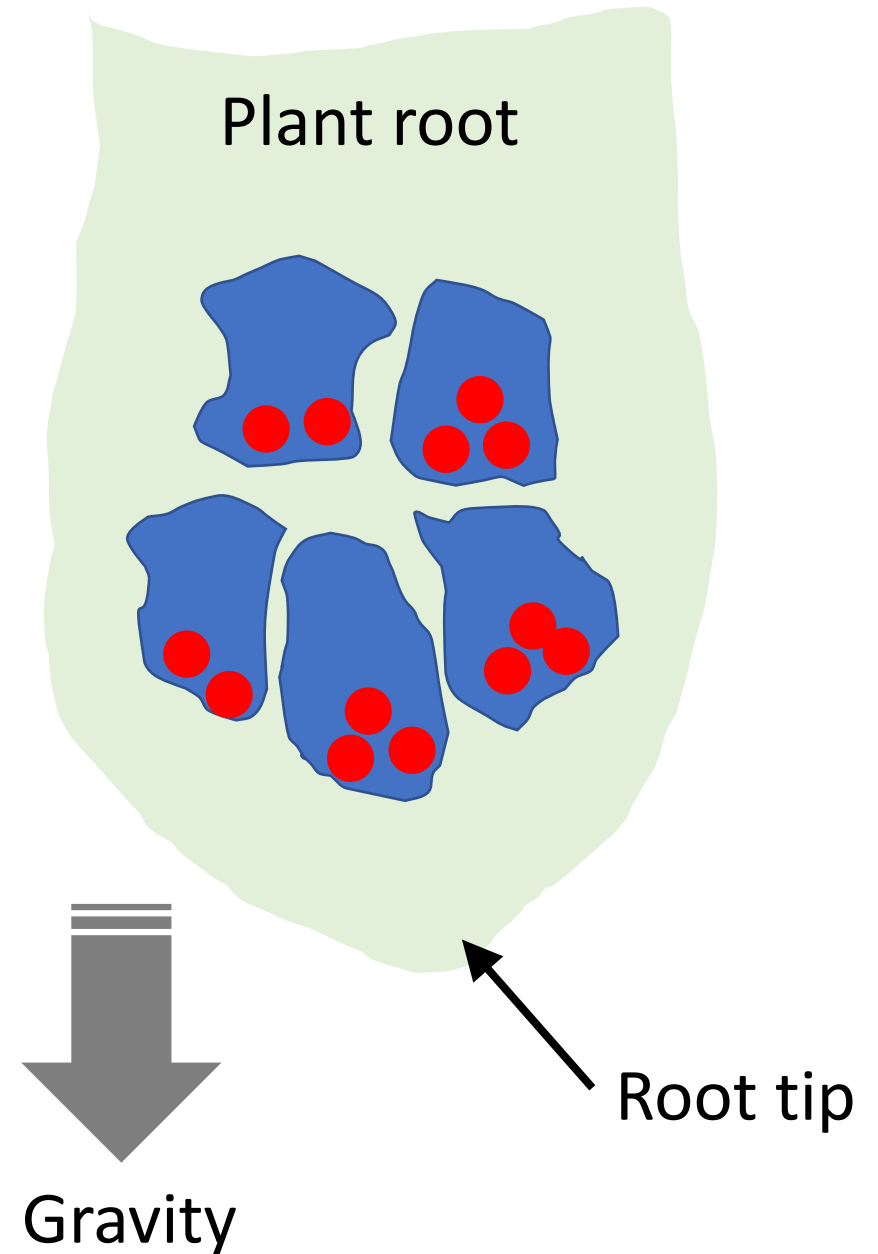


How do plants know which way is up or down?



Gravitropism

- Plants use special cells in their root tips to sense the direction of gravity
- Plant growth responds to the direction of gravity



Materials you need

- Zip-lock sandwich bags
- Permanent pen
(or pen and clear tape)
- Paper towels
- Water
- Spoon
- Radish seeds
- Strong tape
- Large cardboard box





Prepare the large cardboard box

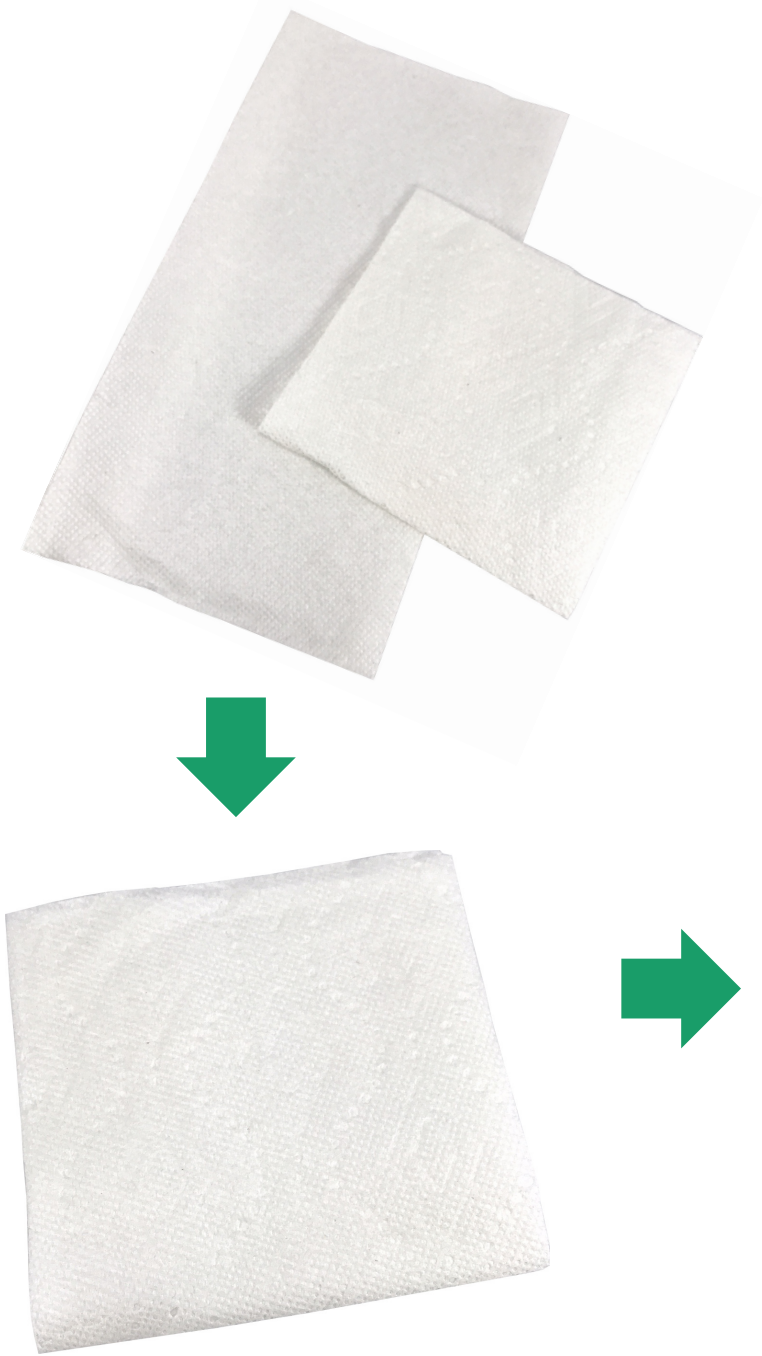
- Lightproof the box
- Seal any cracks with tape



Label all 3 zip-lock bags

- Label all four edges with
 - "Up"
 - "Down"
 - "Left"
 - "Right"

Fold the paper towels

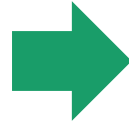


- *Full-sheet*: fold in half twice so it fits in the bag
- *Half-sheet*: stack two on top of each other and fold in half once
- Put the folded paper towels in plastic bags
- Make sure the bags can close

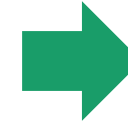
Moisten the paper towels



Add two tablespoons
of water to the bag



Swish the water
around



Paper should be
damp but not wet

Add radish seeds to all bags



Open bags so there are two layers of paper towels on each side

Place five seeds in the middle of the bag

Close bags

- Leave some air inside
- Press down on seeds so they "stick"

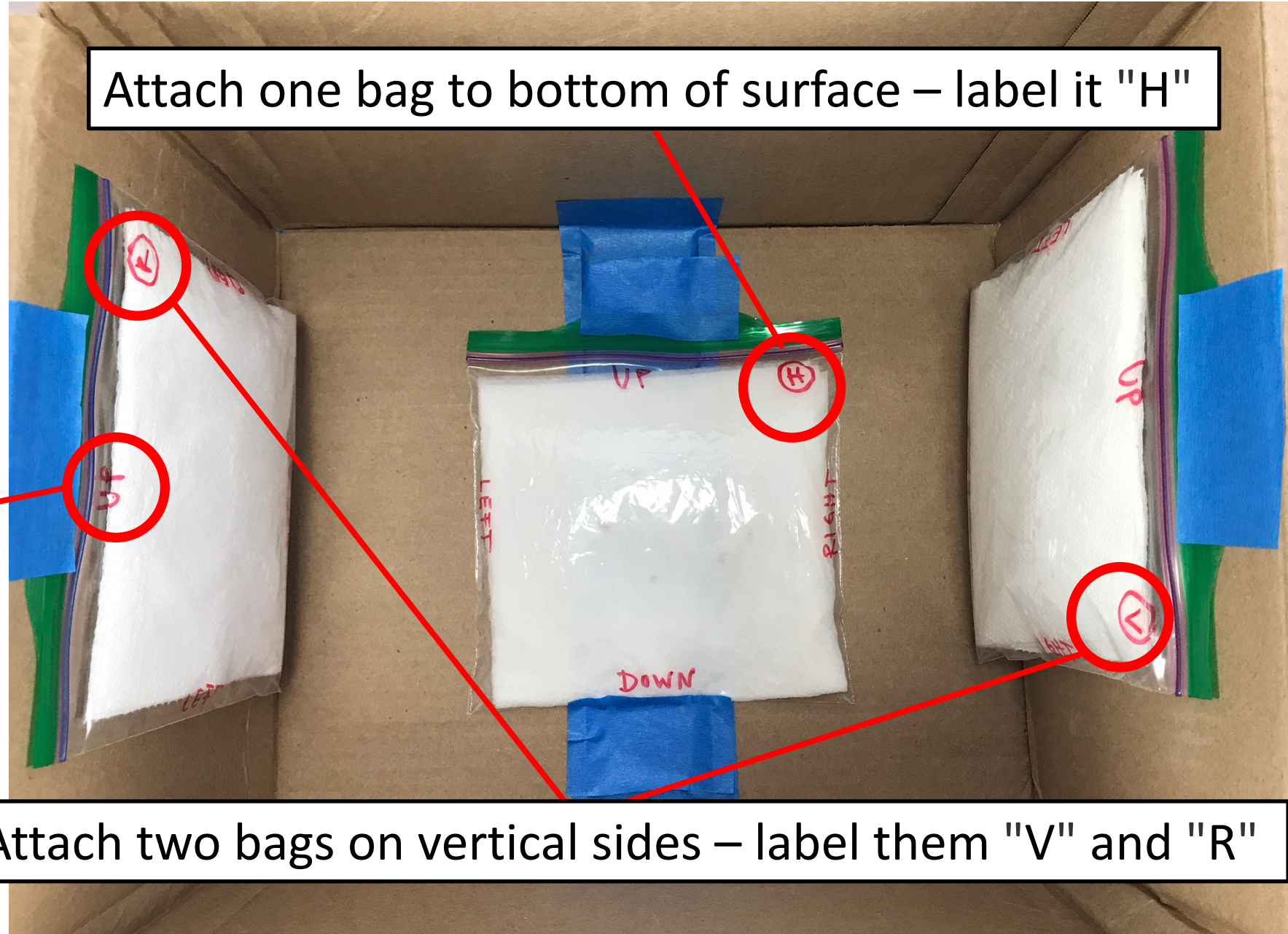
Tape
bags into
lightproof
box

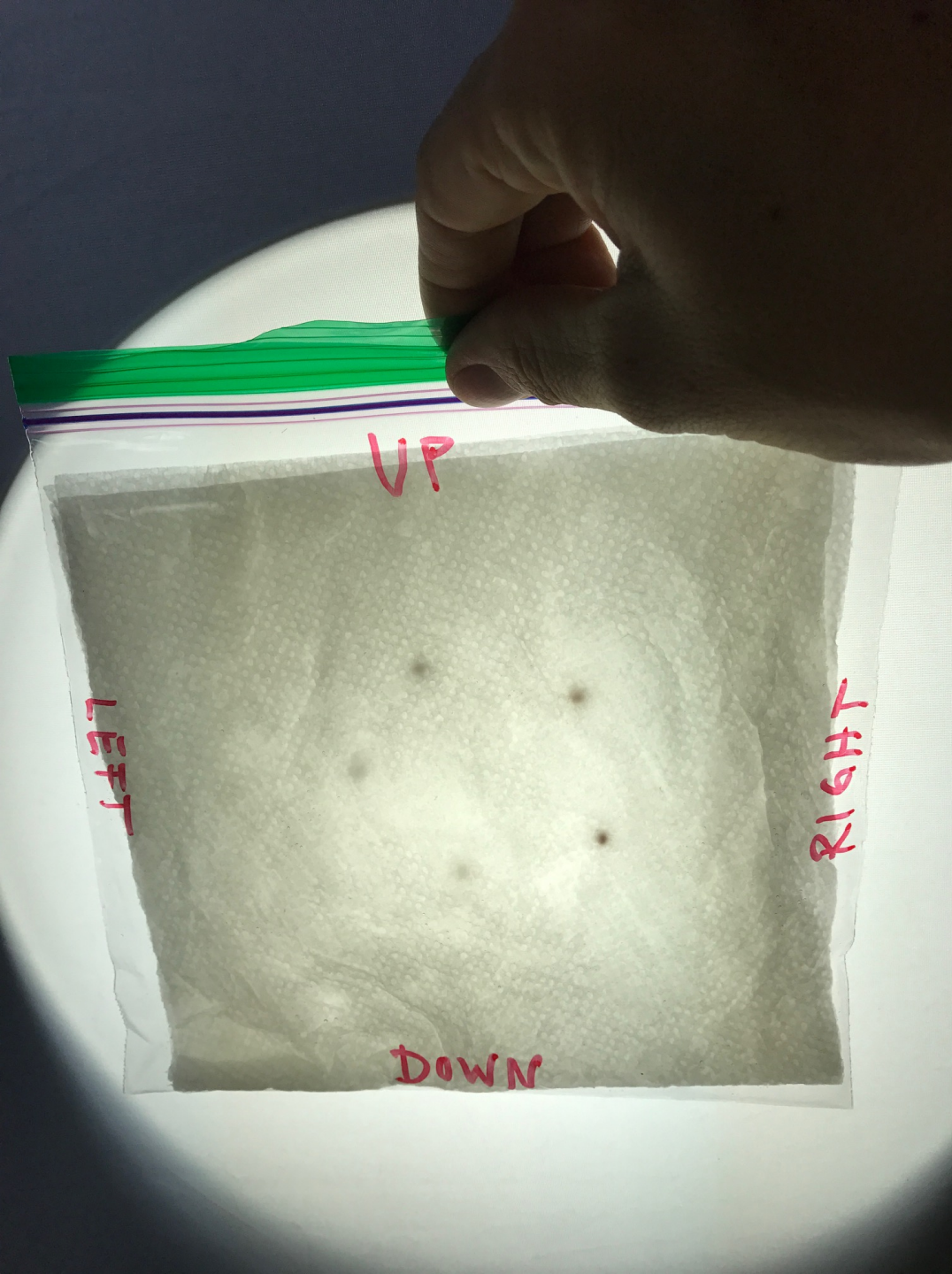
Make sure "Up"
label is on top

Close box
and tape lid

Attach one bag to bottom of surface – label it "H"

Attach two bags on vertical sides – label them "V" and "R"





Day 3

- Remove each bag from the box - one at a time
- Hold the bags up to a light to check for root formation and root growth direction
- Feel with your fingers if there are any roots between the paper and which way they are growing
- Do not leave any bag exposed to light for more than 10 minutes!

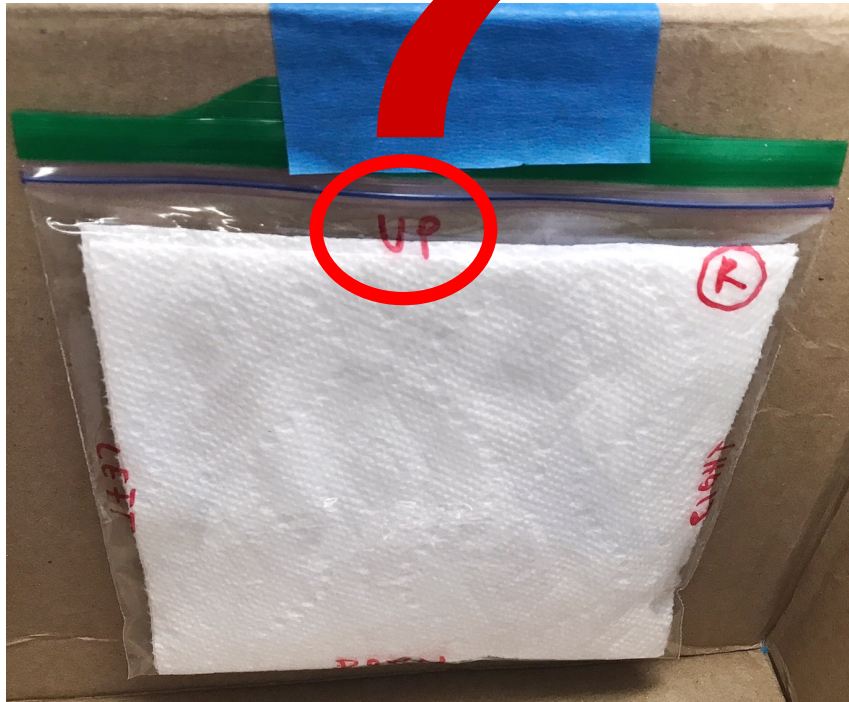
Day 5

- Repeat the same steps as listed for Day 3

Change the direction of gravity

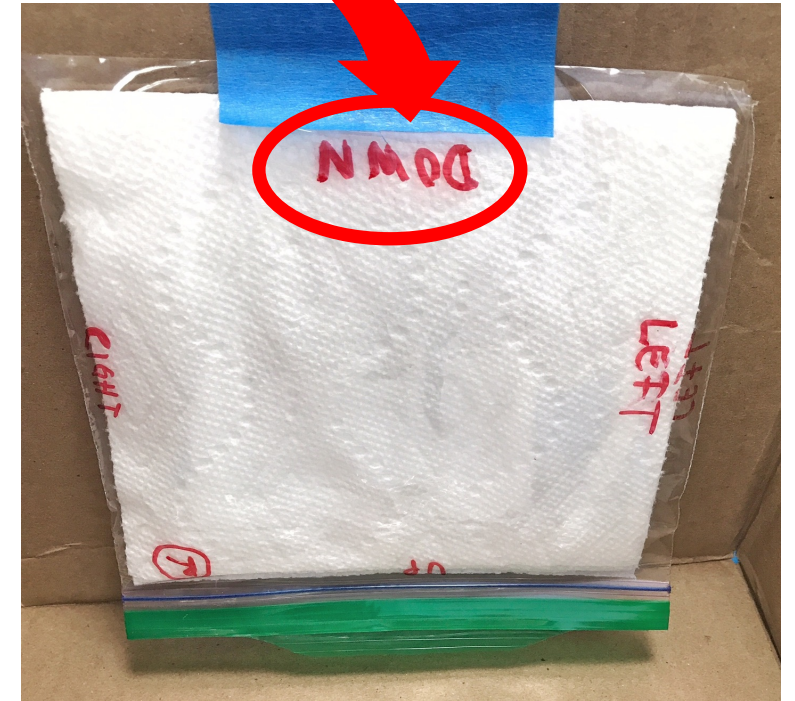
Day 3

90°



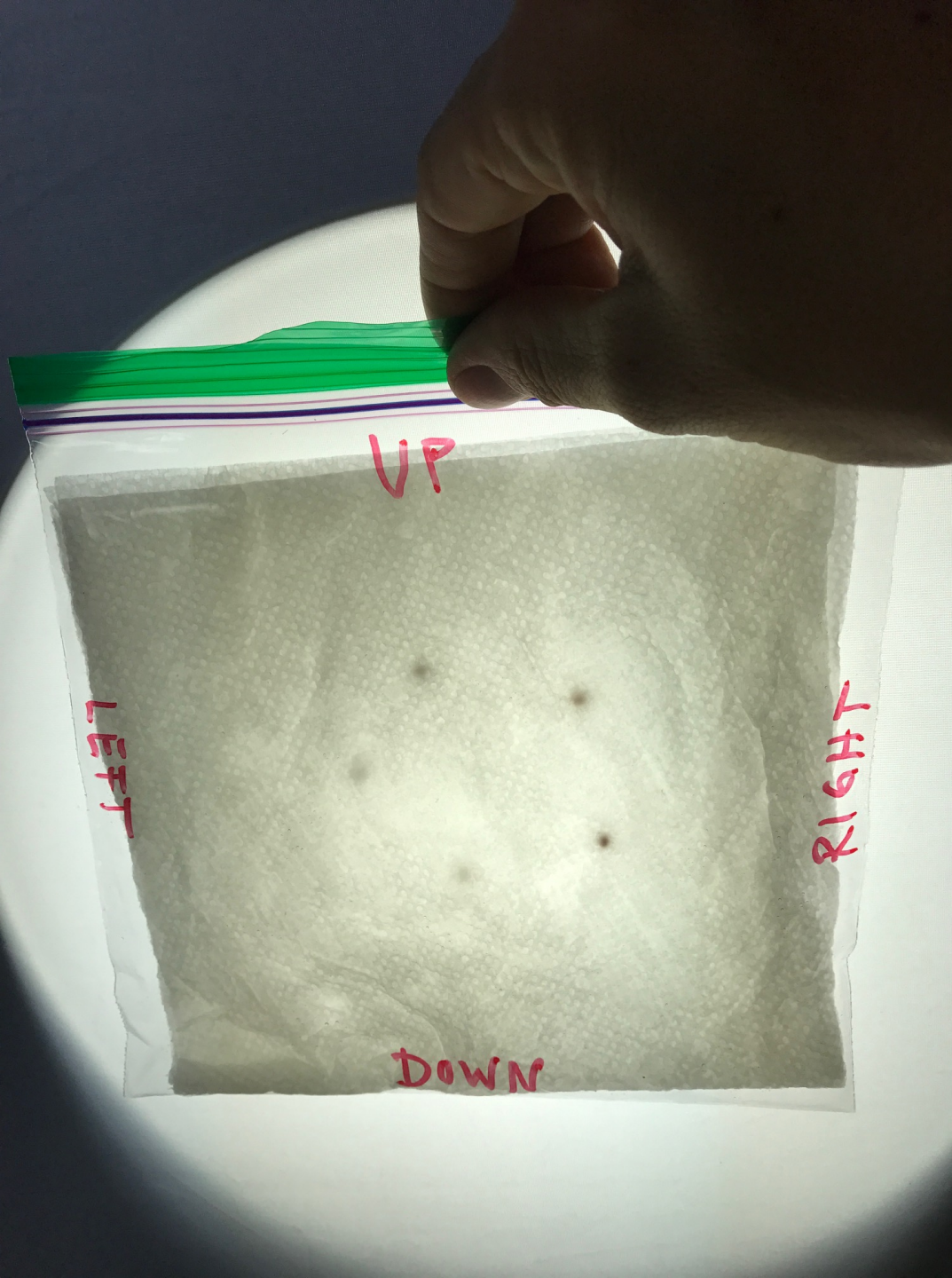
Day 5

90°



Rotate "R" bag 90 degrees clockwise ➡ Put all bags back in box and close lid

Day 7



- Remove each bag from the box - one at a time
- Hold the bags up to a light to check for root formation and root growth direction
- Open each bag and take out the paper towels. Keep their orientation the same as in the bag!
- Carefully open the paper towels to look at the seeds. Do not break the roots or stems!