Hello future surgeons,

We discussed different anatomical planes we use when discussing the brain:

- coronal (the way a crown sits on a head; the front view of the brain)
- sagittal (side profile of the brain)
- axial (bird's eye view of the brain)

Since brain is 3 dimensional, we have to target regions of interest with three different coordinates.

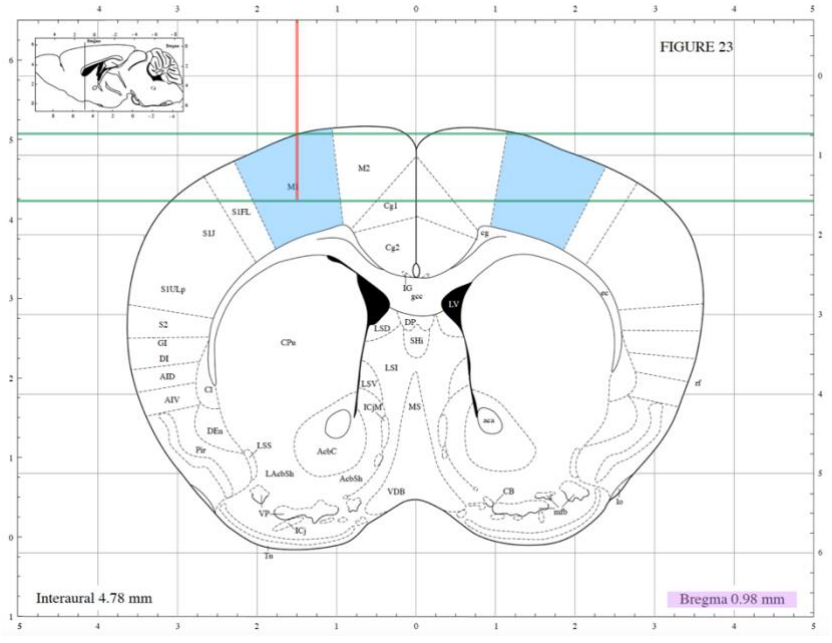
- AP (anterior-posterior: front to back)
- ML (medial-lateral: side to side)
- DV (dorsal-ventral: top to bottom)
    - **dorsal actually means back, while ventral means underside or belly.
        - This is relevant to animals that do not walk on two legs e.g. mice or dogs.

In the mouse brain atlas, our three stereotaxic coordinates are read on different sections of the page. Bregma, the brain equivalent of the Earth's equator, is a universal landmark on the skull. Coordinates are measured relative to their distance from bregma.

For example, if we wanted to record neural activity in the motor cortex to determine how the brain controls movement, these are the steps we would take.

First, we look up the brain nomenclature (the name of the region) and the abbreviation (short name of the region). The index is alphabetical. The **nomenclature** *(primary motor cortex)* and **abbreviation** (*M1*) is highlighted in blue. The **coronal brain figures** where M1 can be found are highlighted in purple. This means we could pick any number between 11 and 42 and find M1. The **sagittal brain figures** where M1 can be found are highlighted in orange.

Next, we determine our coordinates. I have randomly picked figure 23 showing a coronal (front) view of the brain. I highlighted **M1 in blue**. You will notice that this region is seen on the left and right hemisphere. The **bregma measurement** is highlighted in purple. This represents our **AP stereotaxic coordinate** or ***+ 0.98 mm.*** The red vertical line represents a single wire electrode. The electrode is perfectly vertical thus the surgery angle is 0 degrees. Sometimes we target brain regions from an angle. To account for surgical error or variation in brain structures in animal subjects, we target the middle of our region of interest. The **x-axis** is the scale we use to determine **ML stereotaxic coordinates**. 0 is midline, the middle of the brain that separates the left hemisphere from the right hemisphere. I am targeting the left hemisphere. The **line intercepts with the x axis** at 1.5 mm. DV cans be measured from the surface the brain or the skull. I will be measuring from the surface of the brain. The **y-axis** measures DV. The first green line is at top of the brain above our target region. The second green line is at the bottom of our target region. DV is line 2 (4.25 mm)- line 1 (5.05 mm) or ***-0.8 mm.***



Our M1 stereotaxic coordinates are **AP (+0.98 mm)**; **ML (-1.5 mm)**; **DV from brain (-0.8 mm).**

Here is an activity designed to help you think about how bundles are designed and how the atlas helps us determine our surgery coordinates. We will find brain regions we target in our lab surgeries. We record electrical activity in brain regions that play roles in thinking, memory, and emotions such as the prefrontal cortex, hippocampus, and amygdala.

1. Find the target regions based on these coordinates given. I have randomly ordered the coordinates. This is not the order that you would follow in a surgery.

AP	ML	DV	Surgery Angle
-3.4	-0.25	-4.25	0
+1.3	-2.25	-4.1	22.1
-1.58	-0.3	-2.88	0
-3.3	-3	-3.78	0
+0.75	-1.12	-2.25	0
-1.4	-2.9	-3.85	0
+1.5	0	-2.25	0

   The target regions listed in alphabetical order are:
   AcbC, **AcbSh**, **BLA**, **CA1**, **CeL**, **Cg**, **CPu**, **IL**, **MDM**, **PrL**, **VTA**

2. Once you believe you have correctly matched the target regions to the coordinates, compare your answer to our bundle designs to ask:

   - are bundles staggered (multiple length wires in one hole to target different subregions or DVs)?
   - are bundles bilateral (simultaneously targeting left AND right hemisphere)?
   - what is the thickness of the wires (35 um, 50 um, 35 and 50 um)?
   - what are the dimensions of the bundle (2x2, 4x1, 3x2, etc.)?
   - how does the DV of the bundle compare to the DV of the surgery coordinates (e.g. bundle DV - 5.1 mm, surgery DV -4.1 mm)?

I have attached a PDF of the mouse brain atlas in stereotaxic coordinates to help with this activity.

Good luck and email me with any questions or difficulties you encounter!