

INTRODUCTION TO BOLD IMAGING

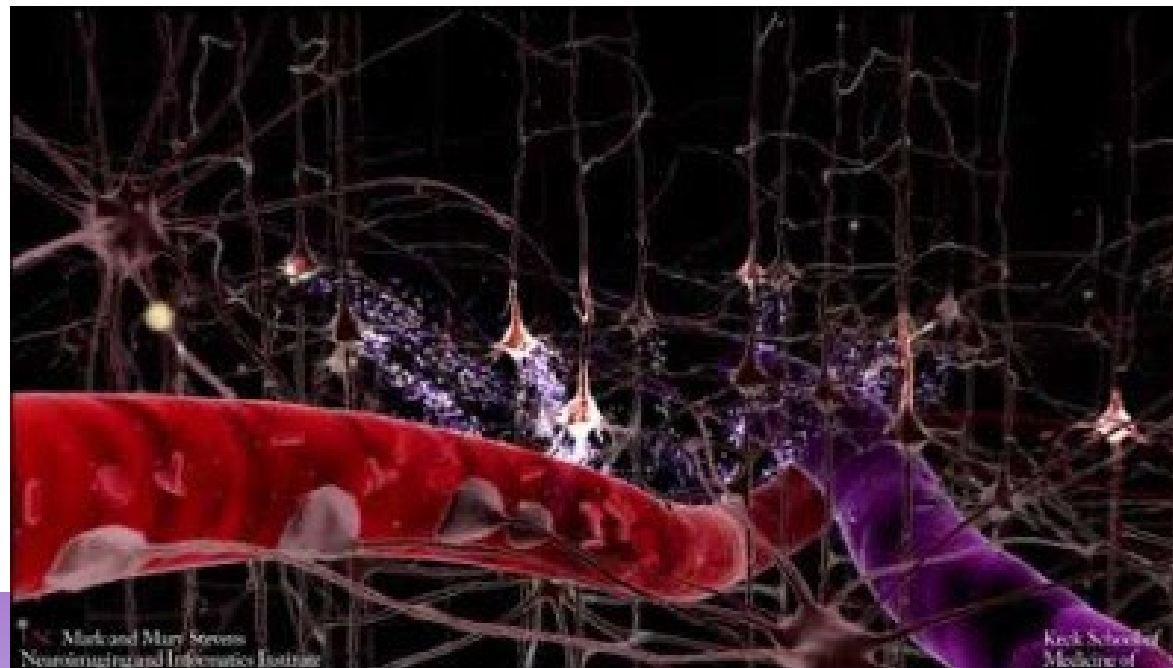
BIG OLE' DATA

LAUREN HOPKINS

JUST KIDDING



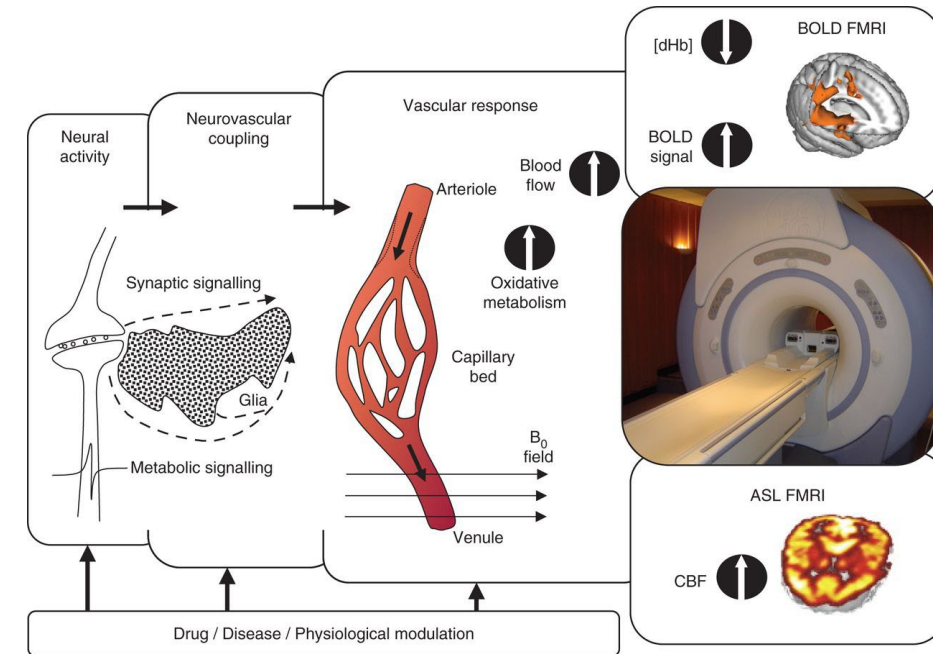
- BOLD = Blood-Oxygen-Level-Dependent imaging
- BOLD is used as a correlate of 'brain activity' during fMRI - NOT anatomical or DTI
- BOLD measures the magnetic signal from oxygen in blood in the brain



HOW DOES BLOOD = BRAIN ACTIVITY?



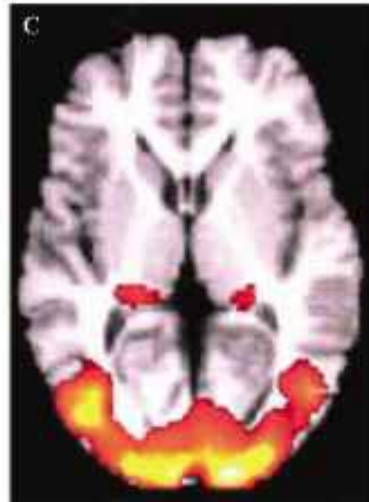
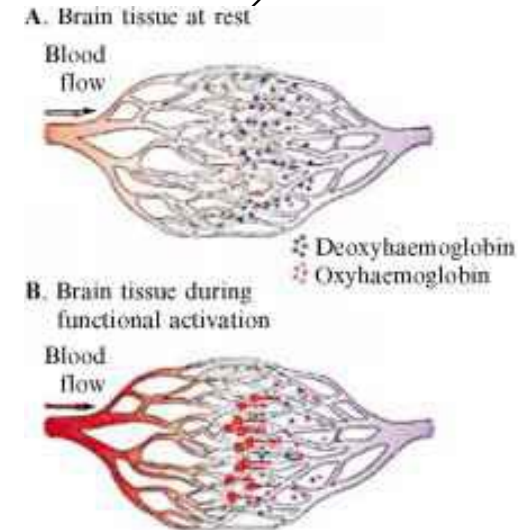
- Neurons don't have internal energy reserves of oxygen and sugar
 - The more a neuron fires the more energy it needs
- Blood releases oxygen to active neurons ("for energy")
 - This causes a relative change in deoxygenated & oxygenated blood
- Oxygenated blood is magnetically different than deoxygenated and the MRI can tell you where the oxygen is.



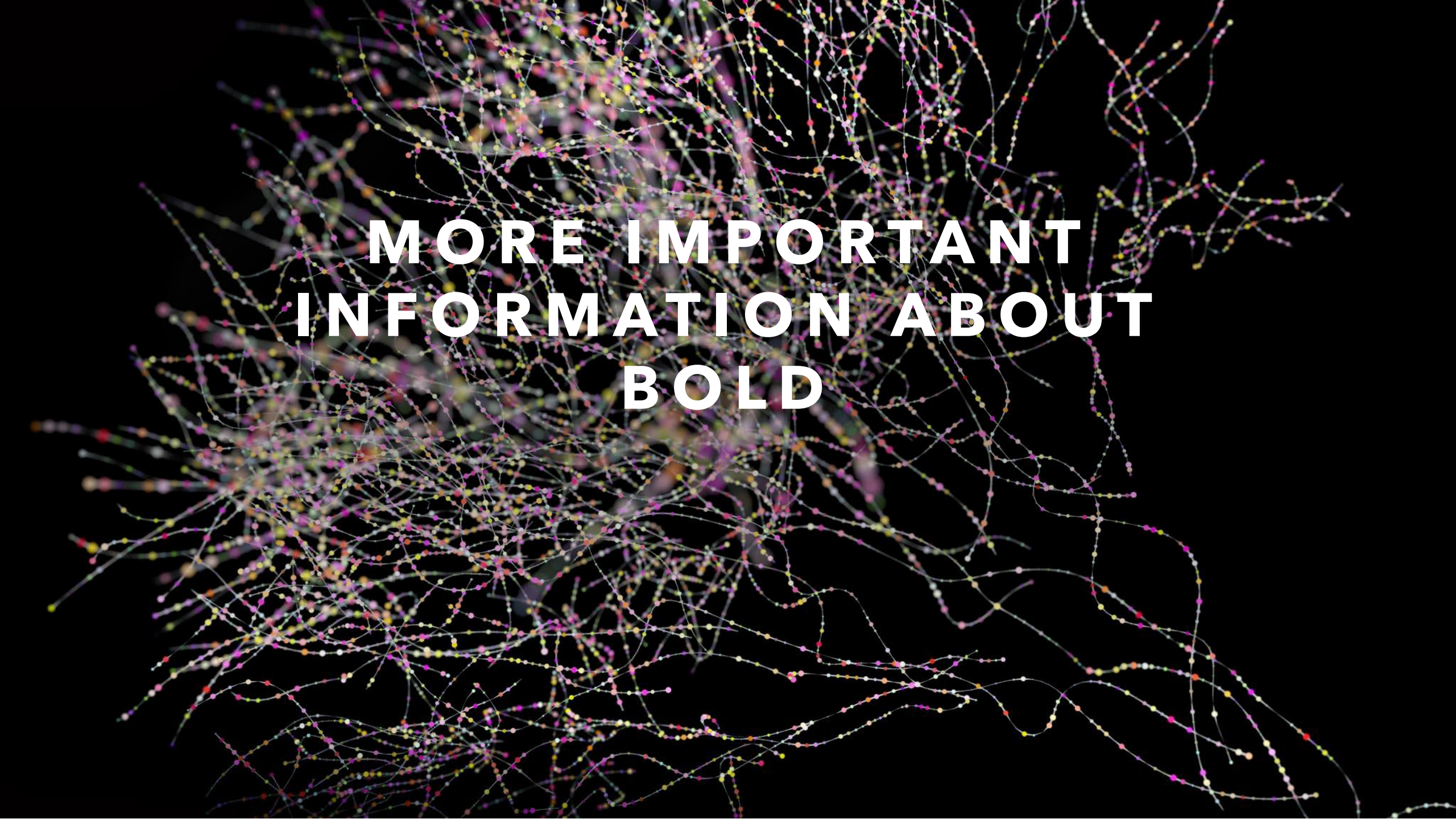
BREAKING DOWN THE BOLD:

TAKING A HIGHLY DIFFICULT CONCEPT AND MAKING IT WAY SIMPLER THAN I PROBABLY SHOULD

1. Blood flow in the brain is highly locally controlled in response to O_2 in tissue
 - BOLD is a regional measure
 - It is used to delineate regional activity
2. BOLD measured O_2 in **BLOOD**
 - BOLD **DOES NOT** measure direct neural activity
3. Increased activity in a region leads to more O_2
4. fMRI measures this because of there is a difference in magnetization between oxygenated and deoxygenated blood

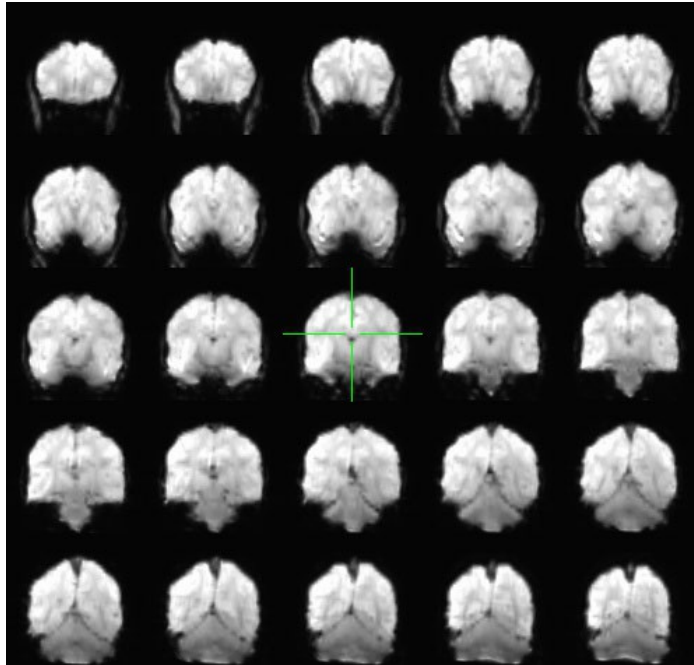




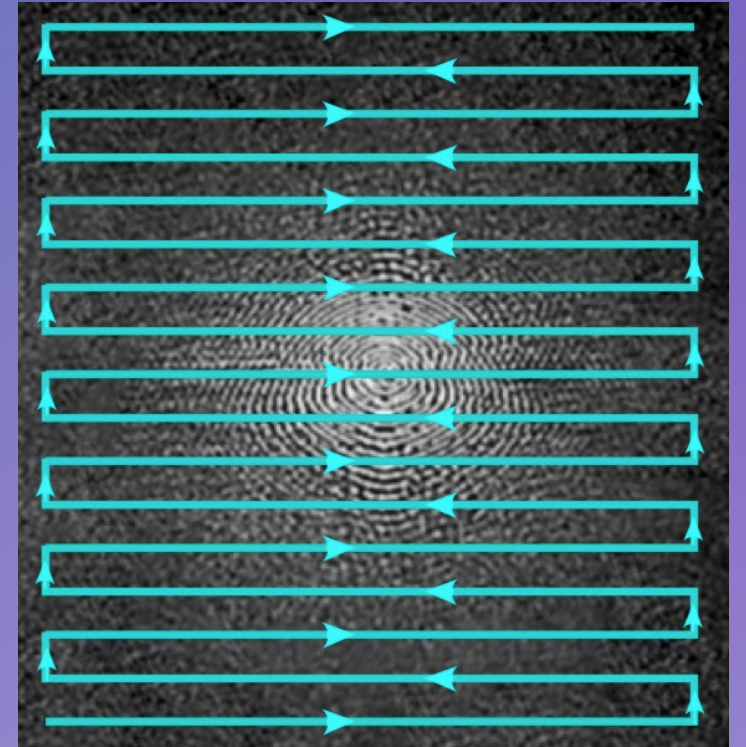


**MORE IMPORTANT
INFORMATION ABOUT
BOLD**

BOLD LOOKS LIKE SHIT BUT THAT'S OK

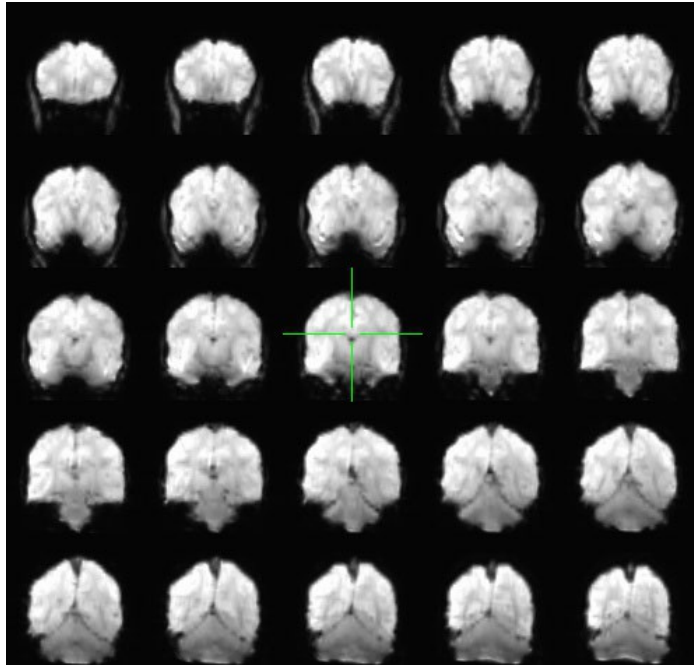


- A BOLD scan needs to get an ENTIRE scan of the brain very quickly
- We sacrifice **spatial resolution** for **temporal resolution**
 - It gets blurrier but faster

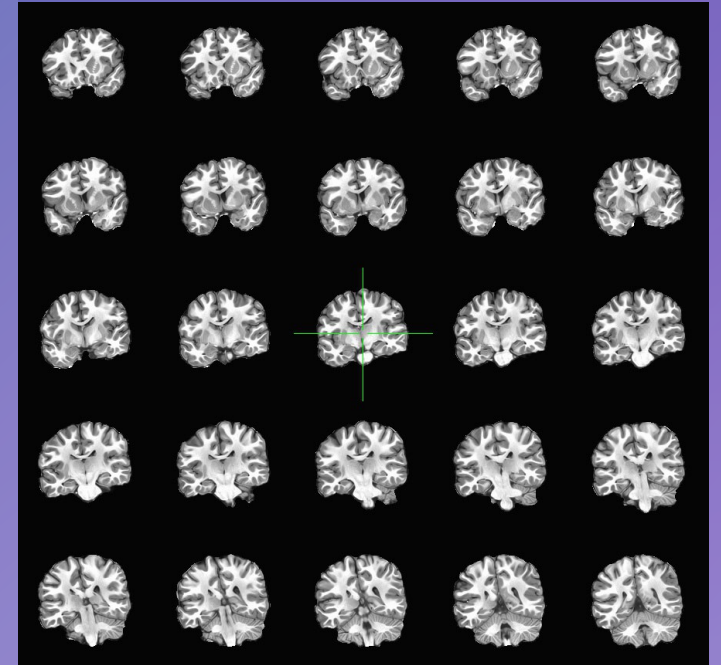


- BOLD images are EPI scans
- Anatomical scans have high **spatial resolution** but low **temporal resolution**
 - Look crisper, only 1 timepoint

BOLD LOOKS LIKE SHIT BUT THAT'S OK

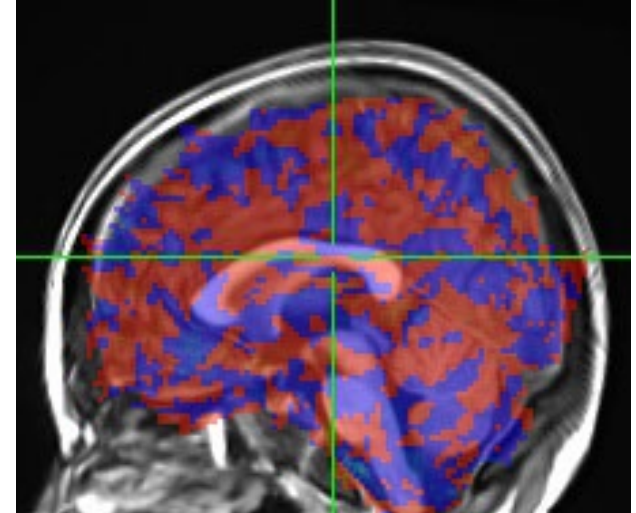
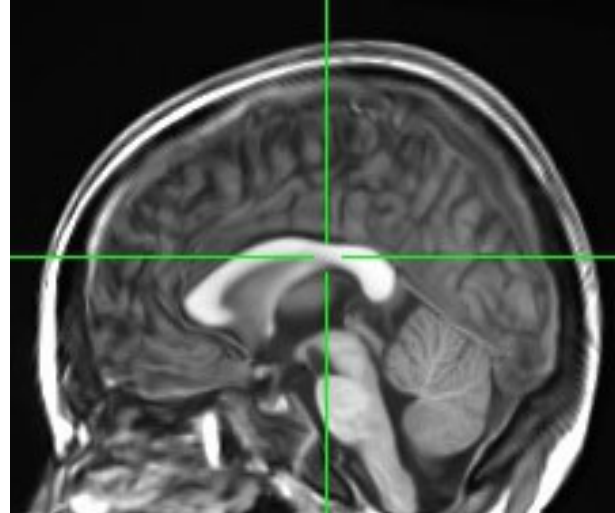
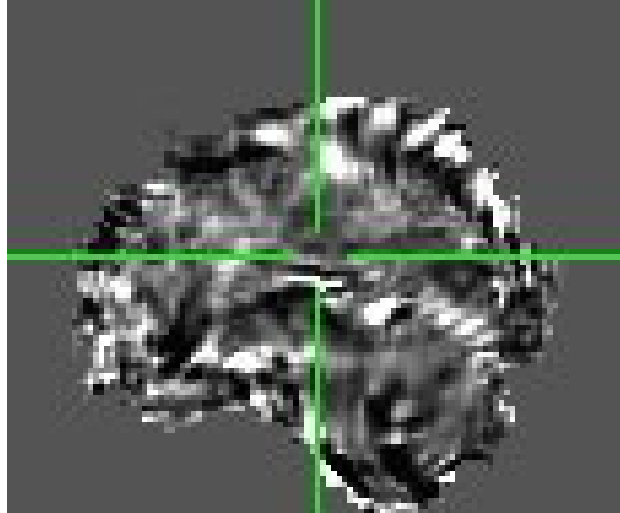


- We sacrifice **spatial resolution** for **temporal resolution**
 - Voxel size: 3x3x5mm
 - Get single whole brain scan every 2s

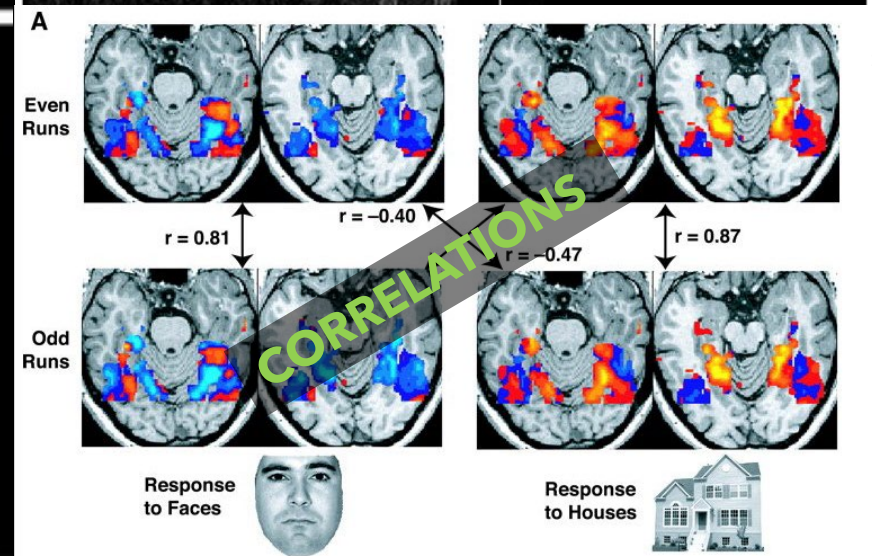
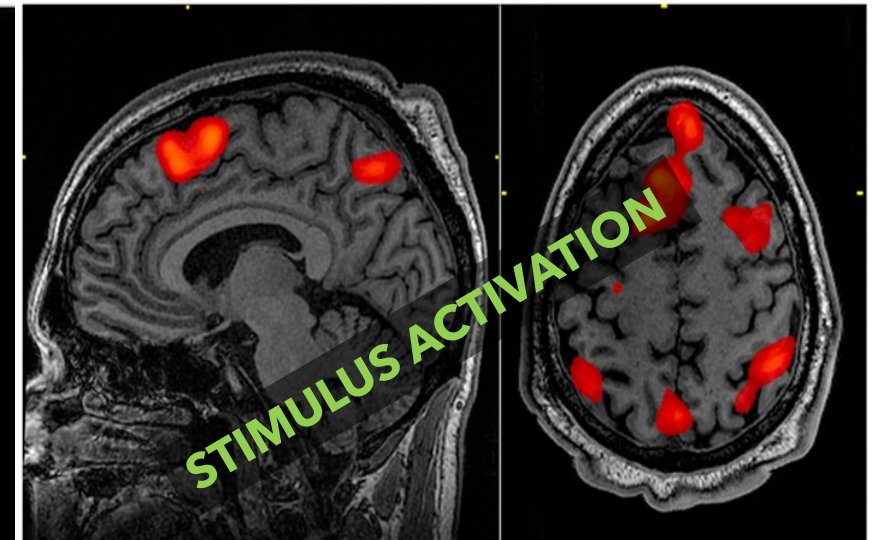
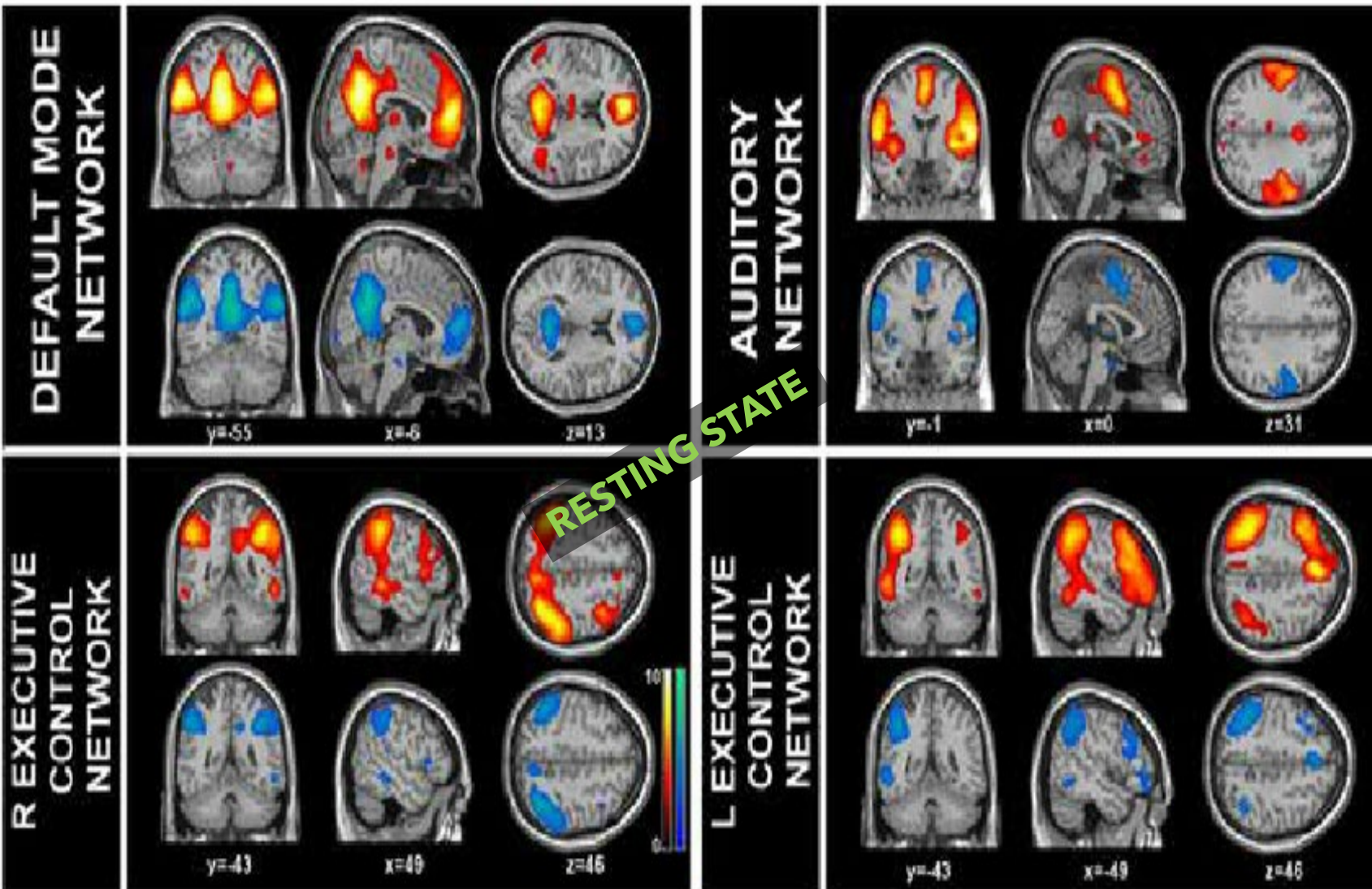


- Anatomical scans have high **spatial resolution** but low **temporal resolution**
 - Voxel size: 1x1x1mm
 - Get single anatomical image in an ~7m scan

BOLD ISN'T MUCH ON ITS OWN



- BOLD goes OVER the anatomy.



WHAT CAN BOLD LOOK LIKE?

IMPORTANT PROS & CONS OF USING THE BOLD SIGNAL

PROS



- It has been shown to be a **VALID NONINVASIVE** measure of regional brain activity
- Produces images that are really high-res, comparatively speaking
- Shows regional activity differences well
- Safe

BUT

BUT

BUT

BUT

CONS



- *IT IS ONLY AN INDIRECT MEASURE OF BRAIN ACTIVITY*
- One cube of the brain is made up of millions of neurons, **not one**
- Response is slow & laggy - see response 2-6s after stimulus
- Very sensitive to movement

ONE LAST TIME

I'M GIVING 5 TALKS SO I'M
GOING TO LET OXFORD
SPARKS TAKE IT FROM HERE

