Arterial Spin Labeling (ASL)

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What is ASL?

- Arterial spin labeling uses arterial blood water as an endogenous contrast agent

- Blood is "tagged," or magnetically inverted, which changes its magnetic properties and its effect on MR signal

- Advantages: non-invasive, fast, better spatial specificity than BOLD

- Also, can quantify CBF (cerebral blood flow)

Principles of ASL

1. Tag inflowing arterial blood by magnetic inversion
2. Acquire the **tag image**
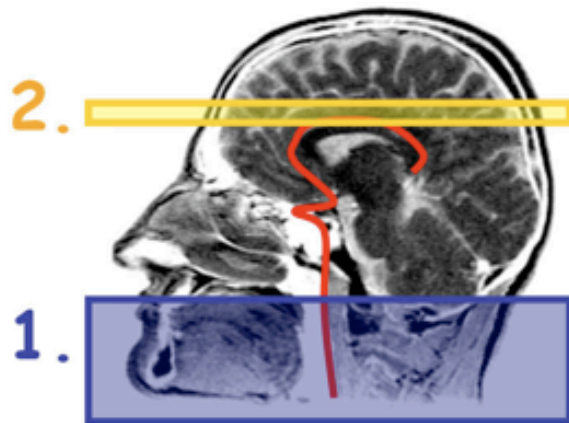
3. Repeat experiment without tag
4. Acquire the **control image**
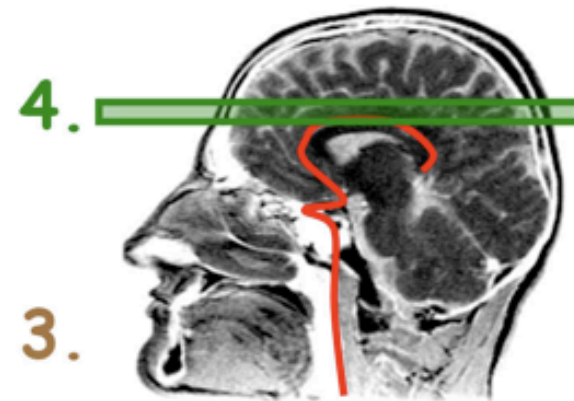
$$\uparrow - \uparrow = \uparrow \propto CBF$$

5. Subtract: **Control image** - **Tag Image**

The **difference** in magnetization between control and tag conditions is proportional to regional cerebral blood flow.

http://www.umich.edu/~fmri/asl.html

BOLD vs. ASL

Effect on MR Signal

- Brain tissue = diamagnetic = inert

- Oxy blood = diamagnetic = inert

- Deoxy blood = <u>para</u>magnetic = decrease

- BOLD signal produced by rinsing (displacement) of deoxy blood by oxy blood

- In ASL, create <u>para</u>magnetic tracer that suppresses MR signal wherever arterial blood is delivered

BOLD vs. ASL

	BOLD	**ASL**
Contrast:	T2	T1
Spatial:	Veinules	Arterioles/Capillaries ⭐
Sample Rate (TR):	1-3s ⭐	3-8s
Intersubject Var:	High	Low ⭐
Coverage:	Whole-Brain ⭐	Part or Most
Artifacts:	Susceptibility; motion	Vascular Artifact
% Signal Change:	0.5-5% ⭐	<1%
Ideal for:	Task Design	Physiological States

Excerpt from http://bitc.bme.emory.edu/BOLD_ASL.html