



Your Brain Without Oxygen

**Insights into the Cerebral Response
to Hypoxia from functional MRI**

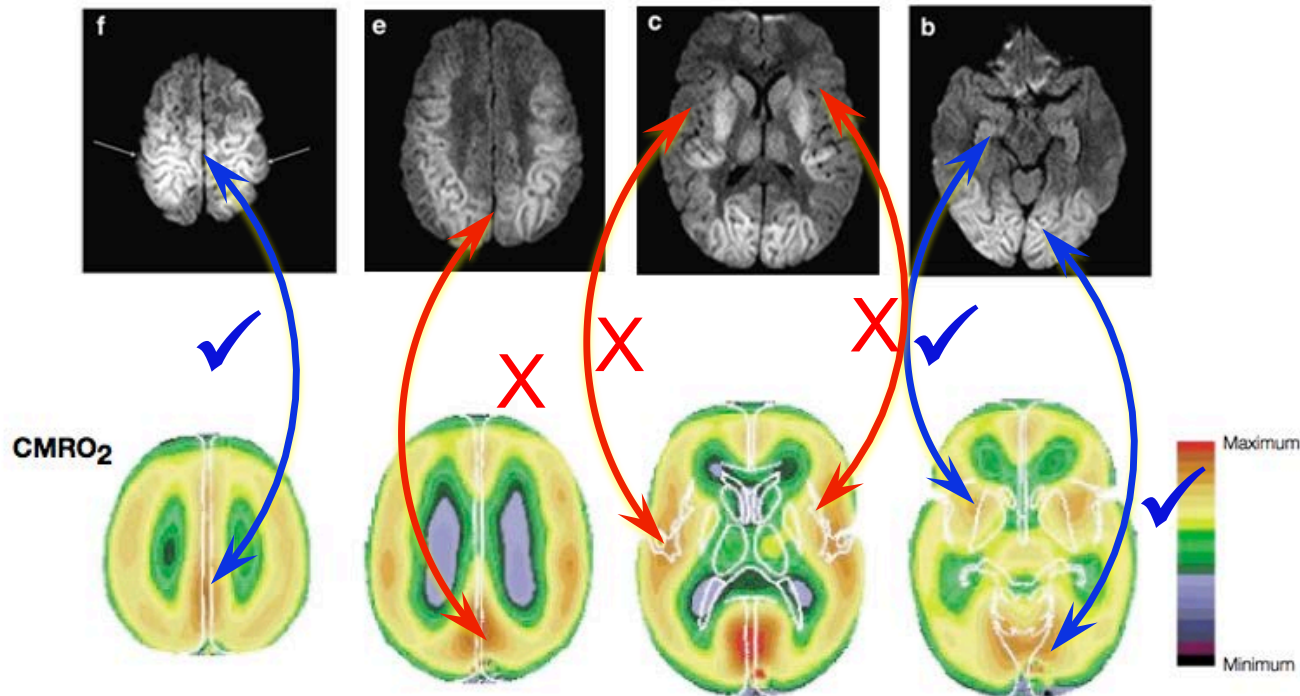
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Regional hypoxic vulnerability

Selective hypoxic vulnerability

Luigetti et al. Acta Neurol Belg 2011



Gusnard & Raichle. Nat. Rev., Neurosci. 2001

Challenges:

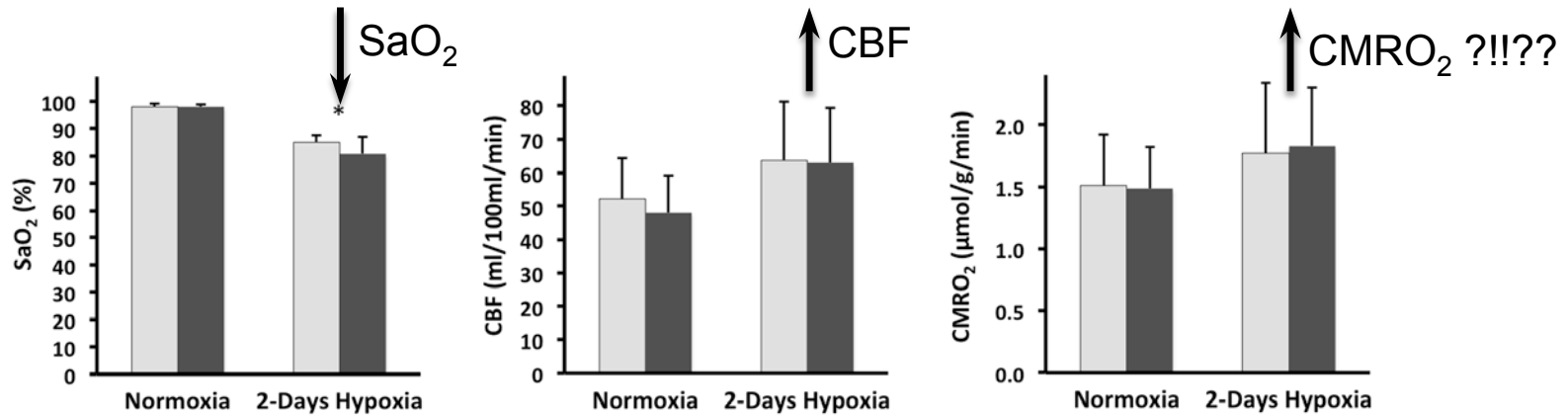
- Can't study normal physiological response once brain is already damaged
- Need a "safe" model of global cerebral hypoxia

Sustained Hypoxia at High Altitude Barcroft Lab

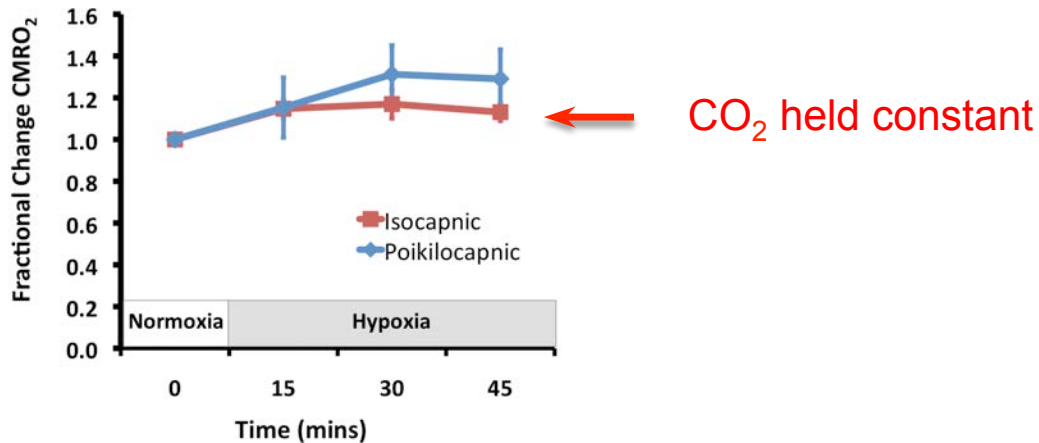


- Advanced fMRI techniques developed at CFMRI to quantify:
 - Cerebral blood flow
 - Cerebral O₂ metabolism
 - Tissue oxygenation
 - Parenchymal swelling
 - Diffusion

Brain Changes at "recreational" altitudes



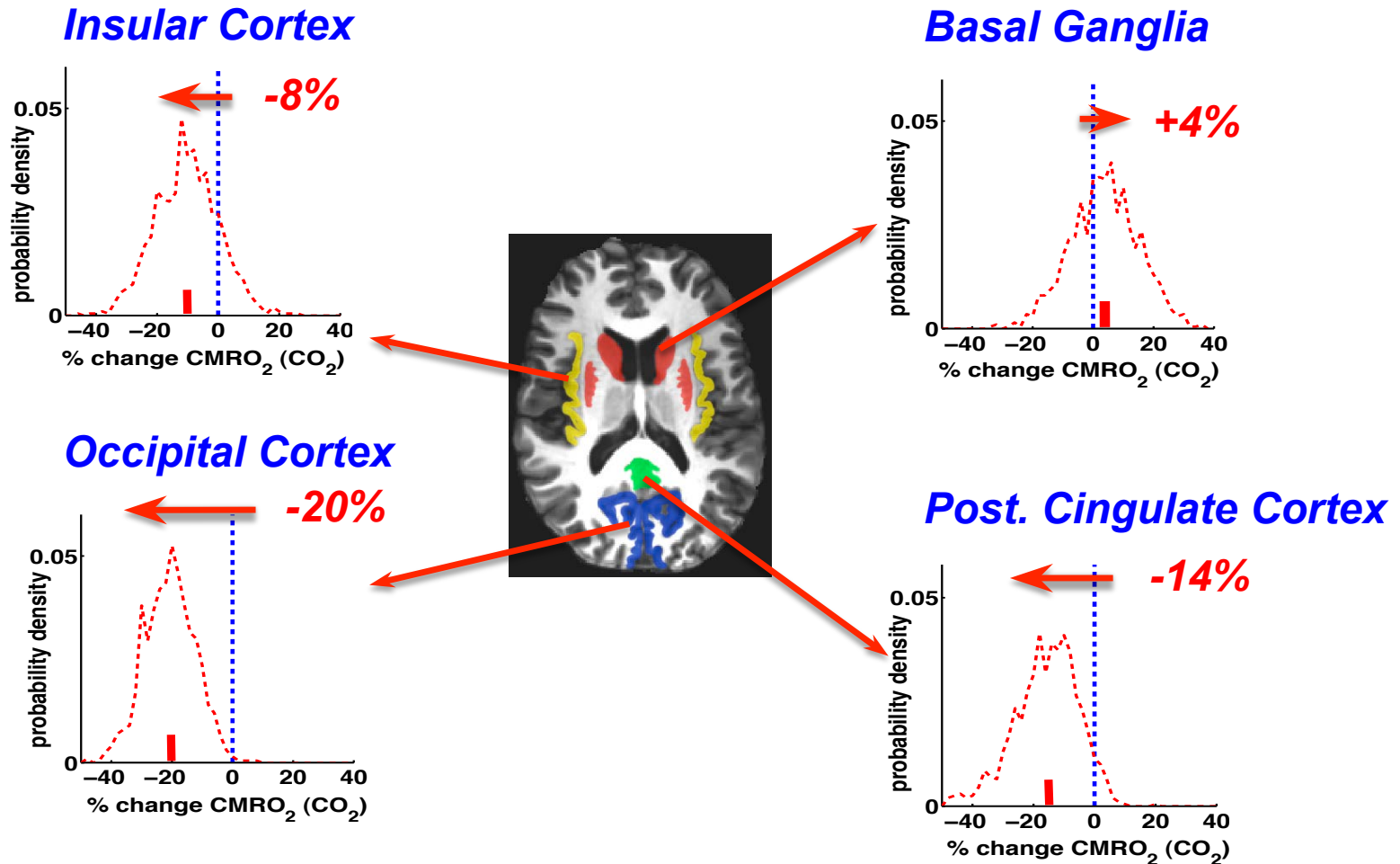
Smith JAP 2013;114:11-18



- CO₂ is an important modulator of blood flow
- CO₂ is also an important modulator of O₂ metabolism

Hypoxic for 6 hrs (85% SaO₂)

Does +5% CO₂ (as in ischemia) cause regional differences in Δ CMRO₂ ?

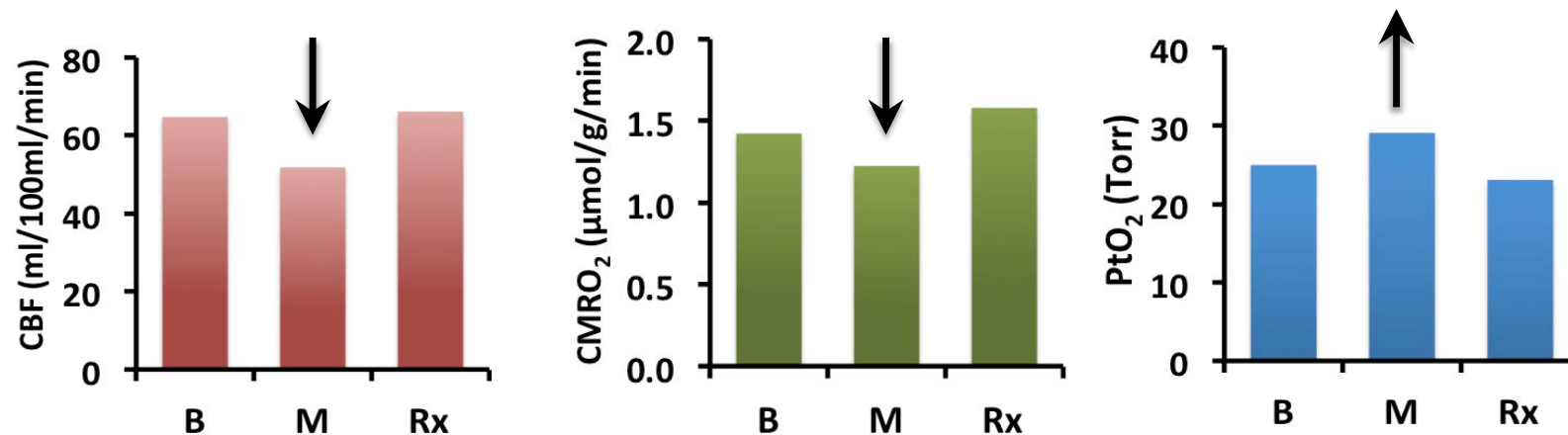


CO₂ sensitivity appears to be important in regional hypoxia vulnerability

Current Grants:

- Regional CBF / CMRO₂ sensitivity to CO₂ in hypoxic vulnerability
- Hemodynamic and Metabolic Coupling in Migraine

CBF / CMRO₂ / PtiO₂ in Migraine



- Global hypoperfusion and hypometabolism during migraine headache
- Reversed by sumatriptan therapy (5-HT agonist)