



EEG power-down during whole body metabolic inhibition induced by Hydrogen sulfide (H₂S) inhalation in rats

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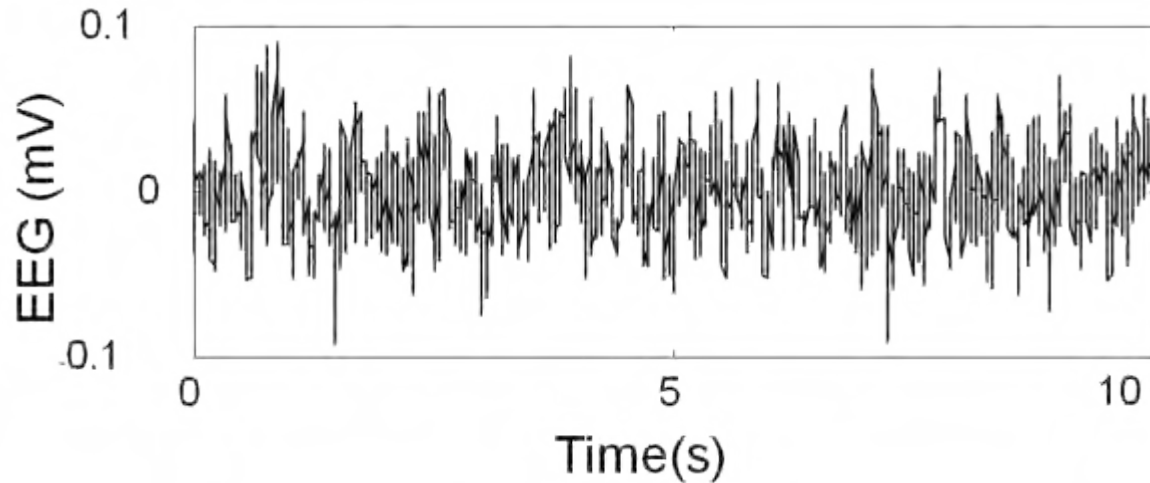
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?!?



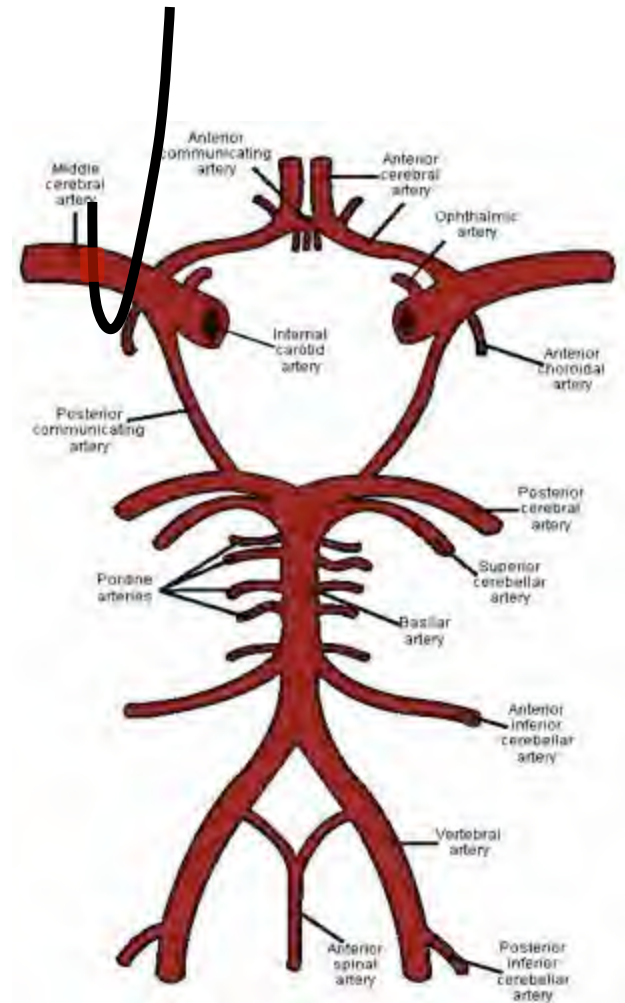
- EEG = measures the electrical activity of the brain using electrodes mounted on the dura

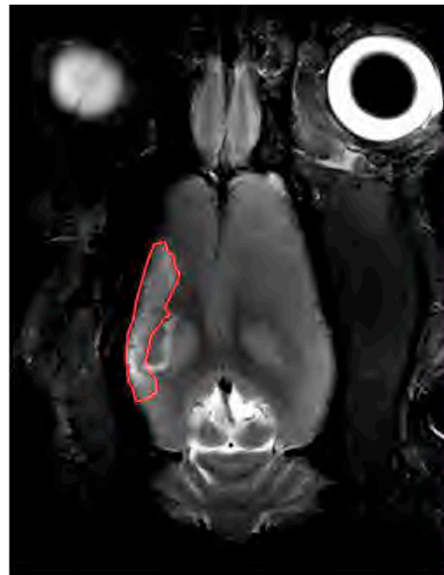


- H₂S = hydrogen sulfide, a bad smelling gas (rotten eggs) used as a chemical weapon in the second world war (as a poison!), recently viewed as a potentially controllable neuromediator.

Recently, it was reported that H₂S exposure was able to reduce the extent of brain damage caused by experimental stroke in rats. However, the mechanisms mediating this neuroprotective effect remain unclear.

→ 23rd January 2008, NEUROSCIENCE LETTERS,
Baltromejus Florian, Raluca Vintilescu, Adrian Tudor Balseanu,
Ana-Maria Buga, Olaf Grisk, Lary C.Walker, Christof Kessler,
Aurel Popa-Wagner, *Long-term hypothermia reduces infarct volume in aged rats after focal ischemia*





7 Tesla MRI and head images obtained for a normal rat, an infarct with H₂S exposure and an infarct without H₂S exposure

Exposure to hydrogen sulfide (H₂S) in the air induces a reversible metabolic “shut-down” resembling “suspended animation” in mice.

→ 22nd APRIL 2005, SCIENCE, Eric Blackstone, Mike Morrison, Mark B. Roth *H₂S Induces a Suspended Animation–Like State in Mice*

Suspended animation = a state of metabolism similar to the hibernation state in animals capable to do so (bears and squirrels in winter)

Mice, rats (and humans) do not naturally hibernate!!!

1. **Cytochrome c oxidase**, a component of the oxidative phosphorylation machinery within the mitochondrion, is one intracellular target of H₂S

2. **Activation of potassium-dependent ATP channels** is another major mechanism of H₂S, which in turn causes vasodilation, preconditioning against ischemia/reperfusion injury and myocardial protection

3. An endothelium-dependent effect seems to contribute to these vasodilatory properties: in human endothelial cells, H₂S caused direct **inhibition of the angiotensin-converting enzyme**

→ Bench-to-bedside review: Hydrogen sulfide – the third gaseous transmitter: applications for critical care Florian Wagner, Pierre Asfar, Enrico Calzia, Peter Radermacher and Csaba Szabó

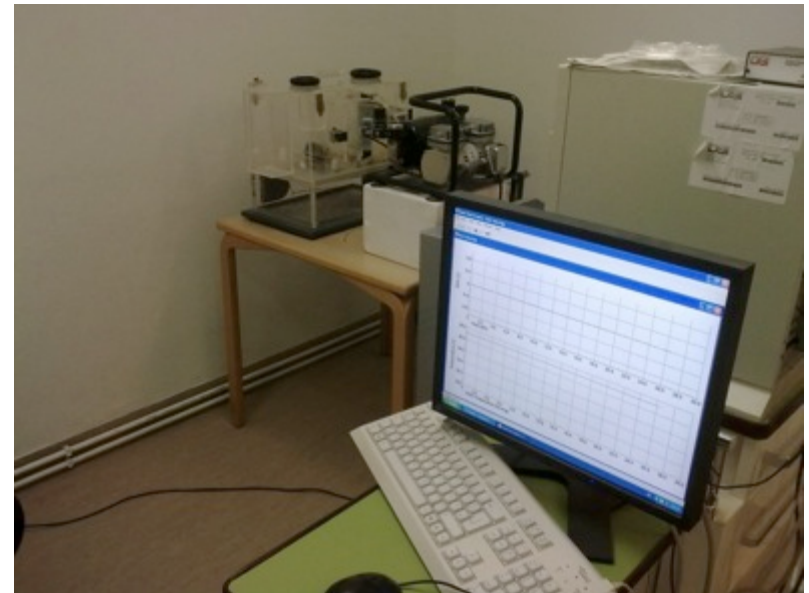
What happens to the
EEG of the rat during
H₂S exposure?

Materials and methods

Acquisition equipment



Image showing the EEG, Temperature and Activity transmitter which was implanted in the rat, placed in a “pocket” made beneath the skin on the back; the receiver and acquisition station



Surgery and electrode position



Image showing the surgical procedure for implant and electrode placing through the skull relative to bregma. (aprox 9 mm between electrodes)



H₂S exposure

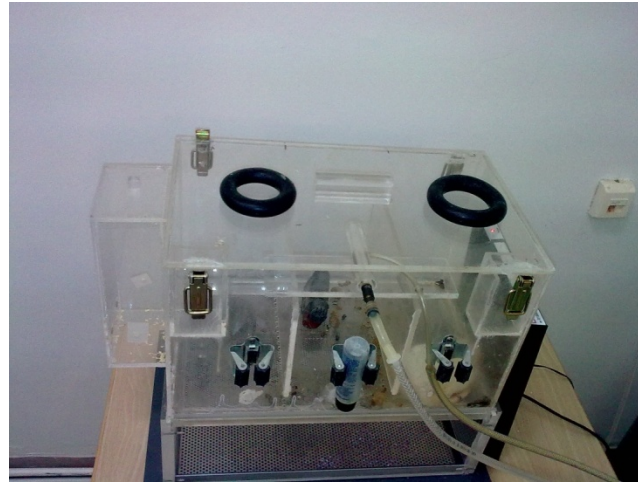
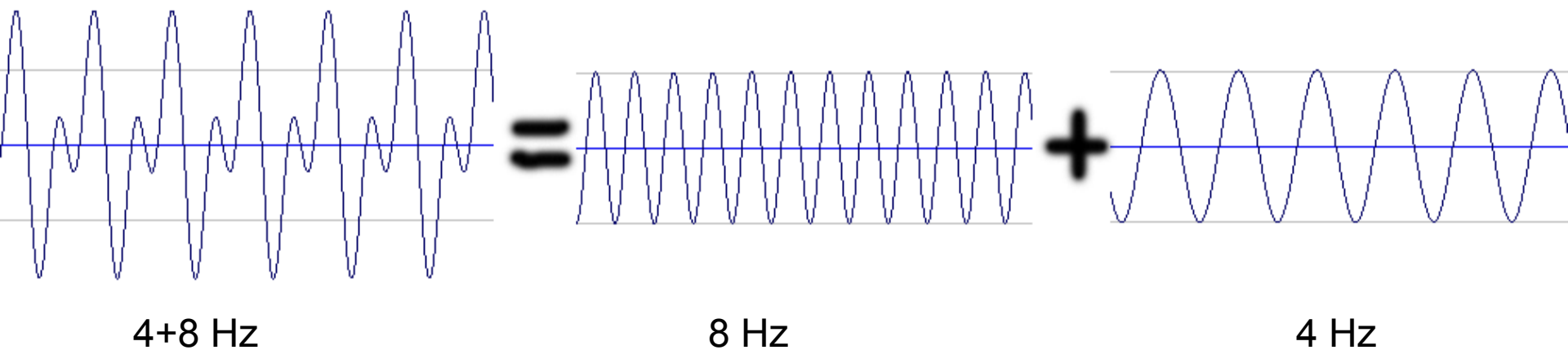


Image showing the cage where H₂S-atmosphere was obtained, the regulation method (air and H₂S flux control and H₂S-concentration detector); 5%-H₂S tanks were used. Food and water were provided in the cage.

Results



ALPHA



8-13 Hz

BETA



>13 Hz

THETA



4-7 Hz

DELTA



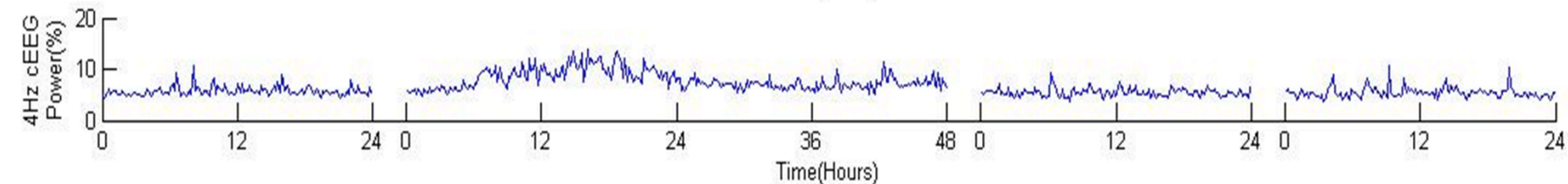
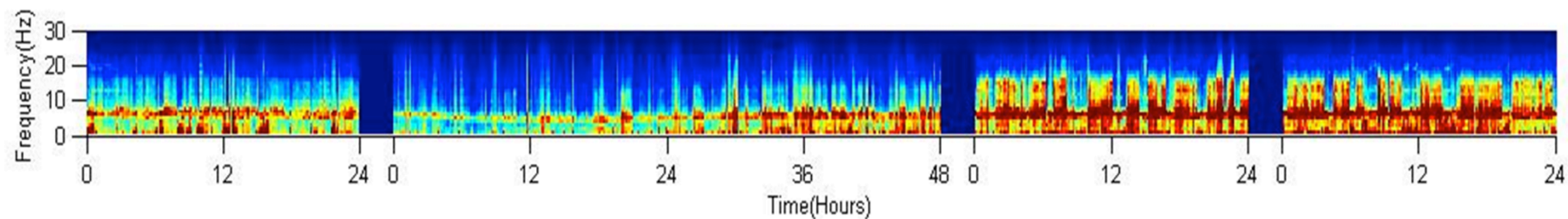
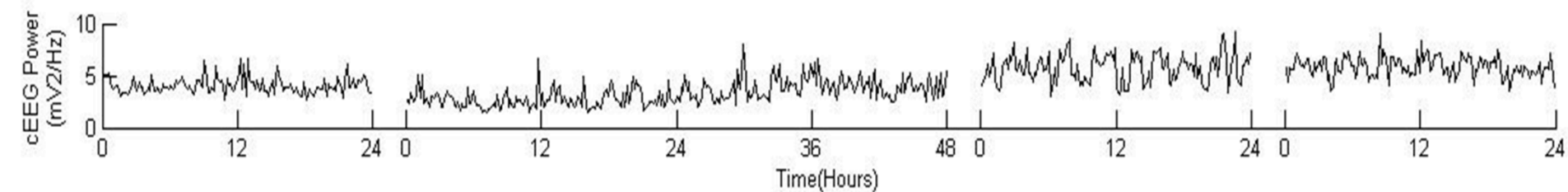
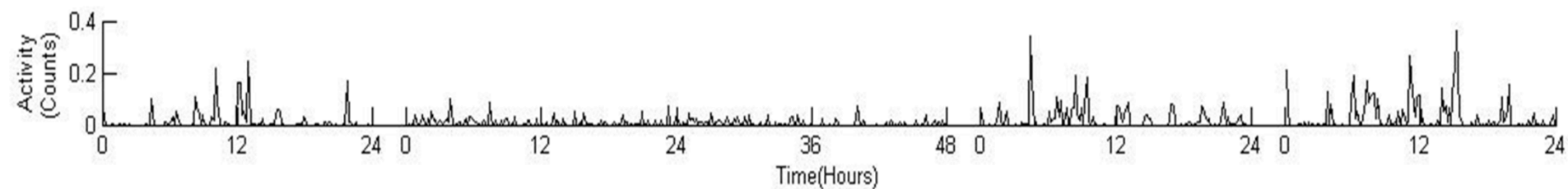
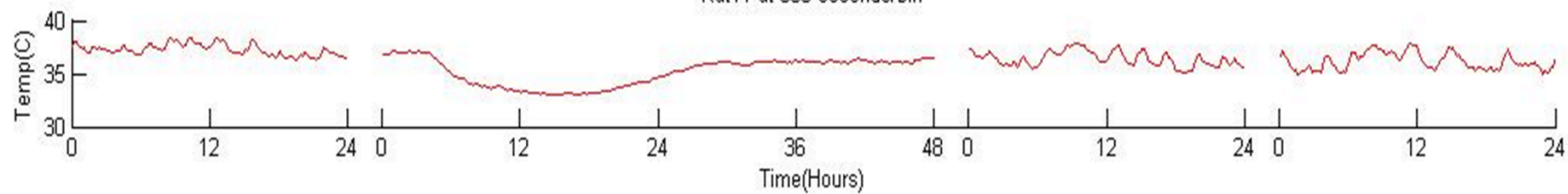
<4 Hz



1 sec



Rat11 at 600 seconds/bin



An overall image of the experiment: 24 hours pre-exposure to H₂S, 48 hours exposure, recovery at 7 days and recovery at 14 days.

Graph. 1 showing the evolution of the body temperature during the course of the experiment.

Graph. 2 showing the activity during the time of the experiment (rat movement)

Graph. 3 showing the total power of the EEG signal during the experiment

Graph. 4 showing a spectral representation of power of EEG relative to signal frequency during the time of the experiment

Graph. 5 showing the evolution of the 4Hz frequency power in the course of the experiment.

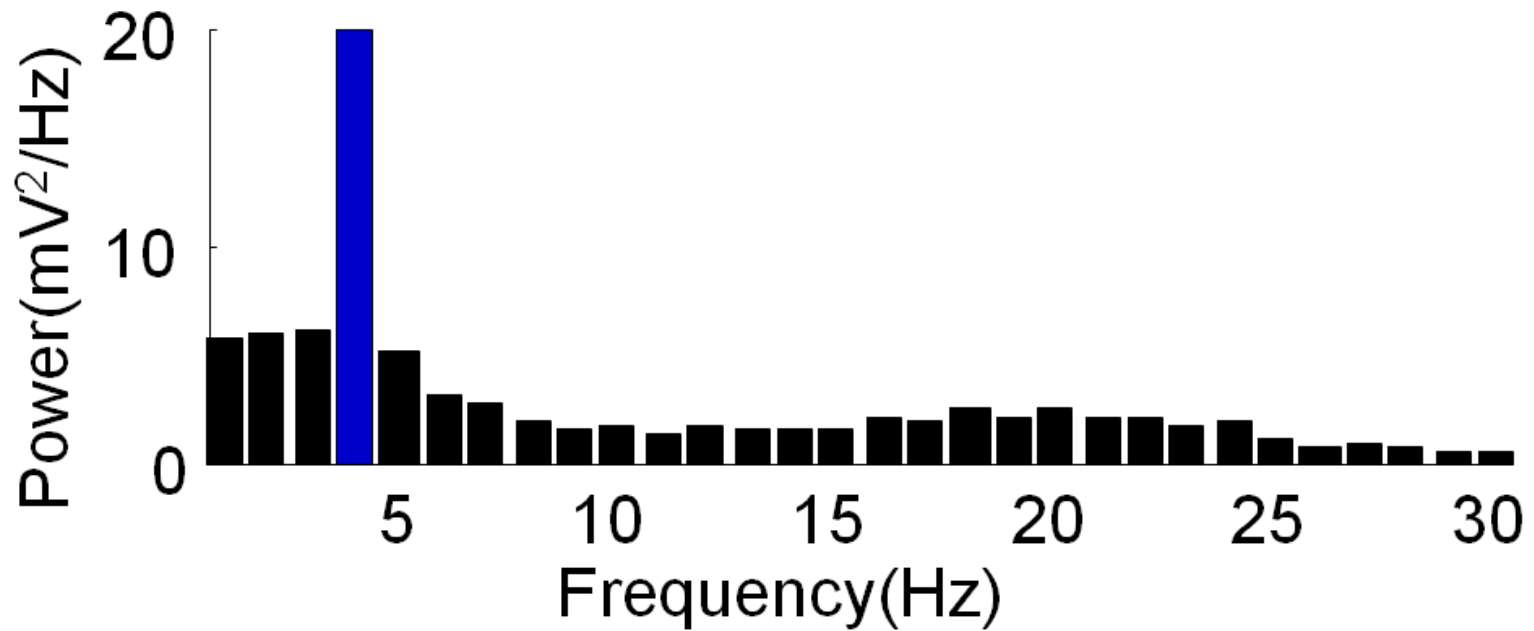


Image showing the dominating frequency (4Hz) in terms of EEG Power during H₂S exposure

Conclusion

Our data suggest that H₂S exposure can be an effective way to transiently power-down electrocortical activity in rodents. If this can be made to work in humans, it could be useful in the emergency management of brain injury and epileptic seizures.

Or...

If one wishes to have a healthy imagination...



NASA and ESA (European Space Agency) are looking for ways to make the trip to Mars easier for humans. Could humans hibernate?



Thanks SOMS!