The stressed rat: out of sight but not out of mind

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Training for MR imaging of awake rodents

From Becerra et al (2010)
### Stress-induced Analgesia
- Follows acute, intense stressor (footshock, swim, restraint, noise...)
- Associated with fear responses
- Mediated by descending modulatory systems
- Opioids, monoamines, cannabinoids, GABA, glutamate...all involved

### Stress-induced Hyperalgesia
- Follows chronic, repeated stressor (footshock, swim, restraint, noise...)
- Associated with anxiety responses
- Mediated by descending modulatory systems
- Opioids, monoamines, cannabinoids, GABA, glutamate...all involved
NON-RESTRAINED
NON-EXPOSED
Day 1
Baseline mechanical sensitivity + baseline thermal sensitivity + CORT

Days 2 + 3
Restraint/treatment (30 mins) + mechanical sensitivity + thermal sensitivity + CORT

Day 4
Restraint/treatment (30 mins) + heat stimulus to paw (4 x 48°C for 36s, 36s ISI) + mechanical sensitivity + thermal sensitivity + CORT

Day 5
Post-treatment mechanical sensitivity + thermal sensitivity + CORT

Experimental timeline
Restrained animals show stress responses...
But so do non-restrained controls

F_{(2,64)}=13.1, p<0.0001

** = versus other groups
### = versus baseline

All mean±SEM
n=9-12
Restrained rats show no difference to controls

### = versus baseline

All mean±SEM

n=9-12
But **non-restrained** rats become hypersensitive

\[ F_{(2,336)} = 36.6, \ p < 0.0001 \]

** = versus other groups

### = versus baseline

All mean ± SEM

n = 9-12
Summary

• Increases in stress hormones and pain behaviors seen in non-restrained control animals
  – These were rats tested in the same room where other rats had previously been restrained
  – Suggests a form of olfactory stress-induced hyperalgesia

• MRI restraint training causes increases in stress hormones but no changes in thermal pain behaviors.
QUESTIONS?

Graffiti courtesy of Banksy