

# The effect of escapable and inescapable stress on perineuronal nets and parvalbumin in the rat medial prefrontal cortex

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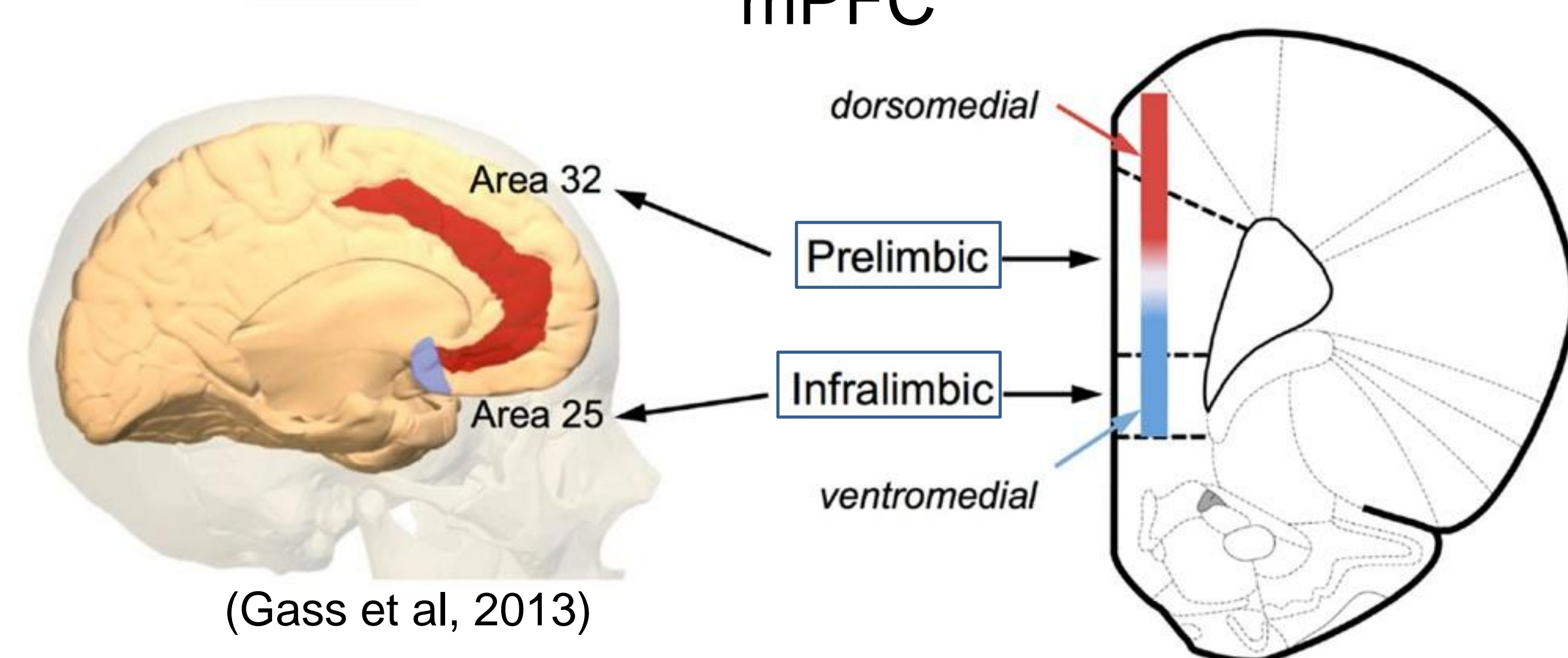
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## Background

- ❖ Anxiety Disorders affect 284 million people and often exist with depression. Current treatments are not very effective (Ritchie et al, 2018).
- ❖ Rats exposed to escapable stress activate the medial prefrontal cortex (mPFC), which blocks development of anxiety-and-depressive like behavior that is present after exposure to inescapable stress (Maier et al, 2006).

Human



(Gass et al, 2013)

- ❖ Parvalbumin interneurons (PV cells) are small brain cells (neurons) that stop nearby neurons from being active.
- ❖ Perineuronal nets (PNNs) surround PV cells to stabilize their connections between other neurons and prevent new connections from forming.

## Hypothesis

Stress alters the staining intensity (amount of protein) in PNNs and PV cells in the mPFC.

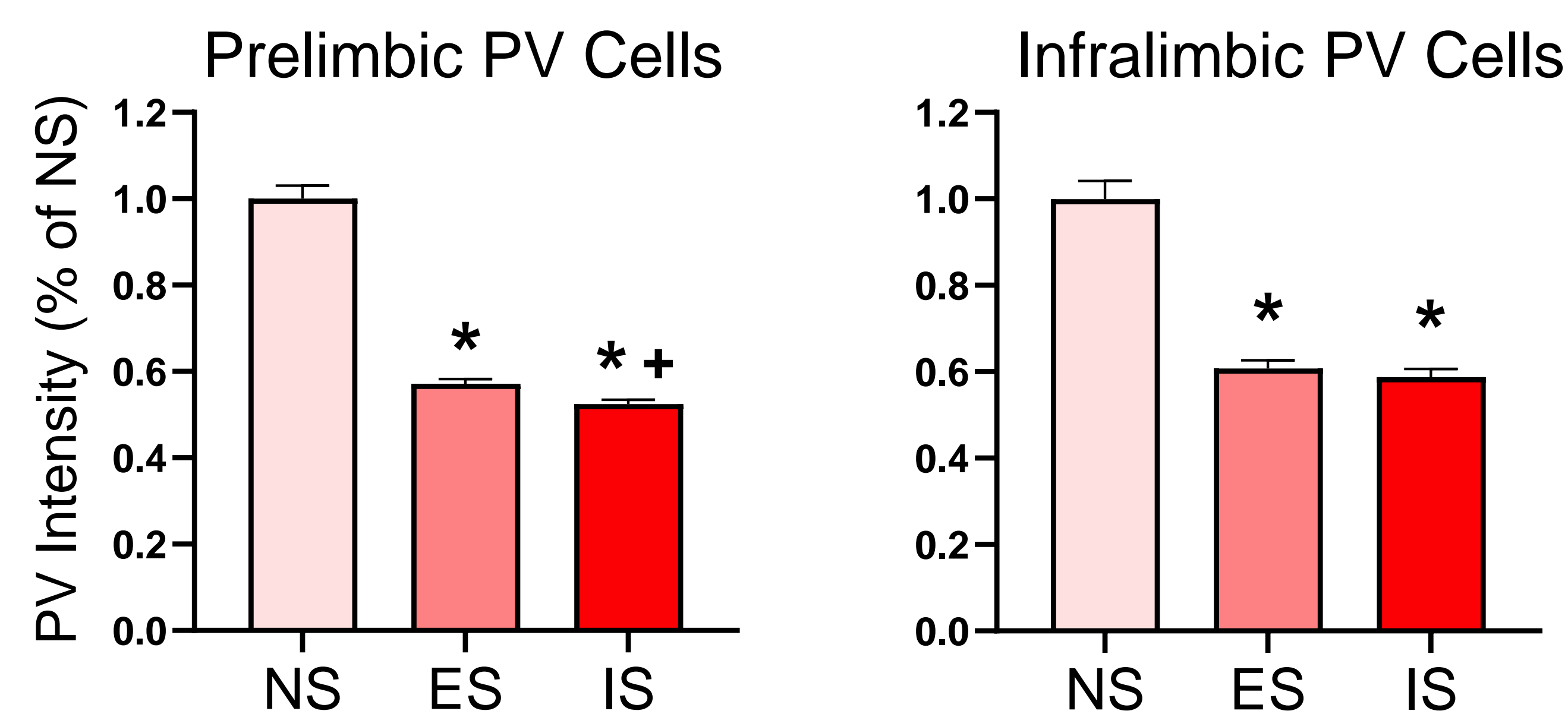
## Methods

3 groups of rats:

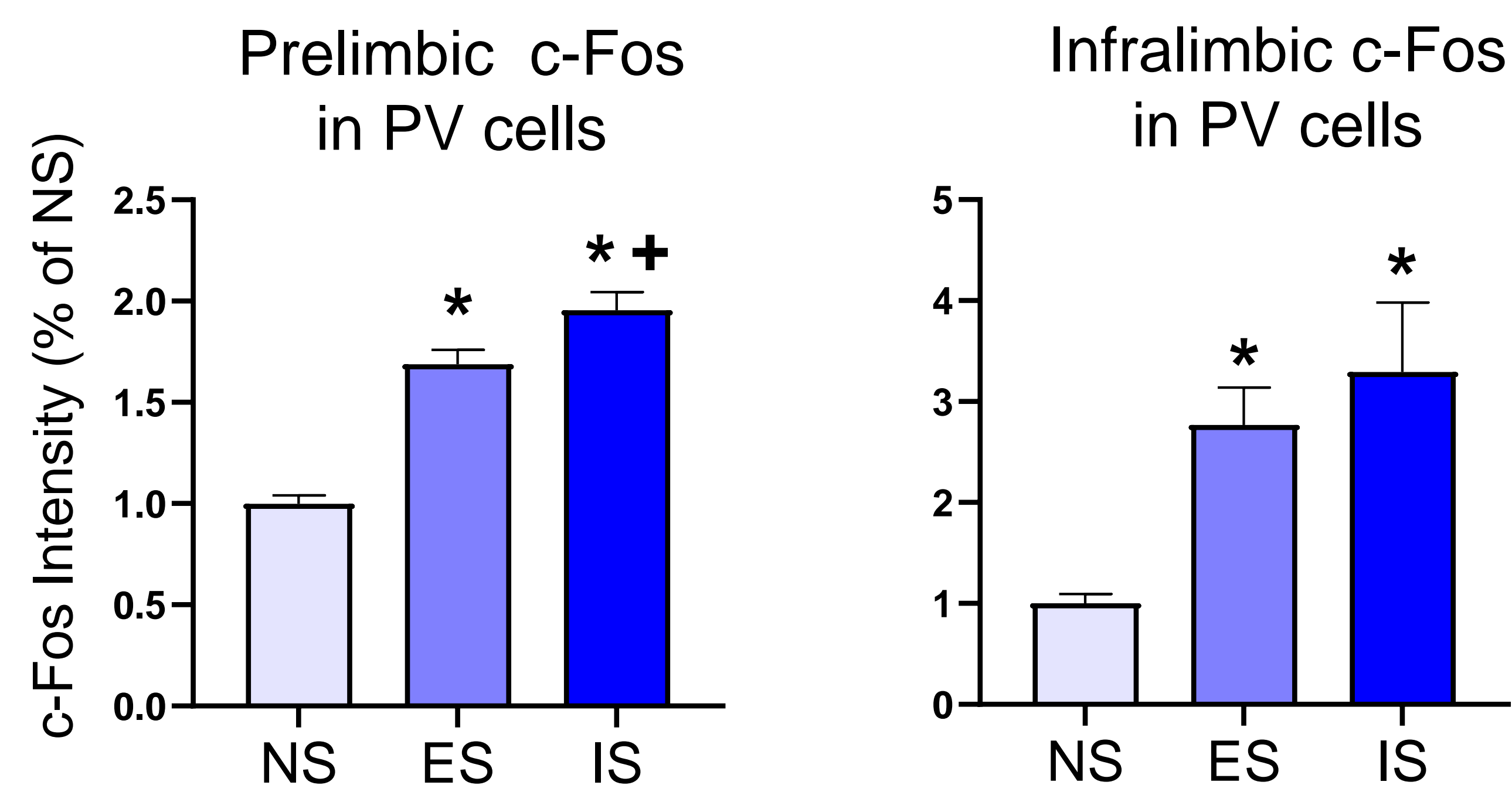
- Escapable stress (ES)-exposed to mild tail shocks (2hr) that could be terminated by spinning a wheel
- Inescapable stress (IS)-exposed to the same mild tail shocks (2hr) but with a wheel with no consequences
- No stress (NS)-stayed in the home cage

- ❖ Brain slices containing mPFC (prelimbic and infralimbic) were stained for PV, PNNs, and c-Fos (protein expressed during neuron activity) using fluorescent tags.

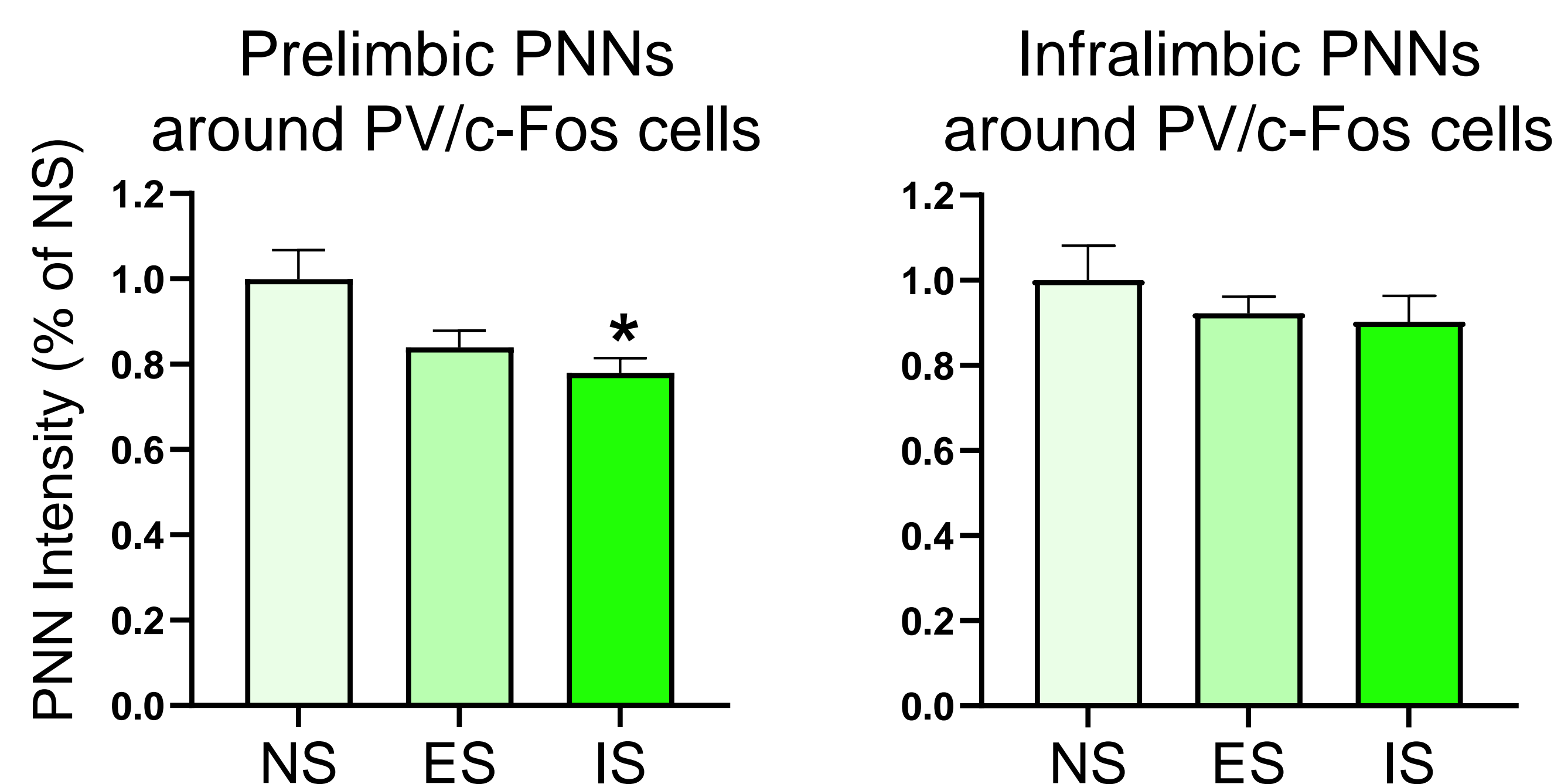
PV staining intensity was lower after stress, but even more in prelimbic after IS.



c-Fos staining intensity was higher after stress in PV cells, but even more in prelimbic after IS.



PNN staining intensity was lower only in prelimbic after IS.



## Conclusions

- ❖ The effects of stress are more exaggerated in the prelimbic region of mPFC.
- ❖ PV staining intensity decreases slightly more after IS. PV protects PV cells from over-firing so less PV may mean that PV cells are more active.
- ❖ Exposure to IS leads to a higher increase of c-Fos in PV cells than exposure to ES. Higher c-Fos indicates higher activity.
- ❖ There is less PNN staining intensity after IS in triple stained cells. Less PNNs could support the creation of new connections between PV cells.

The results suggest that rats exposed to inescapable stress may be susceptible to developing anxiety-and-depressive like behavior because of the increased strength of inhibition in their brain. Therefore, the inhibitory circuitry in the brain can serve as a target for the development of effective therapies for anxiety disorders.

## Future Directions

- ❖ Examine connections onto PV cells in mPFC from regions responsible for anxiety-and-depressive like behavior in rats
- ❖ Directly explore effect of high PV cell activity on the protein PV

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## References

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