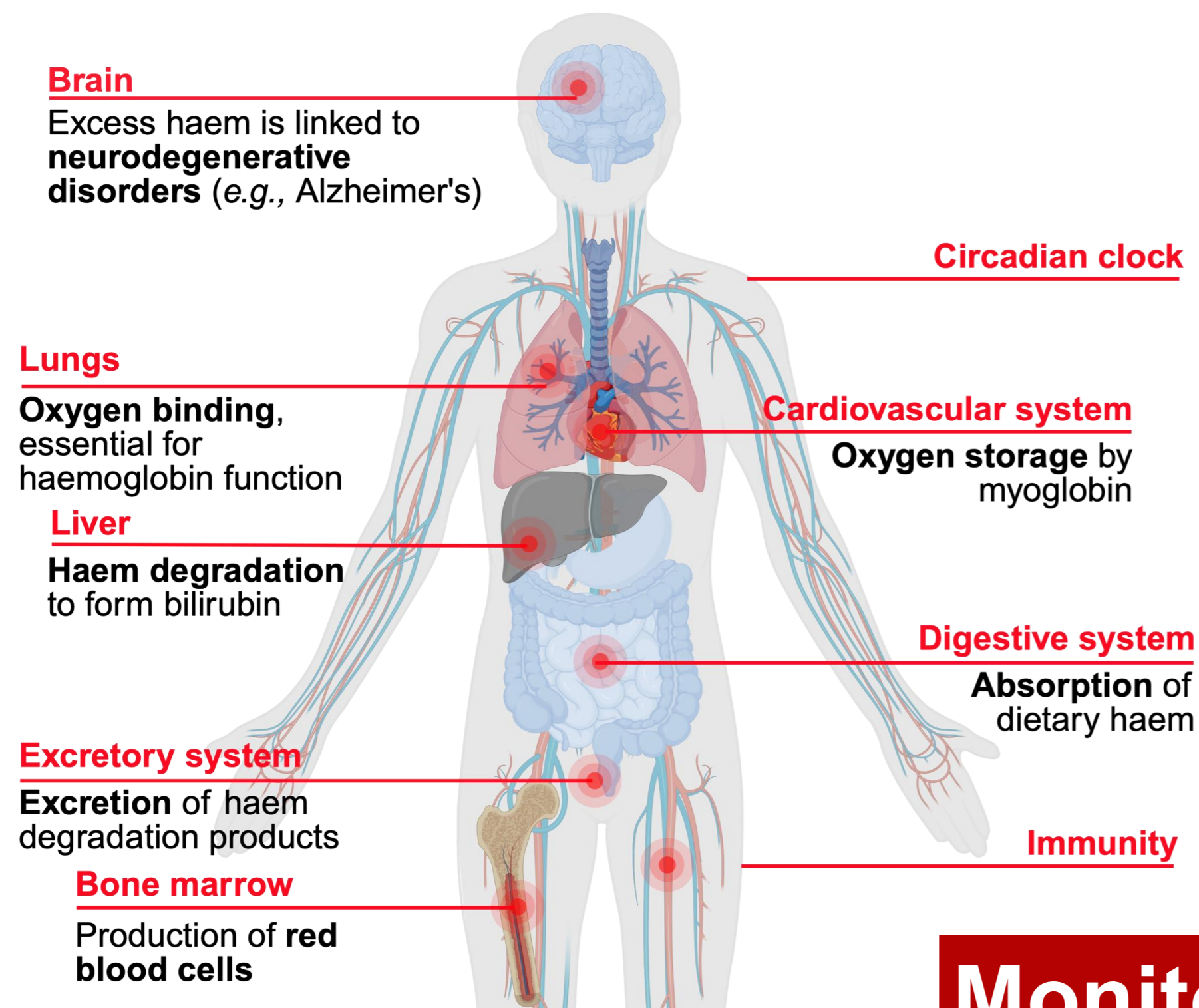


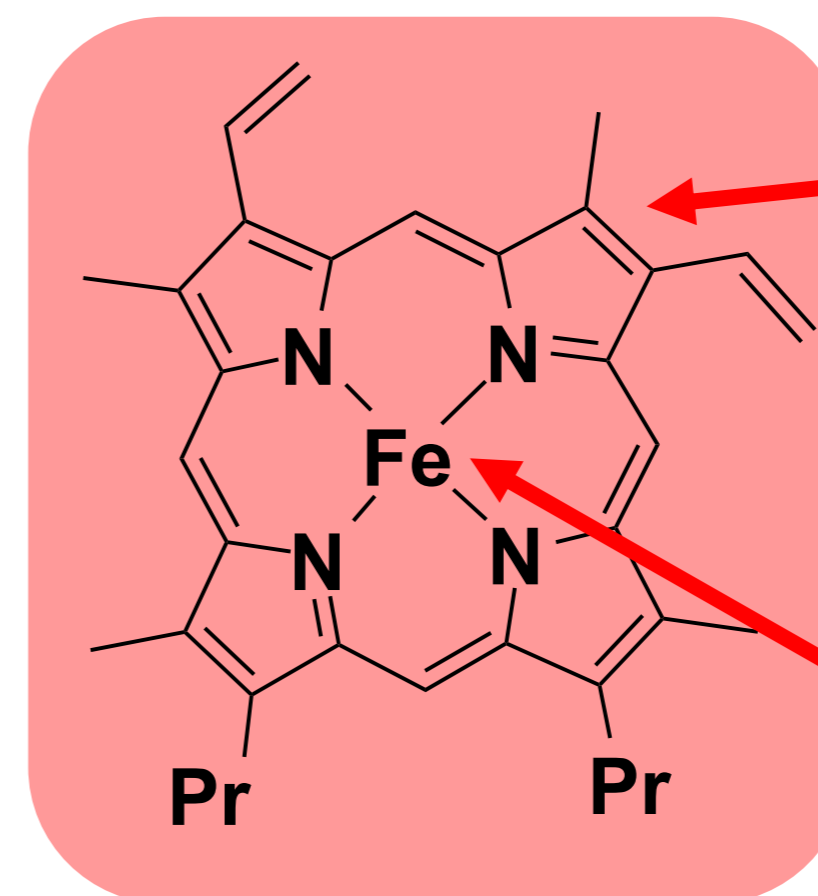
Noa A. Marson, Andrea E. Gallio, Hannah C. Wilson, Andrew Hudson, and Emma L. Raven

## Background

- **Haem** is an **iron-containing** molecule that is **vital** in biological processes across the body, for example by enabling the protein **haemoglobin** to carry oxygen.
  - However, molecular properties of haem make it **potentially toxic** when its levels are too high.
  - This means that haem **levels must be fine-tuned** in our cells so that it can carry out its essential functions, **without causing damage**.



## THE STRUCTURE OF HAEM

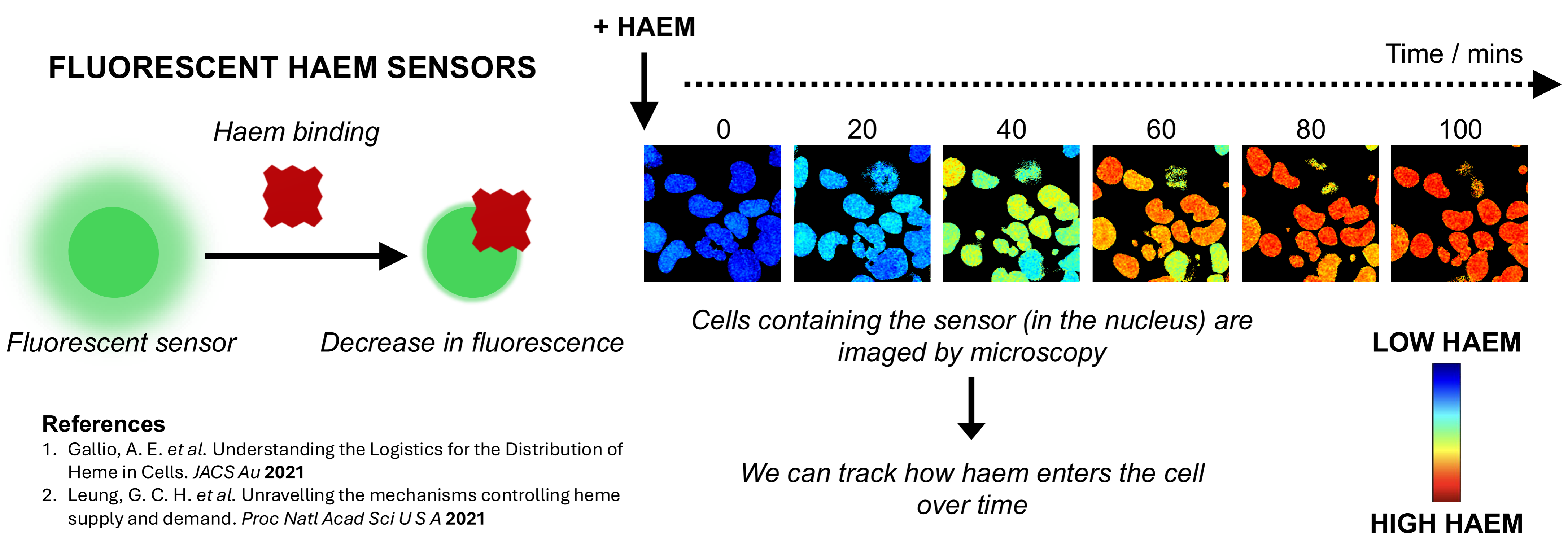


Haem is **not very soluble**, which can cause damage to cells.

**Iron** at the centre of the molecule can lead to the formation of reactive oxygen species, which are harmful by-products that can damage cells.

## Monitoring Haem

- There are mechanisms for breaking down excess haem, but **how haem is moved around cells** to perform its essential functions is not clear.
- We can use **fluorescent protein sensors** that change their fluorescence when haem binds to them.
  - By measuring this change in fluorescence, we can **monitor haem in real-time** and observe its movements.



### References

1. Gallio, A. E. *et al.* Understanding the Logistics for the Distribution of Heme in Cells. *JACS Au* **2021**
2. Leung, G. C. H. *et al.* Unravelling the mechanisms controlling heme supply and demand. *Proc Natl Acad Sci USA* **2021**
3. Gallio, A. E.; Marson, N. A., *et al.* An extended network for regulation of heme homeostasis in cells. *Proc Natl Acad Sci USA* **2025**

## In Summary

- Haem is a **vital but potentially toxic** molecule that must be tightly controlled.
  - Fluorescent sensors can **monitor haem levels** to inform how haem is regulated in the body.
  - This can inform **therapeutic interventions** of diseases connected to unbalanced haem levels, for example, the porphyrias (group of genetic diseases), and inflammatory, metabolic, and liver diseases.