

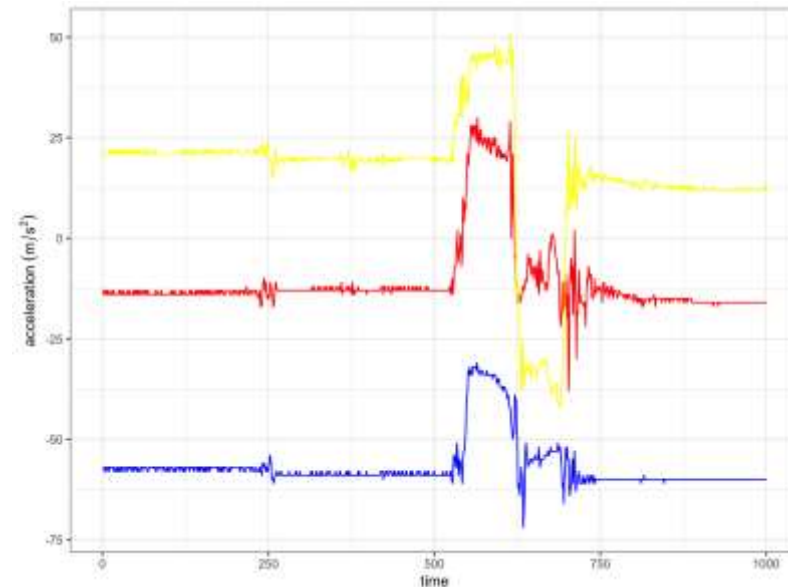
# Understanding circadian rhythms using accelerometer data

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# Accelerometers

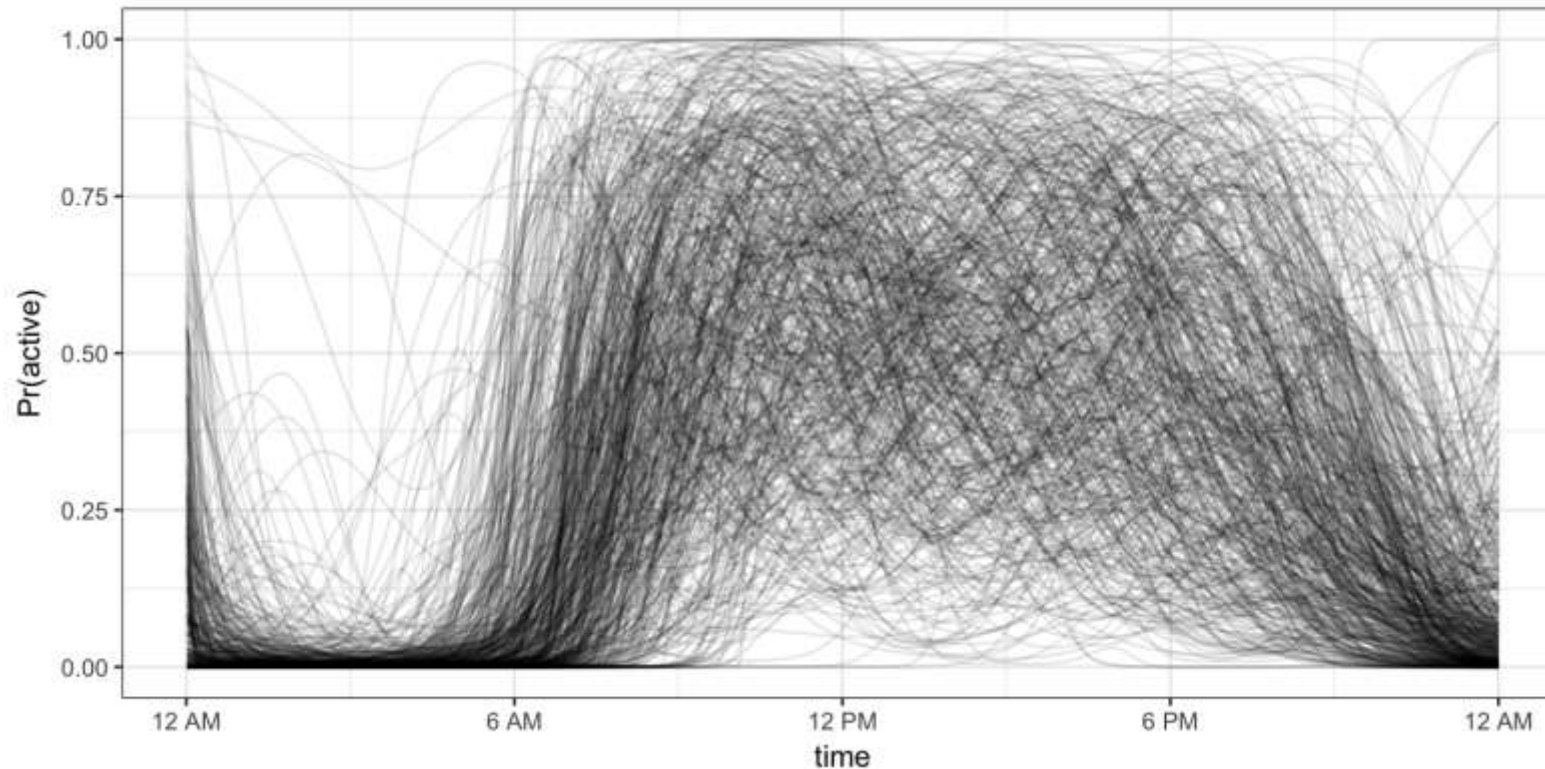
- Physical activity is key to many epidemiological questions
- Active individuals tend to live longer and healthier lives



- Acceleration data from 3 axes is aggregated into activity intensity

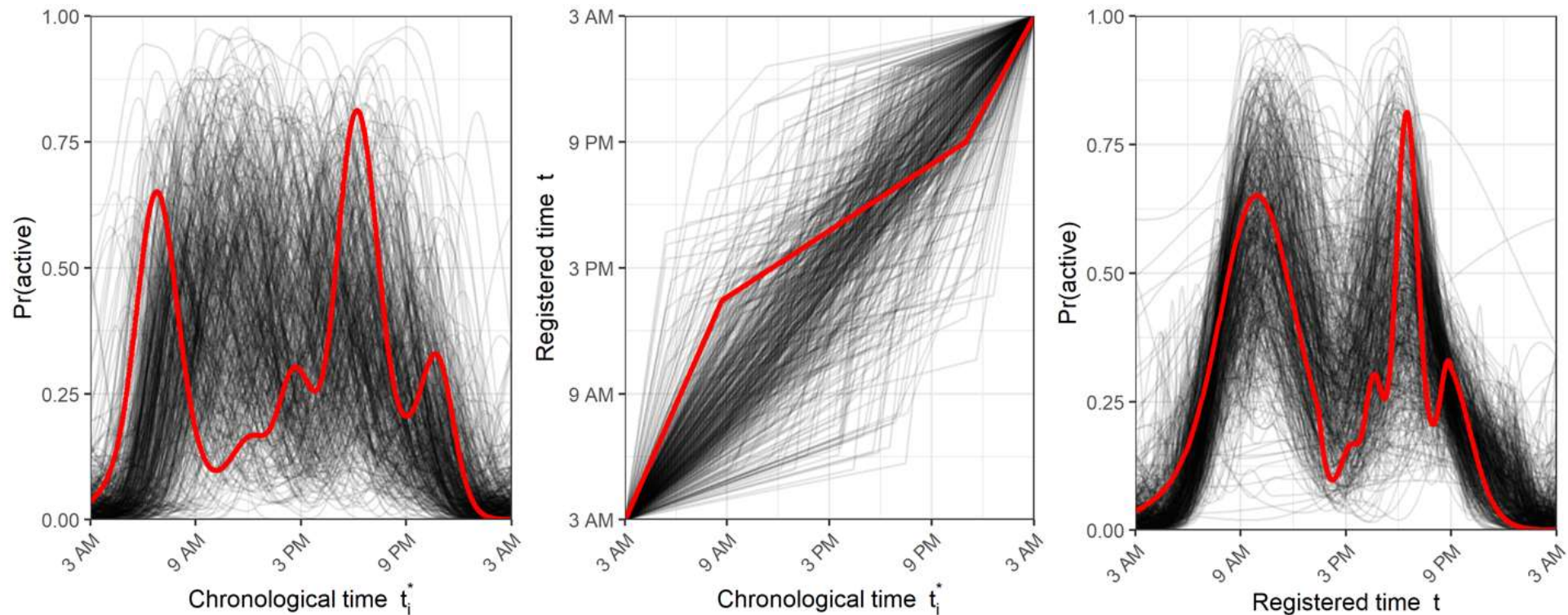
# Activity probability curves for 591 subjects

- **Time variation:** subjects start and end the day at different times
- **Activity level variation:** people have higher or lower levels of activity



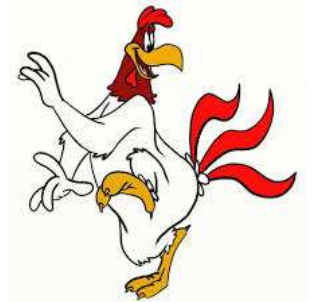
# Registration aligns activity curves

- Separates accelerometer data into time variation and activity level variation
- Features like waking, sleep onset, and midday dip are aligned



## Using registr to understand human chronotypes

- Chronotypes are phenotypes of circadian rhythms
  - Associated with obesity, cardiovascular disease, mood disorders
- Time and activity variability embed different behavioral patterns
  - Warping functions: diurnal chronotypes
  - Registered accelerometer profiles: activity chronotypes





# Thanks!

## Contact Info

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J. Wrobel, V. Zipunnikov, J. Schrack, and J. Goldsmith (2018). Registration for exponential family functional data. *Biometrics*.

J. Wrobel (2018). registr: Registration for exponential family functional data. *Journal of Open Source Software*. 3.