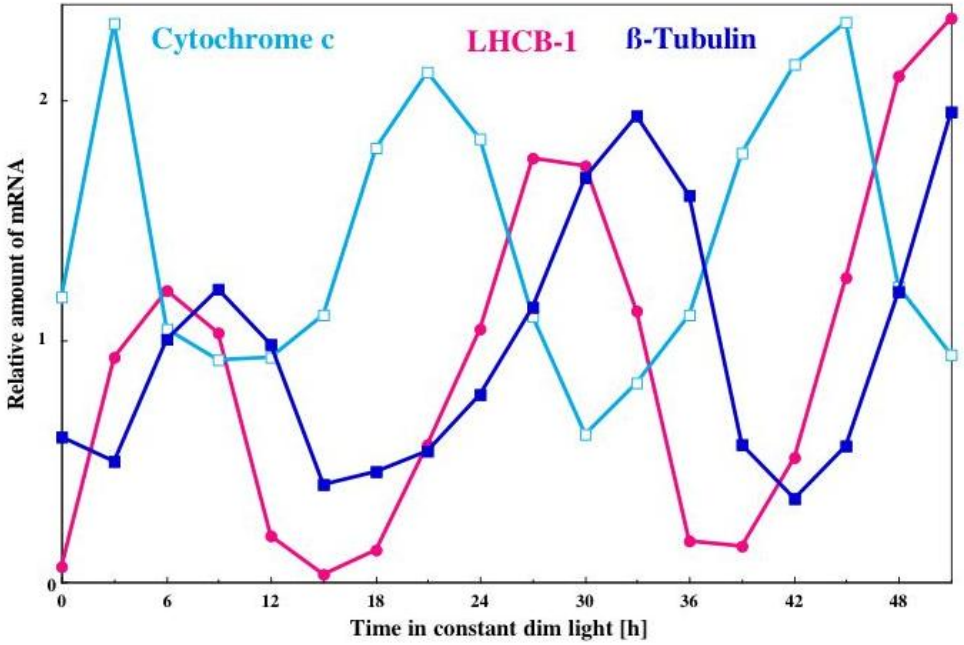
Dr. Sigrid Jacobshagen
Department of Biology

- First Project: Circadian Clock-Controlled Gene Expression in the Green Alga *Chlamydomonas reinhardtii*



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- Mathematical approach to model rhythm of gene expression in collaboration with Dr. Bruce Kessler and Dr. Claire Rinehart.
  - Solvable differential equation:

$$R(t) = 2^{-\frac{t}{h}}k + \frac{ha_0}{\ln 2}\left(1 - 2^{-\frac{t}{h}}\right) + \frac{2^{-\frac{t}{h}}hp\left(-pa_1 \ln 2 + 2h\pi b_1\right)}{4h^2\pi^2 + p^2(\ln 2)^2}$$
$$+ \frac{hp}{\sqrt{4h^2\pi^2 + p^2(\ln 2)^2}}\left[a_1 \cos\left(\frac{2\pi}{p}t - \tan^{-1}\left(\frac{2h\pi}{p\ln 2}\right)\right) + b_1 \sin\left(\frac{2\pi}{p}t - \tan^{-1}\left(\frac{2h\pi}{p\ln 2}\right)\right)\right].$$

  - Phase difference between transcription and mRNA amount rhythm determined by: $\frac{p}{2\pi}\tan^{-1}\left(\frac{2h\pi}{p\ln 2}\right)$
    - as h (the mRNA half-life) goes towards zero, the difference in phase goes towards zero
    - as h goes towards infinity, the difference in phase goes towards p (period)/4
  - Amplitude difference determined by: $\frac{hp}{\sqrt{4h^2\pi^2 + p^2(\ln 2)^2}}$

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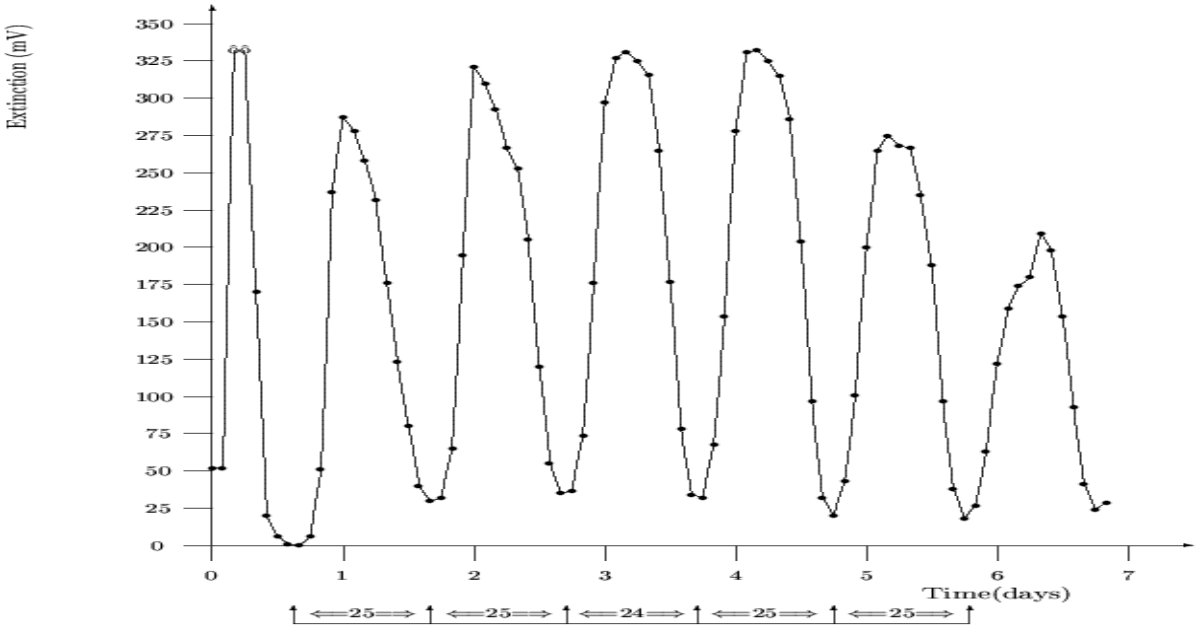
- Second Project: Automated monitoring of circadian rhythm of phototaxis.

  The goal is to get an accurate estimate of the rhythm's period and phase.



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- Mathematical fit by
  Dr. Bruce Kessler and
  Dr. Claire Rinehart

Channel	Period	Phase
1	25.33	0.198
2	25.27	0.068
3	25.41	0.060