Birth-death processes [nln18]

Specification:

- Birth rates: typically proportional to population present.
- Death rates: typically proportional to population present, may be enhanced due to self-inflicted stress.
- Interaction rates: typically proportional to products of populations, with positive sign if impact is favorable and negative sign if impact is unfavorable.

Models for population dynamics:

- particles diffusing through walls,
- particles undergoing radioactive decay,
- molecules undergoing chemical reactions,
- organisms multiplying and dying,
- host-parasite interaction,
- predator-prey interaction,
- animals subject to environmental stress

Levels of description:

- Deterministic time evolution.
  Description via differential equations.
  Contingency encoded in initial conditions.
- Probabilistic time evolution without memory.
  Description via master equation.
  Contingency encoded in initial conditions and in time evolution.
- Probabilistic time evolution with memory.
  Incorporation of learning, heredity, adaptation.
  Contingency encoded in initial conditions, in time evolution, and in rules that govern time evolution.

The future is open to a higher degree in each successive level of description.