# Genetic Code of Spectral Densities [nln98]

Justification of biological term used for analogy:

- Spectral densities, structure functions, dissipation functions, and Green's functions for any given classical or quantum many-body system and any choice of dynamical variable are related to each other by rigorous relations (see [nln39] and nln88]).
- The (symmetric) spectral density is fully characterized by a $\Delta_k$-sequence of continued-fraction coefficients [nln84].
- The recursion method presents a user-friendly and systematic way to calculate coefficients $\Delta_k$ sequentially, either directly (Liouvillian representation [nln83]) or indirectly (Hamiltonian representation [nln91]).
- Hence the $\Delta_k$-sequence is a genetic code of sorts: (i) it is a *code* of retrievable information about key features of spectral densities as listed below; (ii) it is *generative* in nature in the sense that it can be used to produce spectral densities with these very features in conjunction with specific termination schems of continued fractions.

Features of spectral densities that can be identified in $\Delta_k$-sequences (incomplete list):

- Position and intensity of individual spectral lines [nln99].
- Bandwidth of spectral densities with compact support [nln100].
- Band-edge singularity of spectral densities with compact support [nln100].
- Infrared singularity of spectral density with compact support [nln100].
- Bandwidth and gap size of spectral densities with bounded support [nln101].
- Infrared singularity of spectral densities with unbounded support [nln102].
- Large-$\omega$ asymptotics of spectral densities with unbounded support [nln102].
- Gap size of spectral densites with unbounded support [nln103].