# Emergence of Order in Quantum-Mechanical Evolution

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We study evolution equations which model selection and mutation within the framework of quantum mechanics. The main question is to what extent order is achieved for an ensemble of typical systems. As an indicator for mixing or purification, a quadratic entropy is used, which assumes values between zero, for pure states, and $(d-1)/d$, for fully mixed states. Here, $d$ is the dimension. Whereas the classical counterpart, the quasi-species dynamics, has previously been found to be predominantly mixing, the quantum quasi-species (QS) evolution surprisingly is found to be strictly purifying for all dimensions. This is also typically true for an alternative formulation (AQS) of this quantum mechanical flow. We compare this also to analogous results for the Lindblad evolution. Although the latter may be viewed as a simple linear superposition of the purifying QS and AQS evolutions, it is found to be predominantly mixing. The reason for this behavior may be explained by the fact that the two subprocesses by themselves converge to different pure states, such that the combined process is mixing. These results apply also to high-dimensional systems.