Abstract – This year is the centennial of the discovery of superconductivity and the 25th anniversary of the discovery of high- \( T_c \) superconductors (HTS). Though we still do not fully understand how HTS work, the basic rules of design can be determined from studying their systematics. We know what to do to increase \( T_c \) and, more importantly, what to do to increase critical current density \( J_c \). This in turn lays down a challenge for the chemist. Can the ideal design be synthesized? More importantly, what are the limits? Can one make a room-temperature superconductor? In fact fluctuations place strict constraints on this objective and provide important guidelines for the design of the ideal superconductor.

Keywords – high-temperature superconductor, rare-earth cuprate, room-temperature superconductivity