the electronic transparency of single molecules whose configuration approaches the planar wiring configuration encountered in semiconductor devices. Coulomb blockade work on molecule **7** (Fig. 1a), for example, used a tunnel-capacitor model for the metal–molecule–cluster STM junction used to estimate a tunnelling resistance *R* from the experimental data and extract the corresponding transparency *T*, yielding $R = 9\,\mathrm{M\Omega}$ and $T = 1.4 \times 10^{-3}$ (ref. 16). The 'nanopore' technique consists of fabricating holes of very small diameter in a suspended silicon nitride membrane equipped with a metallic electrode in its base. The pores are then filled with molecules and a second metallic electrode is evaporated on top of the device[17]. For molecule **8**, Fig. 1a, nonlinear two-terminal *I–V* characteristics were recorded, and $R = 150\,\mathrm{M\Omega}$ was estimated at low voltage[17]. Break junctions involve the gentle fracture of a microfabricated electrode in its centre by mechanical deformation while measuring the resistance of the metallic wire junction[23]. Its application to single molecules is difficult because a liquid evaporation step is required after formation of the junction, and the

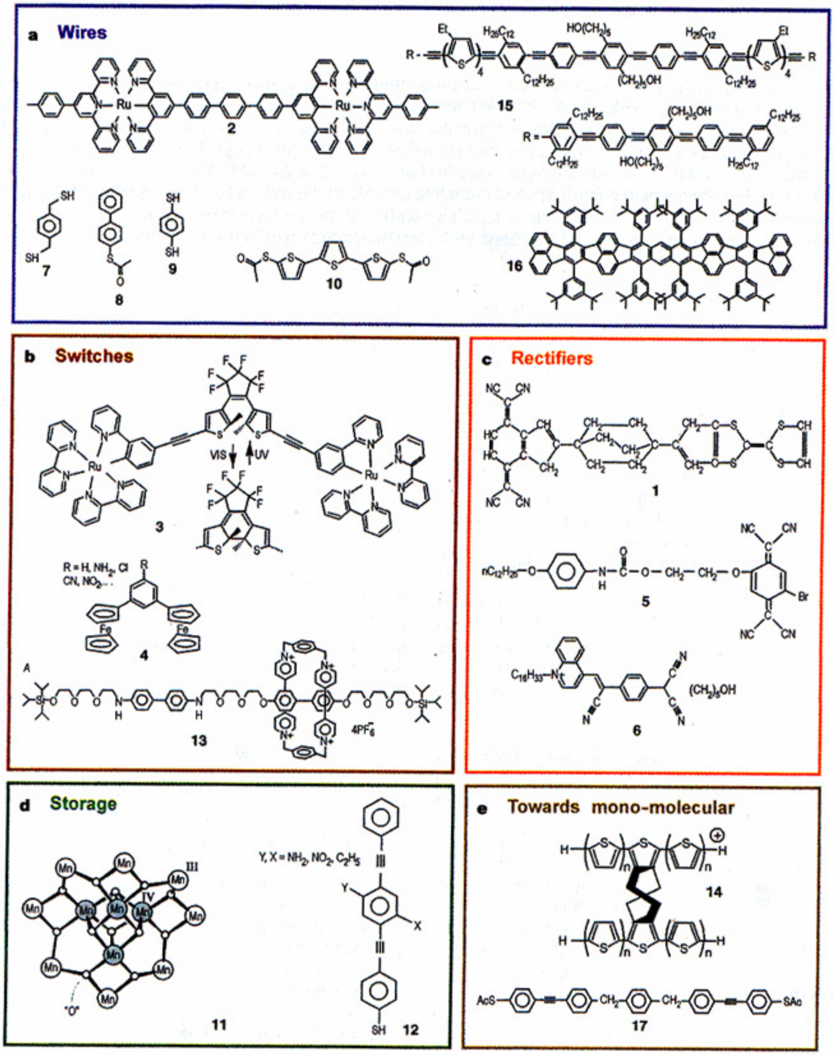

Figure 1 The molecules described in the text. **a**, Wires; **b**, hybrid molecular electronic (HME) switches; **c**, HME rectifiers; **d**, storage; and **e**, two molecules that show promise for mono-molecular electronics. Only the manganese acetate molecule **11** of formula $(Mn_{12}O_{12}(CH_3COO)_{16}(H_2O)_4$ is not completely represented, for clarity[48]. All these molecules have been synthesized apart from the historical design **1** of a d–s–a molecular rectifier[1]. Molecules **14** and **15** have not yet been characterized. **14** is the first proposal of an intramolecular transistor and **17** is an intramolecular quantum well.