Decades ago concrete protocols were proposed to perform remarkable tasks, including breaking widely-used encryption, generating unbreakable codes, and rapidly searching huge databases. However, to achieve these goals new types of devices are required, relying on physical components with coherent quantum-mechanical properties that would persist for nearly unimaginably long times. Solid-state systems appear an unlikely terrain to find such materials, as electrons usually experience dramatic and frequent scattering that rapidly dissipates any memory the electron had of its quantum state. Over the past fifteen years, however, remarkable examples of room-temperature quantum coherent behavior have been identified in condensed matter electronic systems, often involving spin coherence. Predicting the behavior of these spin coherent systems requires integrating theoretical techniques to cope with energy scales ranging from far smaller than the thermal energy to far larger. I will describe some examples of relevant materials and devices for quantum coherent technologies and identify some of the features they share.