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Neutron stars have long been suspected to contain some form of strangeness in their interiors. Matter containing hyperons, or kaons or deconfined quark matter can have lower energy than neutron-rich matter at supranuclear density. I will briefly review models of dense matter where a phase transition to matter strangeness is favored. If strangeness were to occur inside neutron stars it can dramatically change both the structure, cooling and transport properties of the compact object. These changes influence observable aspects of neutron stars. I will review observable phenomena that have the potential to directly probe the composition of the interior. While these observations can provide insights about the existence of new forms of matter inside neutron stars, we need to improve theoretical models of dense matter ad neutron star evolution to properly interpret the current suite of neutron star observations. I will outline a few areas where we can anticipate progress in the near future.