The evolution of the radial metallicity gradient in the Milky Way disk can be studied with resolved stars of different ages. Due to the challenges associated with direct measurements, previous work has generally used spectral classes of stars that coarsely trace young, old, and intermediate-aged populations (e.g. OB stars, Cepheid variables, open clusters, planetary nebulae). In recent years, the application of machine learning algorithms to spectroscopic surveys has improved the landscape, enabling the construction of large samples of star-by-star age estimates. In this talk, I will present measurements with these new catalogs. Surprisingly, both the slope and normalization of the metallicity-radius relation exhibit little to no evolution up to ages as old as ~9 Gyr. This realization motivates construction of the so-called "equilibrium model." The defining feature of this model is that abundances in the interstellar medium are nearly time-independent after the first few Gyr of disk formation but vary with Galactocentric radius. This prediction arises most readily when the observed gradient tracks a decline in the equilibrium metallicity with radius, which in turn tracks a decline in the ratio of star formation per unit accretion. This scenario requires the inclusion of mass loaded outflows, radial gas flows, or some combination thereof in models of Galactic chemical evolution. The equilibrium model opens new avenues for empirically testing metal yields predicted by stellar evolution models and suggests that metallicity gradients are disconnected from the inside-out growth of disk galaxies.