Beatrice Hill was born in England in 1941 and came to New Zealand with her family after the Second World War. She was educated at New Plymouth Girls' High School, where she soon showed signs of academic brilliance. Studying science at the University of Canterbury, she met and married fellow student and physicist Brian Tinsley in 1961. In 1963 they moved to the United States to study at research centres in Dallas (Brian) and Austin (Beatrice). Beatrice Tinsley's PhD thesis on cosmology, completed in 1966, was hailed as 'extraordinary and profound', setting out two major discoveries: that the universe had billions of galaxies, and that these were receding from each other.

The Tinsleys adopted two children and Beatrice cared for them while continuing to research and write academic papers. But her powerful need to contribute fully to her scientific field led to her divorcing her husband and leaving the children with him. She became a full-time astrophysicist and cosmologist at Yale University, where she was appointed professor in 1978. That year she was diagnosed with melanoma and she died in 1981, aged just 40. After her death the American Astronomical Association established the Beatrice M. Tinsley Medal to be awarded for outstanding research in astronomy and astrophysics.