# This Week's Citation Classic

**Iben I, Jr.** *Stellar evolution within and off the main sequence.*
*Annu. Rev. Astron. Astrophys.* 5:571-626, 1967.
[Massachusetts Institute of Technology, Cambridge, MA]

**This paper discusses the evolution of stars from one-fourth to 15 times the sun's mass, beginning with the approach to the main sequence and continuing through all core hydrogen and core helium burning phases. It describes the physical processes occurring in the stellar interior and relates these to changes in external, observable features. [The *SCI*® indicates that this paper has been cited over 345 times since 1967.]**

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"After having spent three years teaching undergraduate physics at Williams College in Massachusetts, in 1961 I made (with my wife and four children) a long but tremendously exciting trip to the California Institute of Technology, where I joined a group being formed by William A. Fowler to study nucleosynthesis in stars. My job was to make stars using the computational facilities at the Jet Propulsion Laboratory. Fowler didn't know that I had never used a digital computer before and that my entire computing experience consisted of trying to construct a main-sequence star during a two-week Christmas 'holiday,' using a mechanical hand-crank desk calculator. I had, however, spent two of my three years at Williams College reading Martin Schwarzschild's book on stellar evolution[1] and teaching myself something about the physics of the stellar interior.

"After three years at Caltech, I proceeded (with my wife and four children) to the Massachusetts Institute of Technology with a large number of boxes containing computer paper accumulated in following the evolution of ten stellar models. Three years further down the road, I had published six papers which described the properties of the individual models fairly exhaustively. The *Annual Review of Astronomy and Astrophysics* article was an opportunity to explore these properties more extensively and with greater perspective, establishing mass-dependent trends and relating theoretical model properties to observed properties of real stars. I suspect that the review and the papers on which it was based have been cited relatively frequently in part because they place such a strong emphasis on understanding the relationship between interior and observed properties.

"I have continued to study stellar evolution through more and more advanced stages, using ever larger and faster computers in order to do so. The paper[2] of which I am most proud is the result of research accomplished at the University of Illinois (where I live with my wife and enjoy visits from our children). It demonstrates that, after an intermediate mass star develops an electron-degenerate core of carbon and oxygen and begins to pulse thermally, the carbon, helium, and *s*-process isotopes produced in the helium-burning convective shell during a pulse are brought to the surface, where they may be seen and, thanks to mass loss from the surface, contribute to the enrichment of the interstellar medium. At the University of Illinois, the pleasant diversion of explaining stellar evolution to myself and others by way of reviews has also continued."[3,4]

1. **Schwarzschild M.** *Structure and evolution of the stars.* Princeton, NJ: Princeton University Press, 1958. 296 p.
2. **Iben I, Jr.** Thermal pulses; *p*-capture, *α*-capture, *s*-process nucleosynthesis; and convective mixing in a star of intermediate mass. *Astrophysical J.* 196:525-47, 1975.
[The *SCI* indicates that this paper has been cited over 150 times since 1975.]
3. ----------. Post main sequence evolution of single stars. *Annu. Rev. Astron. Astrophys.* 12:215-56, 1974.
4. **Iben I, Jr. & Renzini A.** Evolution of single stars with emphasis on the asymptotic giant branch phase of evolution—current status of the theory and comparison with the observations. *Annu. Rev. Astron. Astrophys.* In press, 1982.