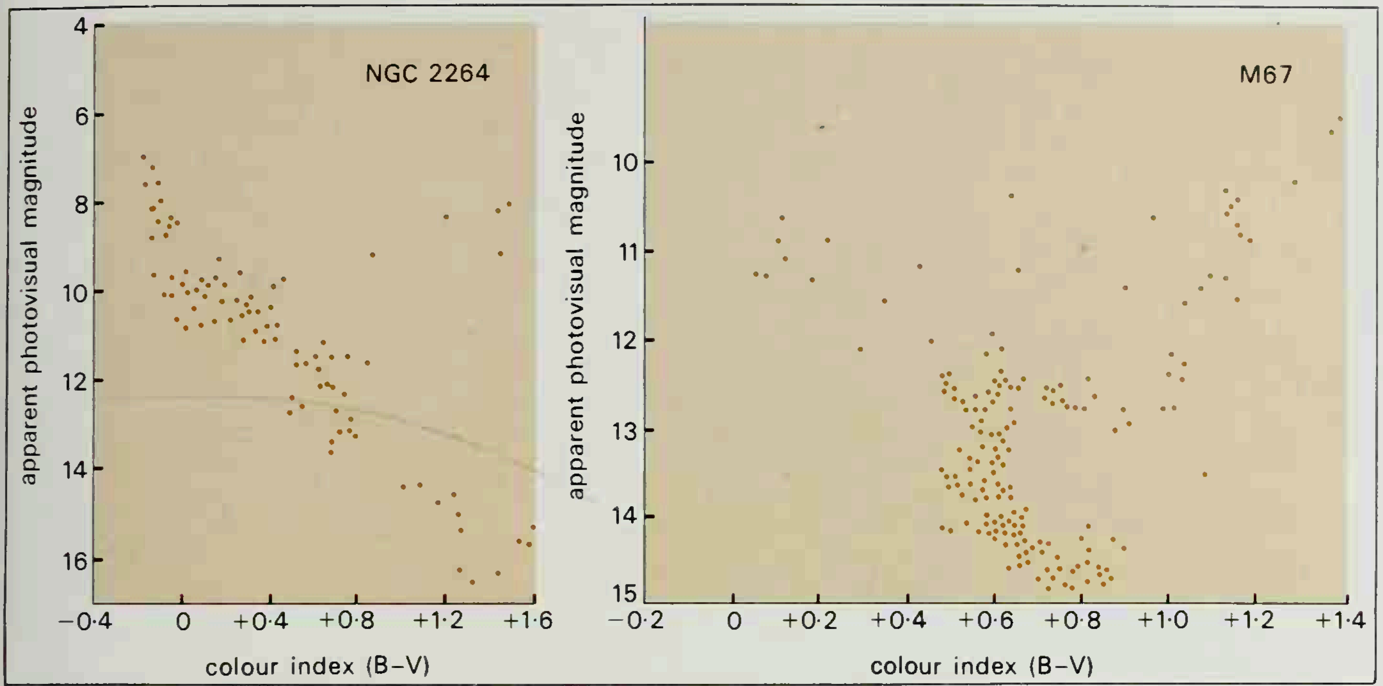

Fig. 6·4 Hertzsprung-Russell diagrams for two open clusters of different ages. NGC 2264 is a young cluster: very few stars have evolved off the Main Sequence. On the other hand, M 67 contains several stars which have by now reached their red giant phase.

majority of them lying within 2 kpc of the Sun. At distances greater than this, they blend into the stellar background, but it has been estimated that the Galaxy may contain in excess of 10^4 such clusters. Most are small, with diameters of about 2 pc and a membership of about 100 stars, but the larger clusters (such as Praesepe, or h and χ Persei) may contain several hundred stars in a region 10–15 pc across. These clusters play a major role in furthering our knowledge of stellar evolution. The stars in each cluster represent a sample which formed simultaneously in the same region of space, and whose present range in brightness and temperature can be ascribed to differences in their initial masses. Studying the H–R diagrams of open clusters can tell much of how stars with different masses change with age, as well as giving an overall age for the cluster (Fig. 6·4). These ages range from a few million years for the very youngest clusters (the Pleiades are some 6×10^7 years old) to several thousand million years (as in the case of M 67, whose age is estimated at 4×10^9 years). (See Pleiades photo, page 171.)

Few open clusters are much older than this, which probably reflects the fact that they disperse on this sort of timescale. As in a globular cluster, all the stars in an open cluster move around and undergo gravitational interactions with one another. The 'leaking-away' of stars as a result of these interactions, while not fatal to the populous globular clusters, does appear to be capable of disrupting the sparser open clusters in a period of about 10^9 years. Details of some of the brightest open clusters are given in Table 6·2.

Measurements of the motion of stars in open clus-

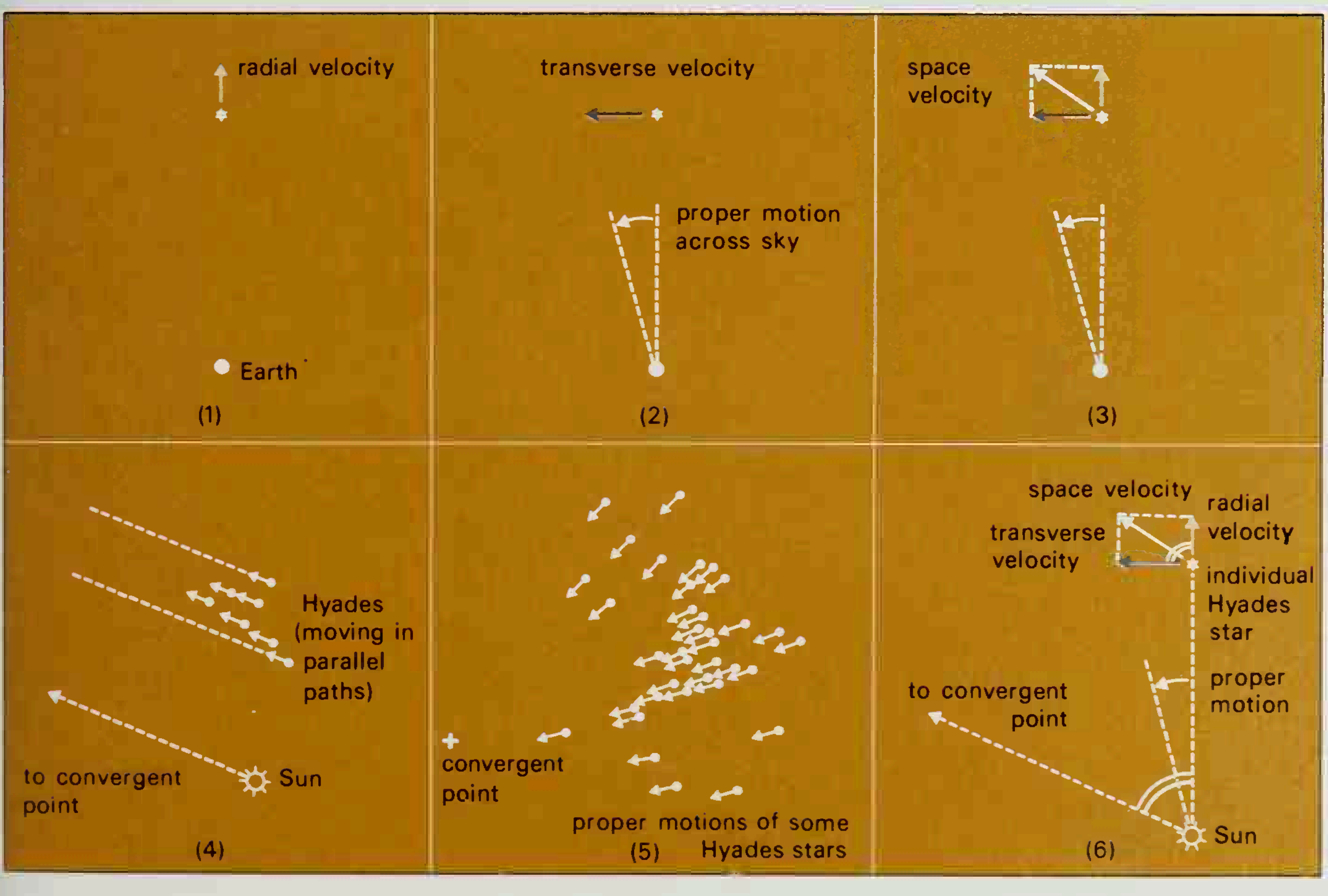

Fig. 6·5 below left: Two 'components' of a star's motion can be detected from Earth. The radial velocity directly towards or away from us is measured from the Doppler shift in the star's spectrum (1), while the proper motion (2) – the star's real motion across the sky – reveals the transverse velocity if its distance is known. Combining these two velocities yields the star's true speed and direction of motion through space, the space velocity (3). On the other hand, if a star's direction of travel and radial velocity are known, then its distance can be estimated by measuring the proper motion. This is the basis of the Moving Cluster method, which relies on the fact that all the stars in an open cluster move in parallel paths through space which appear, by perspective, to converge. (4), (5). A measure of each cluster member's radial velocity, when combined with a knowledge of the direction of this convergent point, gives the transverse velocity (6). When this is compared with the magnitude of the proper motion, the star's distance can be found. The accuracy of this method rests in the large number of stars considered.