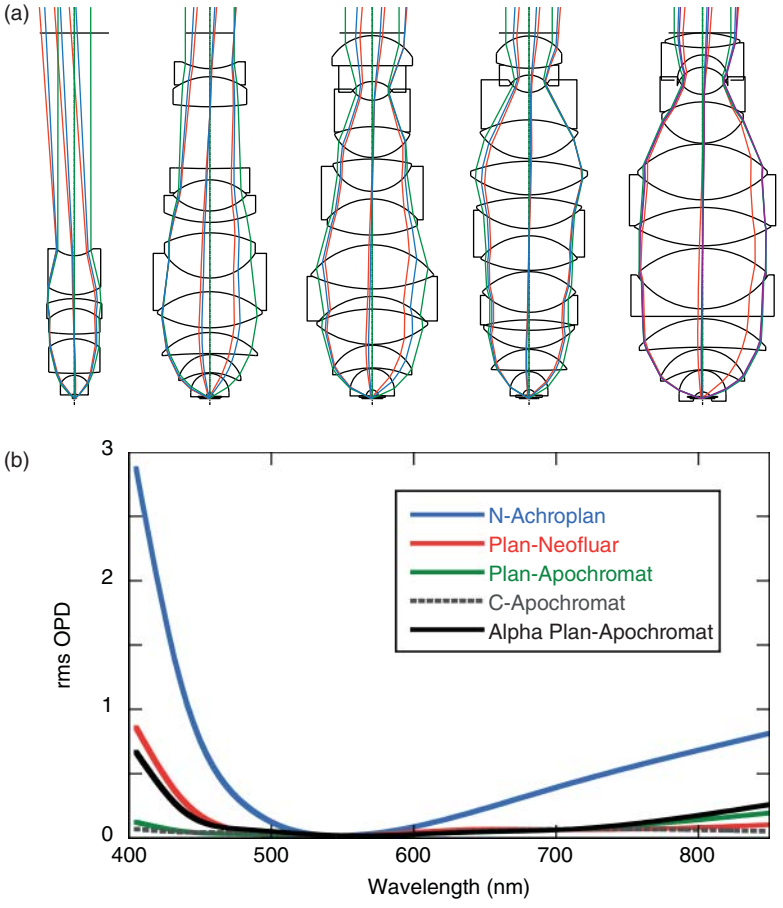

Figure 2.18 Correction of aberrations in objectives. (a) Optical design of five different 63× objective lens systems. From left to right: N-Achroplan with NA 0.85, air immersion; Plan-Neofluar with NA 1.25, oil immersion; Plan-Apochromat with NA 1.4, oil immersion; C-Apochromat with NA 1.2, water immersion; and Alpha Plan-Apochromat with NA 1.46, oil immersion. The different colors label ray bundles emerging from different positions in the focal plane. (b) Comparison of the degree of correction for the objectives shown in (a) in terms of the root-mean-square deviations of the optical path length difference (rms-OPD) in the exit pupil of the objective plotted as a function of the wavelength. N-Achroplan has the simplest design and is achromatic; Plan-Neofluar is optimized for fluorescence applications and shows good correction of chromatic aberrations in the visible wavelength region, whereas the Plan-Apochromat shows excellent chromatic aberration and a very low curvature of field. C-Apochromat has excellent chromatic correction from near-UV to the near-infrared spectral range, and shows an especially low curvature of field. Alpha Plan-Apochromat features an especially large NA and very good chromatic and planar correction. (Reprinted by permission from the Carl Zeiss Microscopy GmbH.)