minal end of the Aβ sequence. The resulting overexpression of amino-terminally truncated Aβ peptides indicates that not only is cleavage by γ-secretase affected by PS1 mutation, but that that by β-secretase is as well. PS1 mutation might also affect these secretases indirectly by interfering with the transfer of APP in the cell. The β-secretase BACE[10] preferentially cuts APP at positions 1 or 11 of the Aβ sequence. Although we do not know how PS1 mutation affects cleavage by β-secretase, on the basis of our results we would expect an increase in BACE cleavage products in PS1-AD subjects. The presence of $A\beta_{py3-42}$, $A\beta_{4-42}$ and other amino-terminally shortened fragments in these brains indicates that other β-secretases could be involved, or that BACE selectivity might be affected by PS1 mutation. The effect of PS1 mutations on the activity of γ- and β-secretases indicates that PS1 could be involved in the regulation of both secretases, rather than itself being a secretase[6].

Carriers of PS1 mutations suffer a significantly earlier disease onset (43.5 ± 0.7 years) and shorter dementia (4.5 ± 0.7 years) than patients with mutant forms of APP (61 ± 2.8 and 12.5 ± 2.1 years, respectively) or with sporadic Alzheimer's (75 ± 8.7 and 8.8 ± 4.0 years, respectively). The direct correlation between increased deposits of amino-terminally truncated Aβ peptides and the clinical course of PS1-AD argues that this is influenced by the presence of these fragments in patients' brains. Similarly truncated Aβ fragments are overproduced in transfected cells carrying an APP mutant that is associated with an early-onset Alzheimer's phenotype[11], and in atypical PS1-AD phenotypes such as the spastic paraparesis variant[12]. In prion disease, various species of pathogenic protein are also associated with different phenotypes[13].

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Astronomy

A massive cool dust torus around η Carinae?

The star η Carinae, the most luminous known in the Milky Way galaxy, is a puzzling object. It is surrounded by a cloud of glowing gas that shows a distinct 'pinched waist' appearance, whose origin has been controversial. Morris *et al.*[1] proposed that a massive but very compact torus of gas encircles the star, and that this caused the bipolar shape by preventing gas ejected by the star from expanding in the equatorial plane. Here we show that the small size of the torus (diameter of 5 arcsec) is insufficient to produce the observed infrared flux that inspired the conjecture. The dust giving rise to the 17-μm emission must be distributed over an area at least ten times the size of the torus. Such an extended structure of gas, however, would probably be incapable of generating the pinched waist.

As no suitable far-infrared images are available, Morris *et al.* based their hypothesis on features seen at wavelengths around 17 μm, where only a small fraction of the total flux is due to the cool 110 K dust in their model. The toroidal structure in question, marked in their Fig. 2, is a familiar feature in previous 2–18-μm infrared maps of η Carinae and has mid-infrared colour temperatures above 200 K (refs 2–8). A simple brightness–temperature argument shows that it cannot account for much of the cooler radiation seen in the data from the Infrared Space Observatory (ISO). At a wavelength of 50 μm, for example, the 110 K dust must produce a flux $F_\nu \approx 22{,}000$ Jy in their model (Fig. 1 of ref. 1). In order to have that flux at that wavelength, a 110 K Planck black body would need a projected area of 37 arcsec^2.

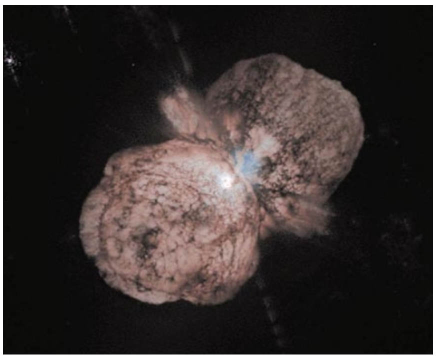

Figure 1 The 'Homunculus' nebula around η Carinae, with axial diameter 17 arcsec, or 0.6 light year.

But this is surely an underestimate, because the region must be optically thin at 50 μm for at least two reasons: first, Morris *et al.* assumed optically thin dust in their analysis of the spectral distribution; second, an opaque torus covering that area would be evident in visual-wavelength images. Thus, one can place a lower limit of roughly 100 arcsec^2 on the extent of the cool dust component. The projected area of the torus, however, is only 5–10 arcsec^2. Evidently that structure is far too small to account for the observed far-infrared flux. More complicated arguments involving heating of the grains, 17-μm intensities in the torus, and so on, lead to the same conclusion.

As Morris *et al.* emphasized, the ISO data seem to indicate at least 5 solar masses of additional ejecta, larger than the amount usually quoted for the bipolar 'Homunculus nebula' of ejecta from η Carinae[9] (Fig. 1). We suggest that a viable model will have two characteristics. First, a continuous distribution of dust temperatures above 100 K is to be expected. This would fit the observed spectral distribution at least as well as the 110 K and 190 K components assumed by Morris *et al.*, and may reduce the implied mass. Second, and more important, the cool 100–150 K dust is distributed much farther from the star than they proposed. Unshielded dust grains outside the homunculus are expected to have temperatures in that range. Existing far-infrared data provide little or no information on whether the cool dust is equatorial or not. We hope that future instruments will provide images at critical wavelengths beyond 30 μm.

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