Mammals arose approximately 225 million years ago in the mid to late Triassic period, as shy, small, secretive creatures springing from a reptilian lineage. At the time mammals evolved, the reptilian order that generated them probably enjoyed tetrachromacy. Most mammalian families became nocturnal (and in many cases arboreal) because of intense dinosaur predation and/or competition. These nocturnal mammalian families lost two visual pigments to become dichromats. It is believed that the now extinct, last common ancestor to the mammalian class probably gave rise to the monotremes (Br J Ophthalmol March cover, 2005), the marsupials, and the placentals, although the sequence of descent and cladistic relation remains controversial.

Approximately 65 million years ago when a comet struck the Yucatan peninsula ending the Cretaceous period and snuffing out dinosaurs forever, the evolutionary door swung open for synapsids including all mammalian clades. Mammalian families extant at that time were mostly dichromatic, and only a few of the primates would later recover trichromacy (Br J Ophthalmol December cover, 2001).

Evolutionary recapitulation is rare, often impossible, since metabolic solutions once lost are not randomly repeated. So, the mammalian wave that followed the dinosaurs includes only certain primates that are trichromatic, and these primates cannot have the same visual pigments as our reptilian ancestors. But, not all mammalian families became nocturnal and lost the original visual pigments.

The marsupials (metatherians) were probably well established before the radiation of the placentals (eutherians). Since most placentals are dichromats and many Australian marsupials are at least trichromats, the metatherians are a key class in understanding the evolution of colour vision. These are pivotal species among amniotes because somewhere during the march from our reptilian ancestors to placental mammals, tetrachromacy and trichromacy were lost. Metatherians, then, will help us understand this evolutionary transition.

If tetrachromacy or trichromacy remain unaltered from ancient Jurassic mammalian ancestors, the metatherians are likely to retain those traces. Indeed, shards of reptilian trichromacy can be found in at least two marsupials although a few are thought to be dichromats, suggesting that the loss of colour vision occurred, or at least began, within the metatherians.

The fat tailed dunnart, illustrated here, and the honey possum have been found to have trichromacy, and the dunnart is believed to be close to the ancestral stock that populated Australia when that continent broke free from Gondwanaland.

Trichromacy, though, in such an animal is intriguing since most other mammals have lost it. Why should this creature have it?

A visual pigment is described best by the peak wavelength of light that stimulates it but for this essay we will use colour designation instead of wavelength.

The nocturnal placentals are believed to have retained a blue and a red-green sensitive photopigment along with the primary rod photopigment thus providing dichromacy. Some primates re-evolved trichromacy by the duplication of the red-green photopigment with some modification in sensitivity. The marsupials that retained trichromacy have a similar blue, a green, and a distinct red sensitive photopigment. In some marsupials, the sensitivity of the blue photopigment range extends into ultraviolet. What advantage would all of these visual pigments confer upon the dunnart, especially sensitivity into the ultraviolet?

Although the 20 g adult dunnart has been known to take small reptiles, and even young rodents, it is primarily insectivorous. So, why should it need a photopigment capable of recognising ultraviolet wavelengths? Insects are often camouflaged by the foliage they inhabit. Most leaves reflect ultraviolet, but insects do not, so the profile of an insect will stand out to any animal capable of vision into this range.

The fat tailed dunnart, then, represents a mammalian colour vision key-stone species with vision that extends into the ultraviolet.