Dumbo Octopus Eyes

They have big **eyes**.
Aside from their ears, **dumbo octopuses** are also known for having bell-shaped heads and big **eyes**. In fact, the diameter of their **eyes** is about one third of the width of their head. (In comparison, the diameter of the **eyes** of a human adult are about 1/7 the width of their skull.)

Unlike most octopuses, the "Dumbo" octopuses have primitive internal shells, which grow in a "U" shape. These structures are thought to help support the substantial fins. They also have large eyes for a deep-sea octopus, often measuring a third of their entire head width.
https://blogs.scientificamerican.com/octopus-chronicles/unusual-offshore-octopods-the-dumbo-octopus-swims-with-fins-video/

Members of the *Grimpoteuthis* species have large eyes that fill about a third the diameter of their mantle or "head," but their eyes have limited use in the eternal darkness of the depths. In some species, the eye lacks a lens and has a degraded retina, likely only allowing for detection of light/dark and movement.
https://www.thoughtco.com/grimpoteuthis-dumbo-octopus-4160927

Most octopuses have a well developed eye that has an iris, a lens, and a retina, like our eyes. The eyes are believed to have evolved independently from those of humans.

https://owlcation.com/stem/Fascinating-Facts-about-Octopuses-Adorable-Dumbo-and-Alien

There are more than a dozen known species of dumbos. While most are small, measuring between 8 and 12 inches long, some can reach upwards of 6 feet in length. Though the mollusks have huge, **bulging** eyes they can barely see. However, given that dumbos **dwell** in the deepest, darkest parts of the Atlantic and Pacific Oceans, where nothing is visible, the lack of sight does not **hinder** them. Instead, they have learned to use the suckers on their tentacles to feel their surroundings.
https://www.dogonews.com/2018/11/2/stunning-rare-dumbo-octopus-spotted-off-california-coast

their eyes are much more developed. https://marinebio.org/species/finned-deep-sea-octopuses/grimpoteuthis-spp/

Sight Cephalopods

Cephalopods are famous for their eyes. In some cephalopods the eyes are as complex as the human eye, and the eye of the giant squid is enormous. Most cephalopod eyes, like human eyes, contain an iris, pupil, lens, and in some cases, a cornea. Octopus, squid, cuttlefish, and nautilus all have differently shaped pupils— an octopus has a rectangular pupil, a cuttlefish has a w-shaped pupil, and a squid's pupil is circular. Only the nautilus has a comparatively basic eye anatomy, relying on a pinhole pupil without a lens. They are able to dilate and constrict their pupils in varying light intensities and can probably distinguish very simple visual cues.

Octopus, squid, cuttlefish, and nautilus all have differently shaped pupils— an octopus has a rectangular pupil. *(Greg McFall, NOAA)*

The rest of the cephalopods have complicated eyes. Even more remarkably, the complex eyes of humans and cephalopods are surprisingly similar in design considering the two evolved independently. **A study by scientists at the Nagahama Institute of Bio-Science and Technology** found that this similarity is due to one shared gene, *Pax6*, traced back to our last common ancestor, more than 500 million years ago. The gene is considered a master control gene—meaning it orchestrates how to make an eye (like an instruction manual) rather than constructing the individual building blocks.

Despite the complexity of their eyes, cephalopods are most likely colorblind. The ability to see color relies on specialized receptor cells. In animals and humans these cells are called cones, a distinction from the light sensitive cells called rods. Humans have three different types of cones: one that detects red wavelengths of light, one that detects blue, and one that detects green. In combination, these cones allow us to see a wide breadth of color hues. But cephalopods only have one type of photoreceptor cell, rendering it colorblind.

Or perhaps not! **A recent study** suggests that the strange shape of their pupils may allow some cephalopods to distinguish colors in a unique way. The unusual shape may act somewhat like a prism, scattering the various colors that make up white light into their individual wavelengths. Once the light has been divided, a cephalopod can then focus the individual colors onto its light-sensitive retina by a subtle change in the distance between the lens and retina. This method would take quite a bit of processing power compared to a multi-cone eye and can help explain why a cephalopod has such a large brain.

A cuttlefish pupil is in the form of a "W." *(Steve McNicholas **Flickr**)*

Cuttlefish eyes are especially notable among cephalopods. Cuttlefish are the most talented at discerning differences in polarized light, a feat that human eyes are unable to accomplish (humans perceive polarized light as a glare). For animals that can see it, polarization adds an extra dimension to an image, similar to the addition of color to a black and white photo. Natural light from the sun, or an incandescent light bulb, is unpolarized, meaning its energy radiates in all directions. But when light reflects off of a surface the light energy may be stripped down to only one direction—this is polarized light. The angle of polarized light varies depending on the surface it bounces off of—t**his is what a cuttlefish can discern**. A cuttlefish can look at polarized light and detect within one degree the difference in that light's energy direction.

https://ocean.si.edu/ocean-life/invertebrates/cephalopods