The Compound Eyes of Fiddler Crabs
A Tutorial

Credits

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Neuroanatomy

Jochen Smolka
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Optics & Visual Ecology

Sharyn Wragg:
Artwork

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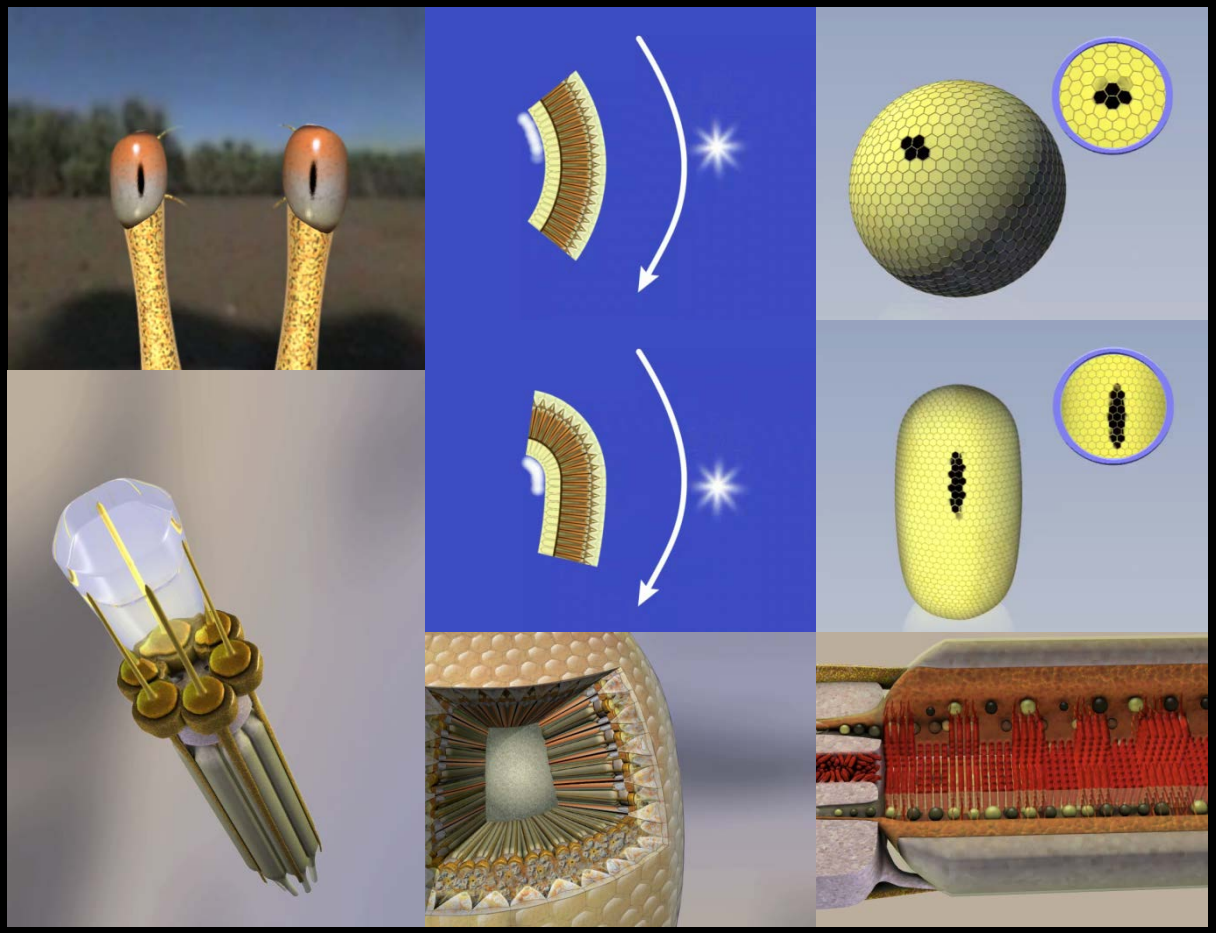
3D Animation



Compound Eyes & the Visual Field

Fiddler crabs can look all around, without the need to move their eyes.

Their compound eyes sit on top of long vertical eye stalks.

The black parts of the eye look into your direction.

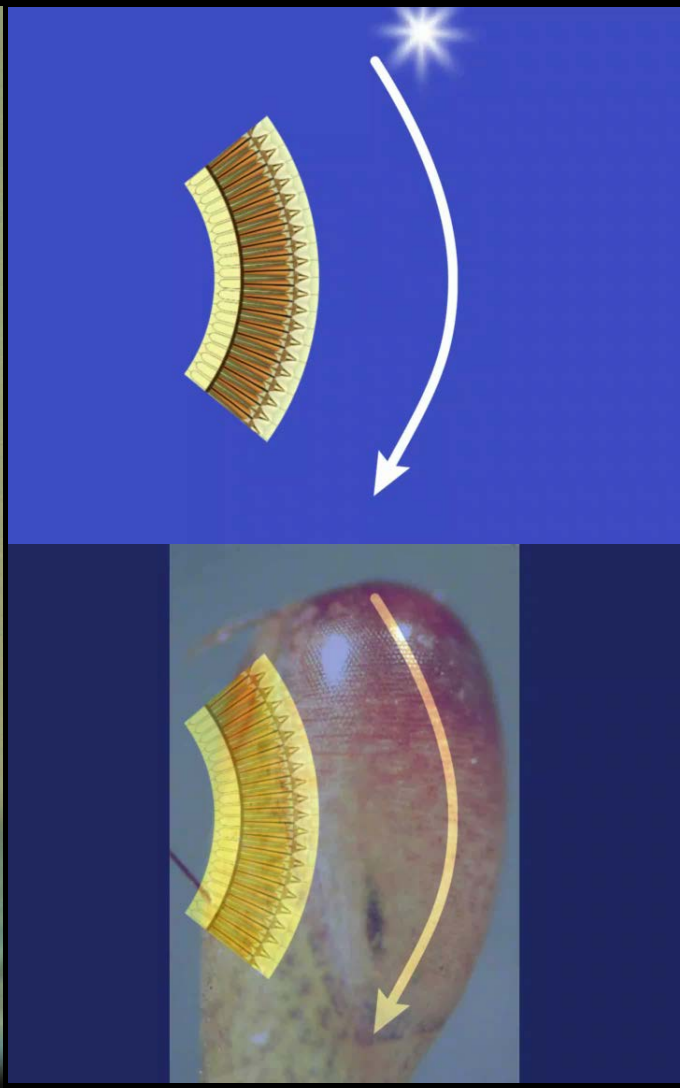
The shape of this *pseudo-pupil* indicates that more receptors look in vertical than in horizontal directions.

Compound Eye Shape & Resolution

Fiddler crab compound eyes are not round, but vertically elongated (not quite as extreme as the eye of a ghost crab shown here).

The angle between the directions of view of neighbouring ommatidia depends on the local radius of the eye:

large eye radius = small interommatidial angles = better resolution.



The Pseudopupil & Resolution

The ommatidia that "look" in the direction of the observer appear black because no light is reflected back.

As one looks at a compound eye from different directions, different groups of ommatidia appear black.

The shape of this pseudo-pupil changes with the local radius of the eye: in a spherical eye it is approximately round, but it becomes elongated in the direction of the largest local radius in an elongated eye. More ommatidia look into the same angle in vertical, compared to horizontal directions.

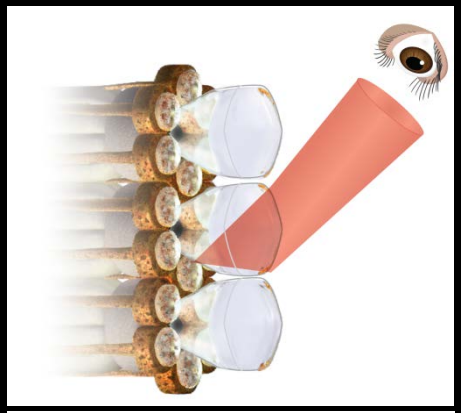
The fiddler crab eye, therefore, has much better resolution in vertical, compared to horizontal directions.

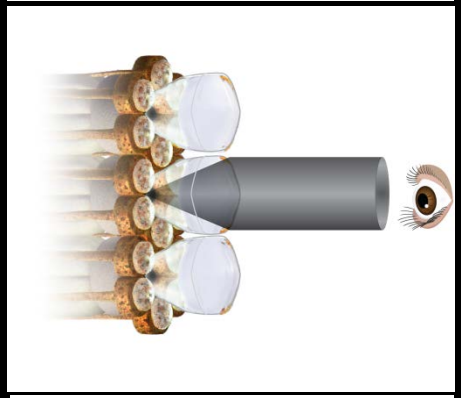
The Colours of Compound Eyes

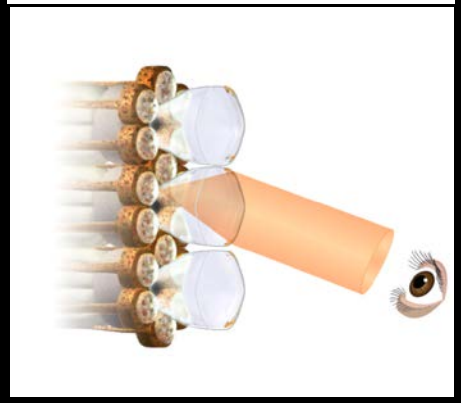
The colours we see in compound eyes derive from the colour of screening pigments.

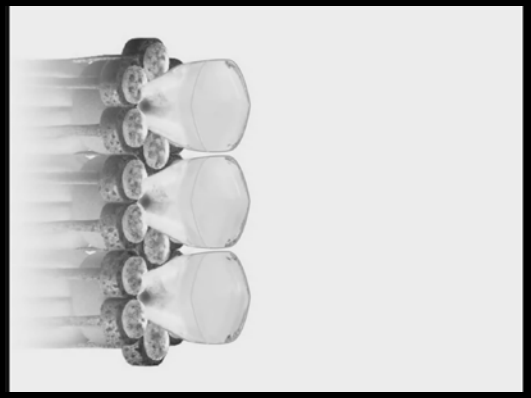
We see their image through the individual facet lenses.

Depending on the angle of view, we see screening pigments, or the dark facets of ommatidia that look in our direction.









The Anatomy of the Compound Eye

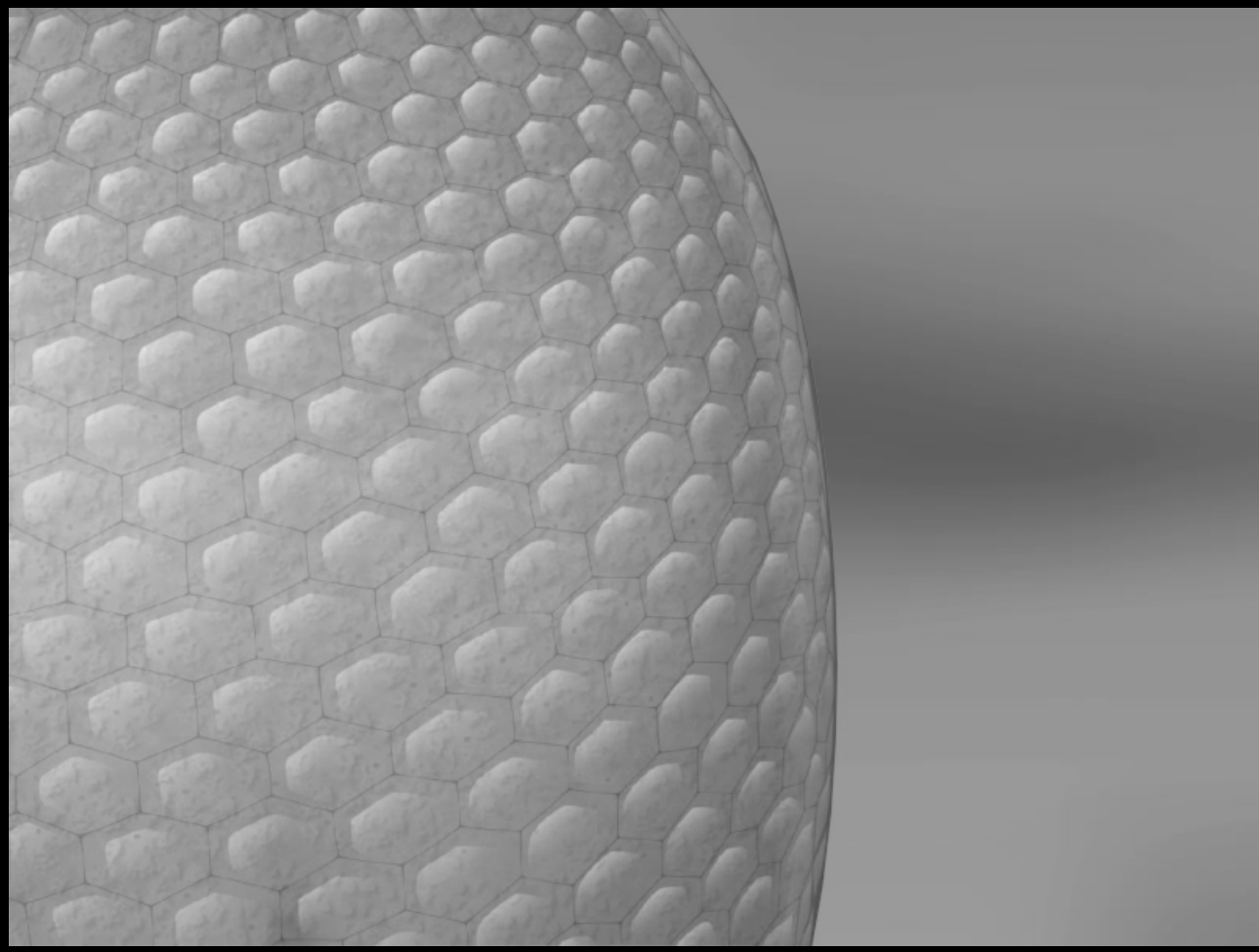
The "pixels" of a compound eye are called *ommatidia*.

Each has a lens system that focusses light on a dense column of microvilli, called a *rhabdom*.

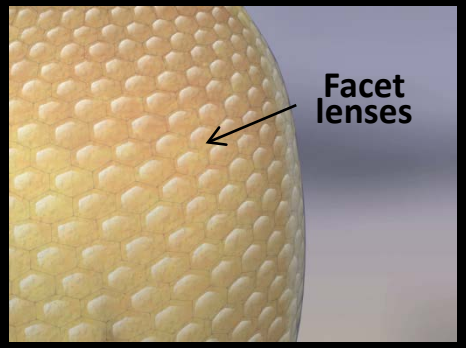
The microvilli contain photo-sensitive molecules.

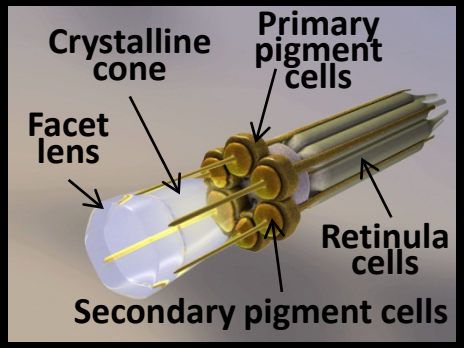
Eight photoreceptors in each ommatidium contribute microvilli to the rhabdom.

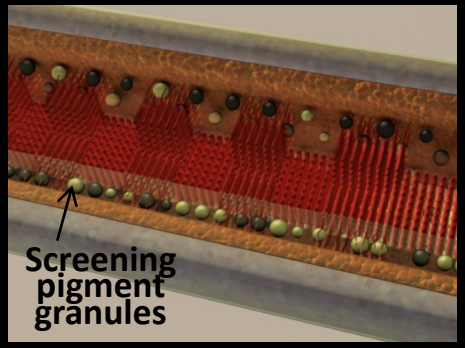
They are surrounded by a pigment cell screen.

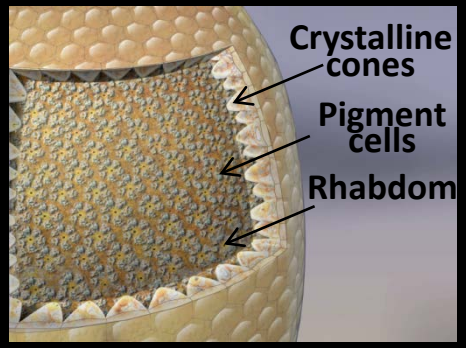


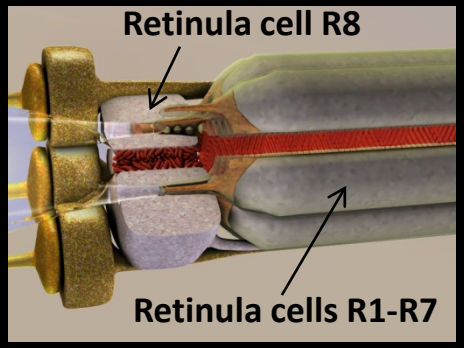
The Anatomy of the Compound Eye

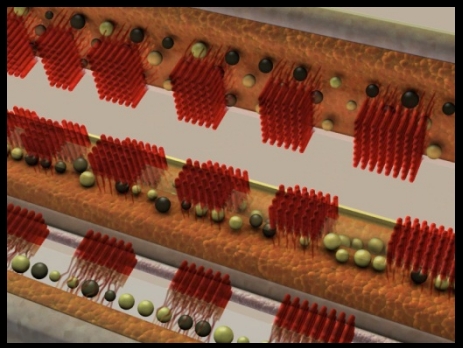


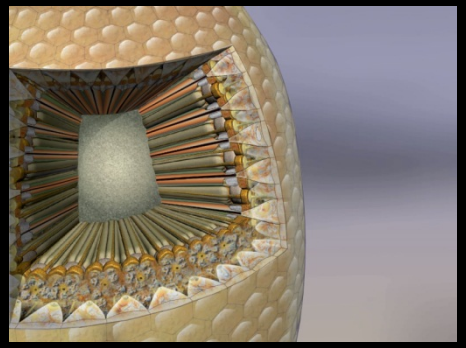


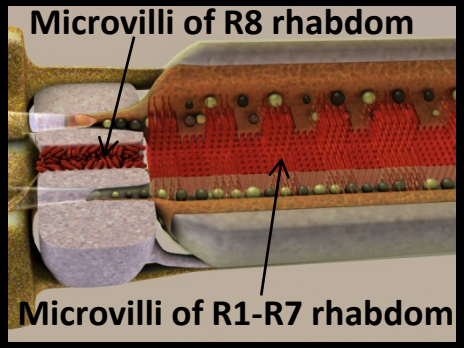


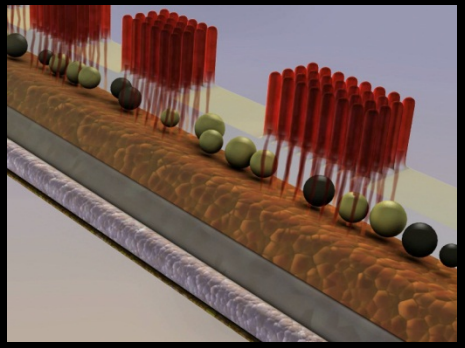












Reading About Eyes & Fiddler Crabs

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Fiddler Crabs:

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