

Capteurs visuels biomimétiques

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Photograph by Robert Clark

Photograph by Eye of Science/Photo Researchers, Inc.



De l'animal à la machine et *vice-versa*



▪ Vision au service de la navigation et vice-versa

Etude et modélisation par approche cybernétique de comportements de vol chez l'insecte



▪ Des capteurs animaux aux capteurs physiques

Etude des capteurs visuels et transposition dans une technologie accessible (électronique numérique et analogique, micro-électronique)



▪ De l'animal à la machine et vice-versa

Conception et réalisation d'un micro-engin volant autonome basé sur un système de contrôle sensori-moteur biomimétique



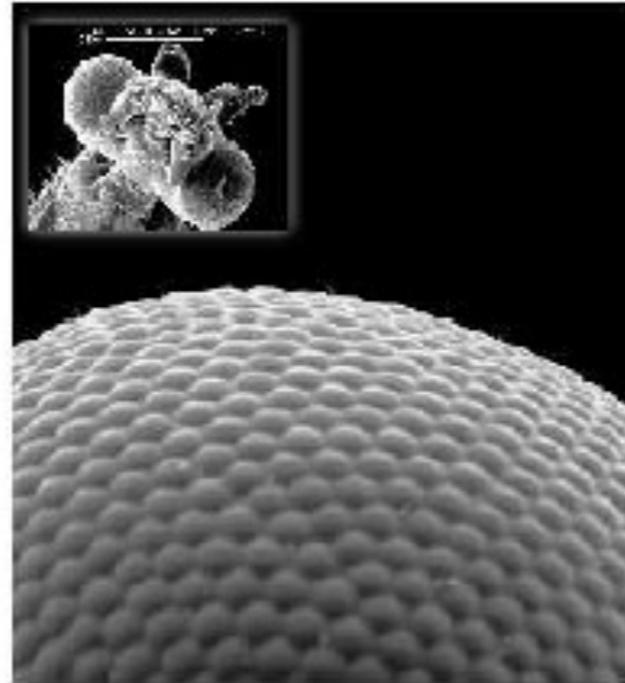
© Dalton, 1975



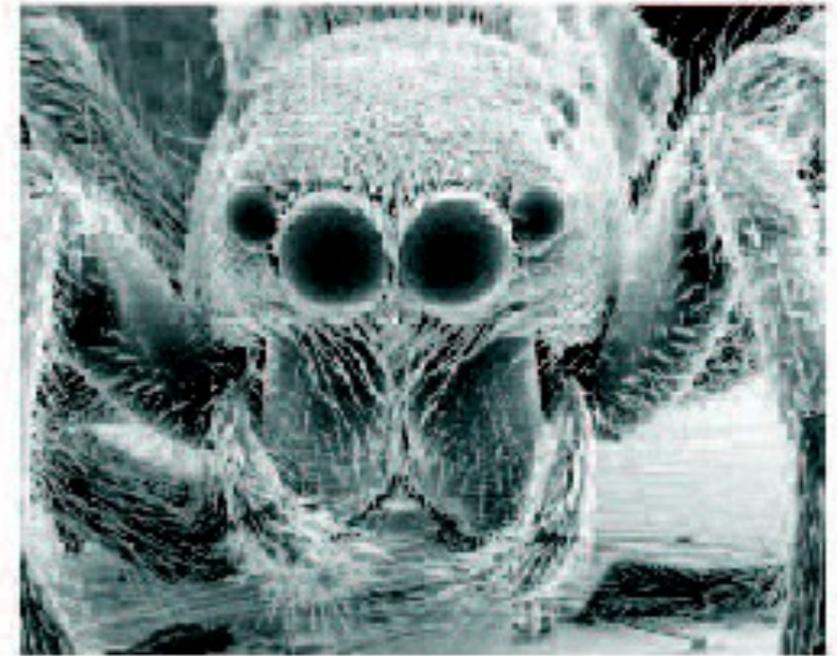
Apposition eye



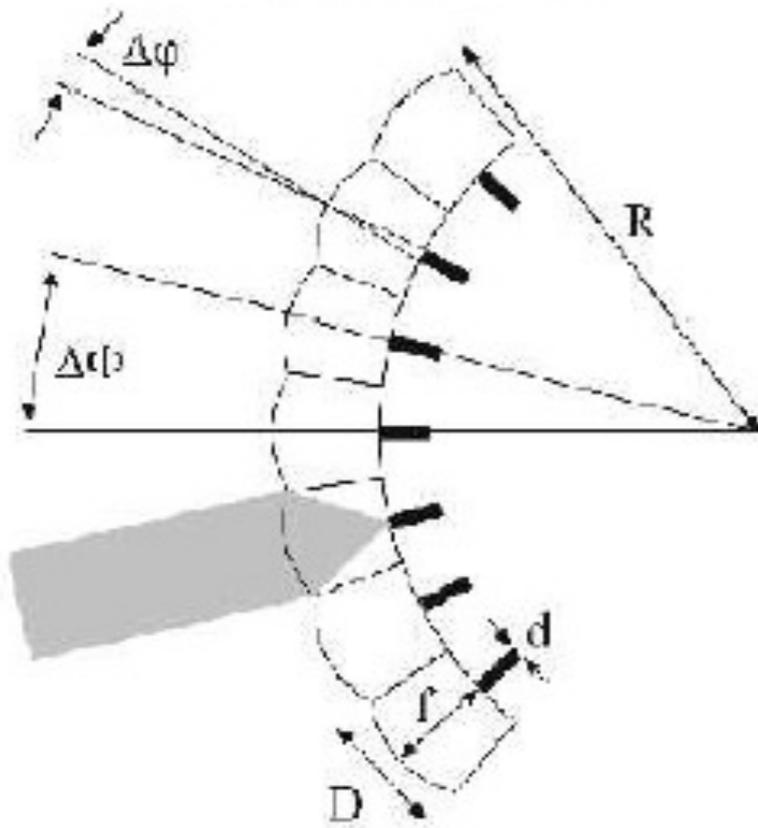
Superposition eye



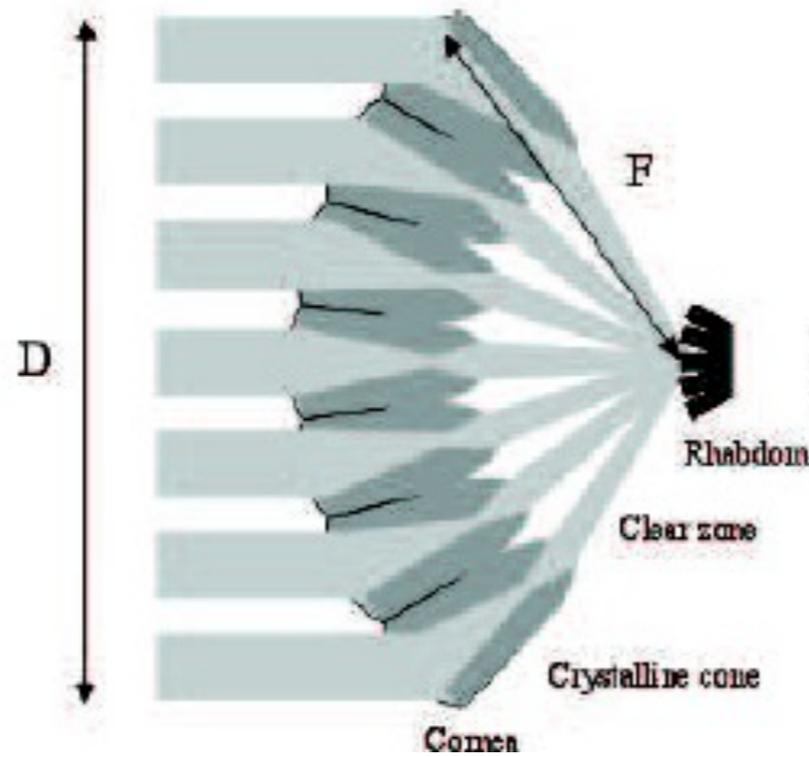
Cluster of single aperture eyes



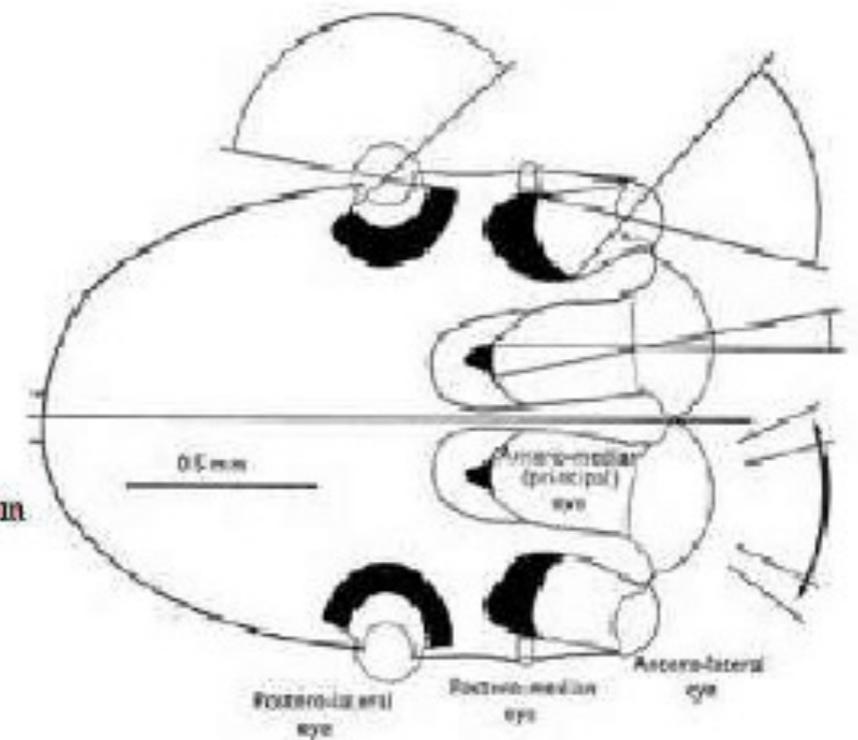
Diurnal insects



Nocturnal insects

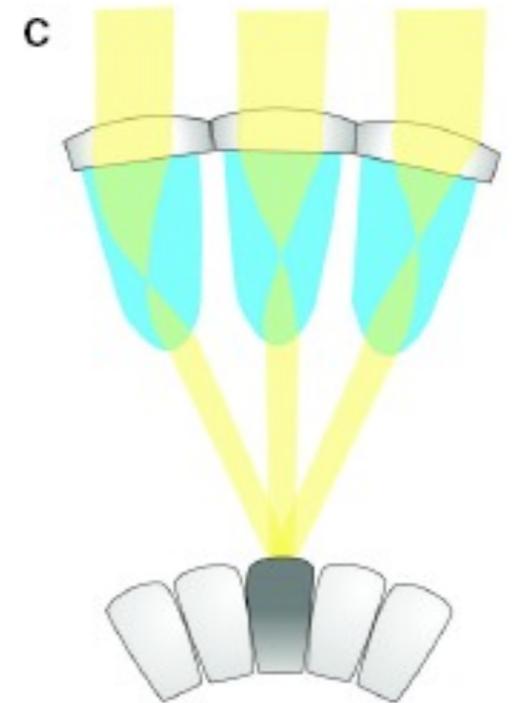
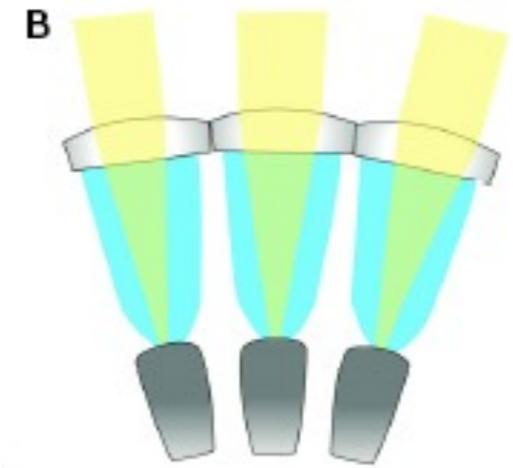
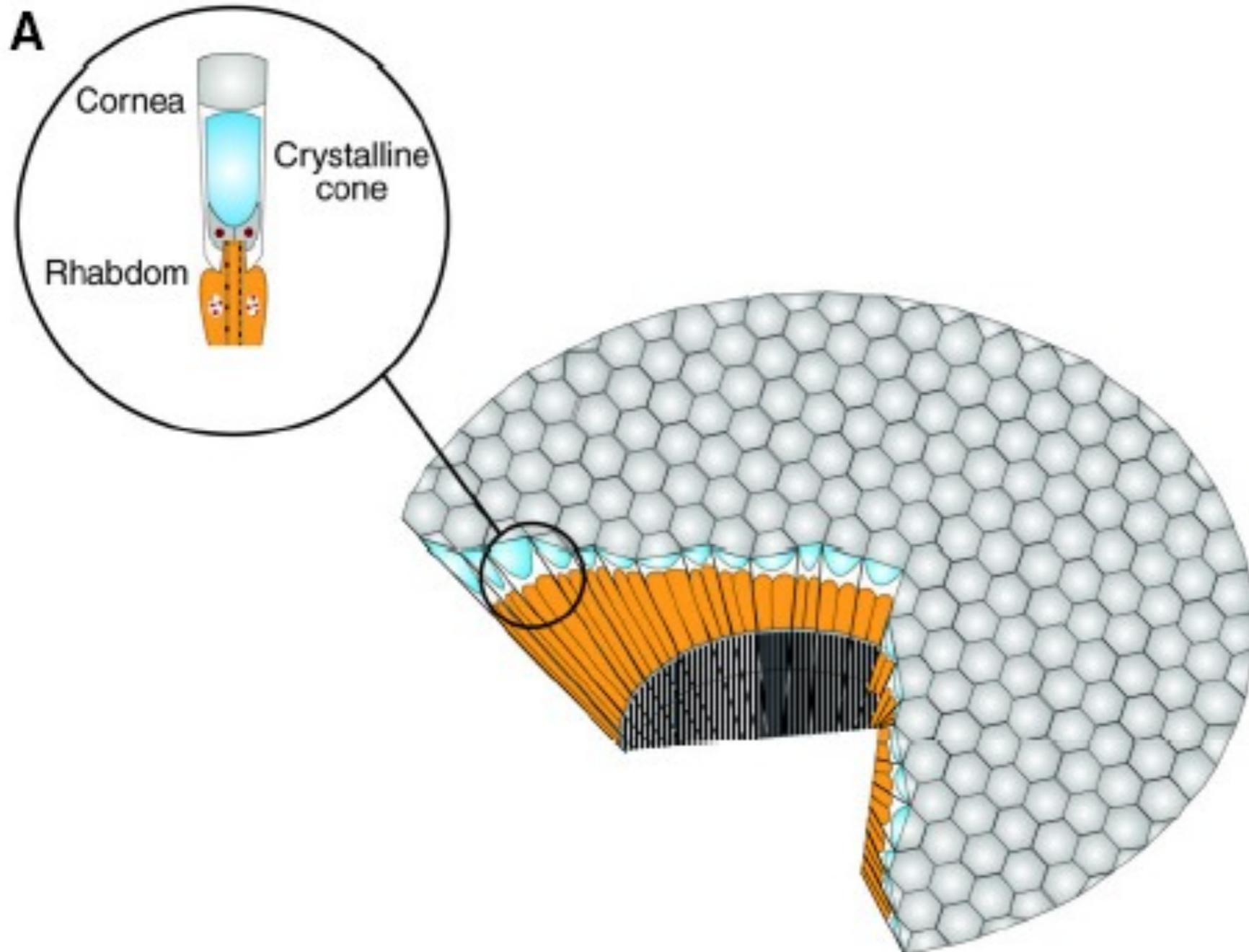


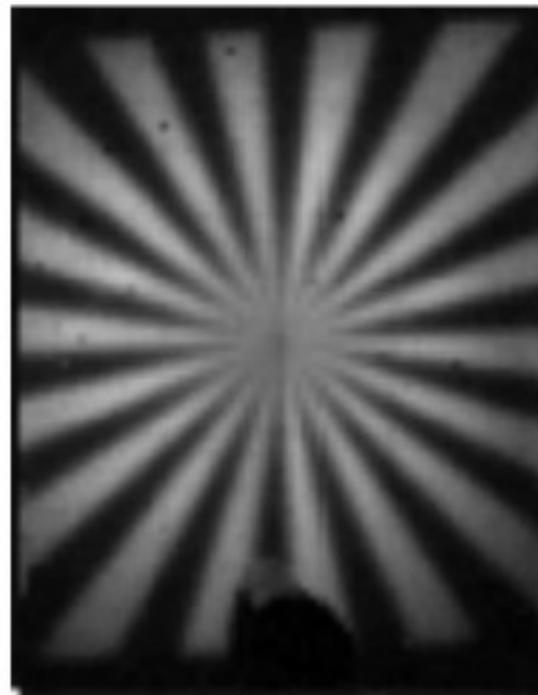
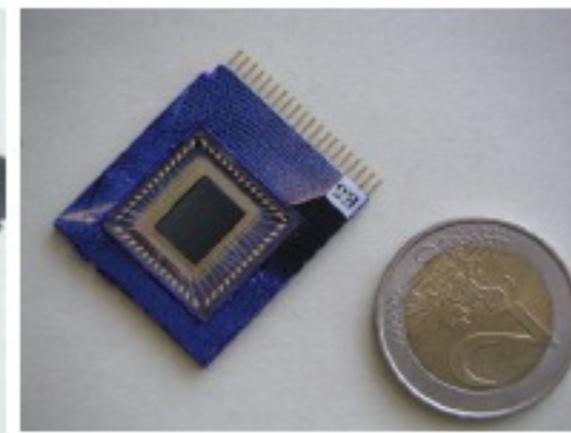
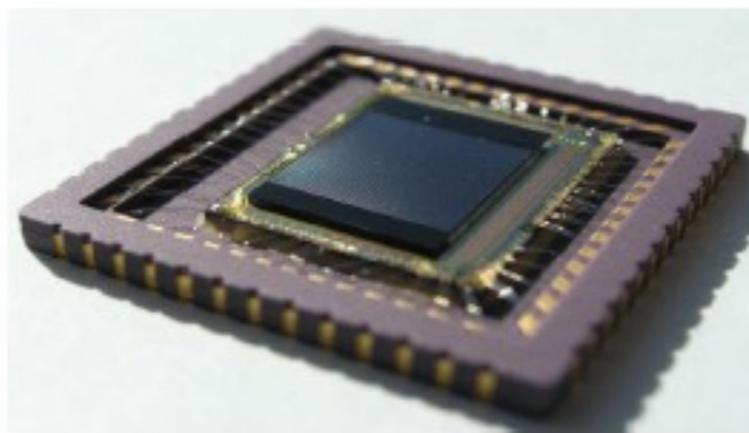
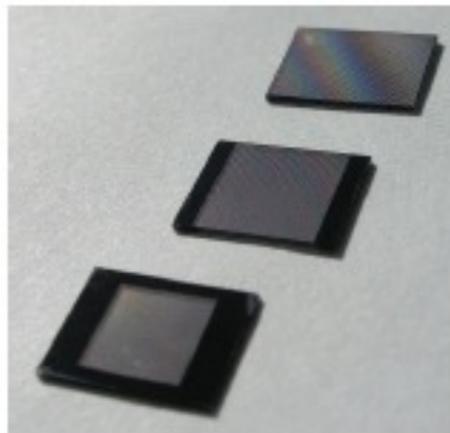
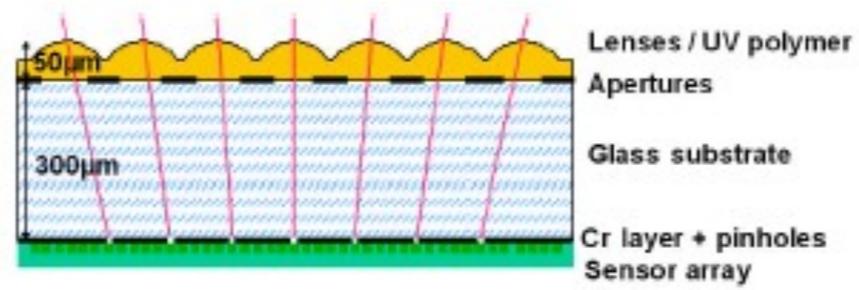
Jumping spiders



Duparré 2005

L'œil composé





(a)

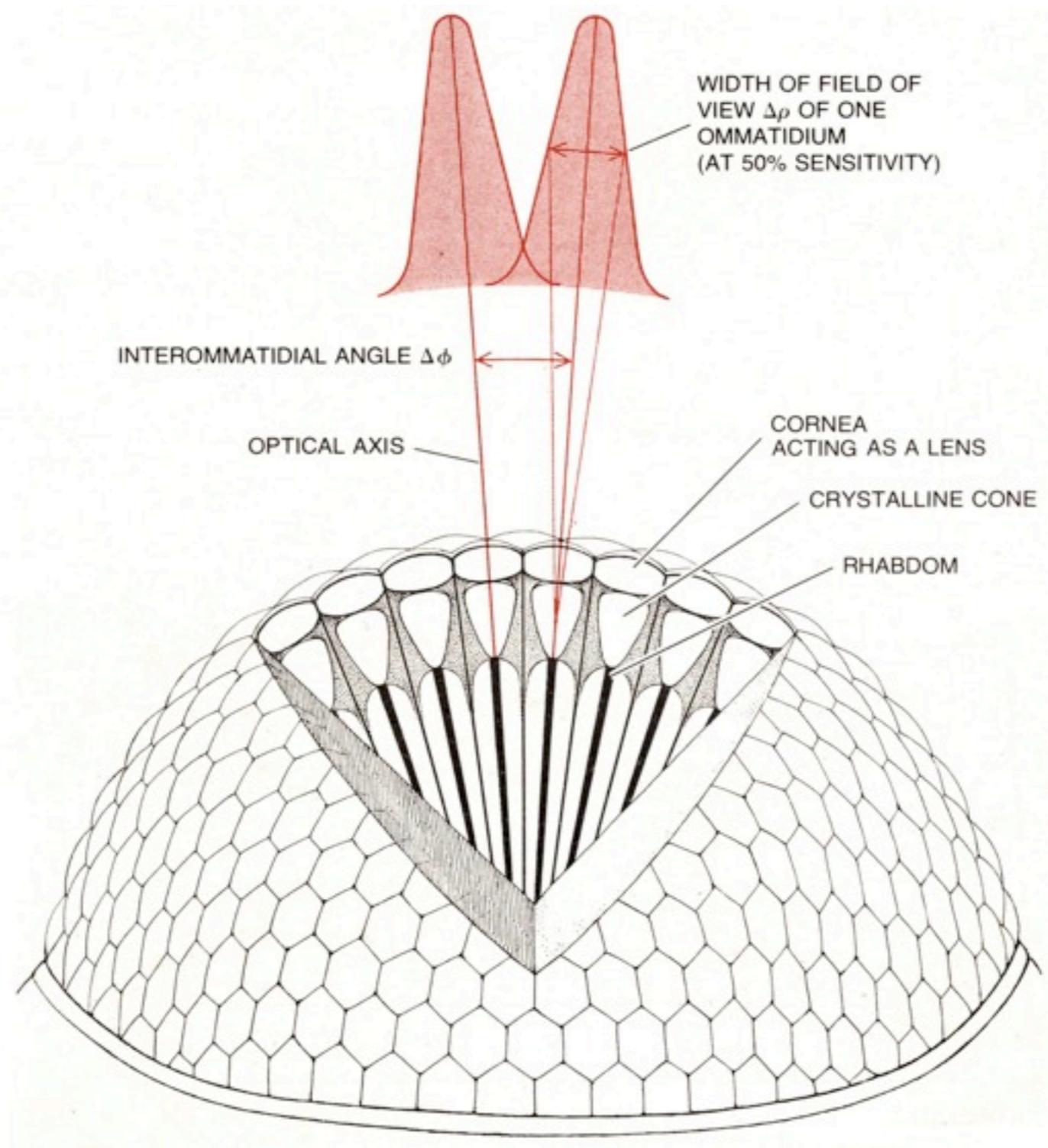


(b)



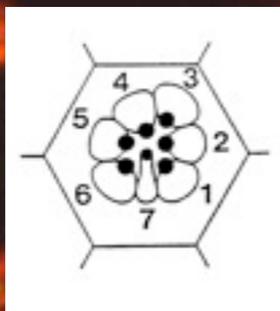
(c)

L'œil composé



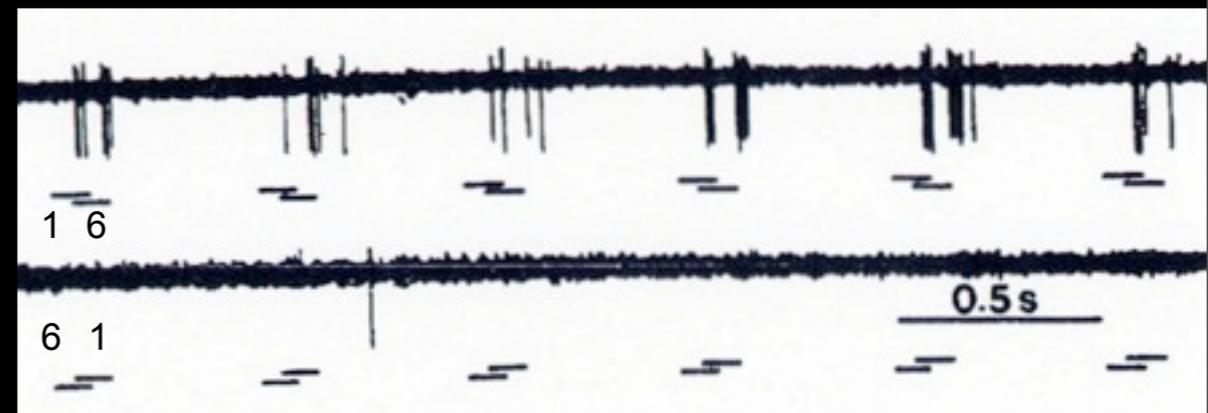
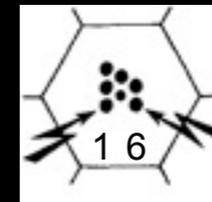
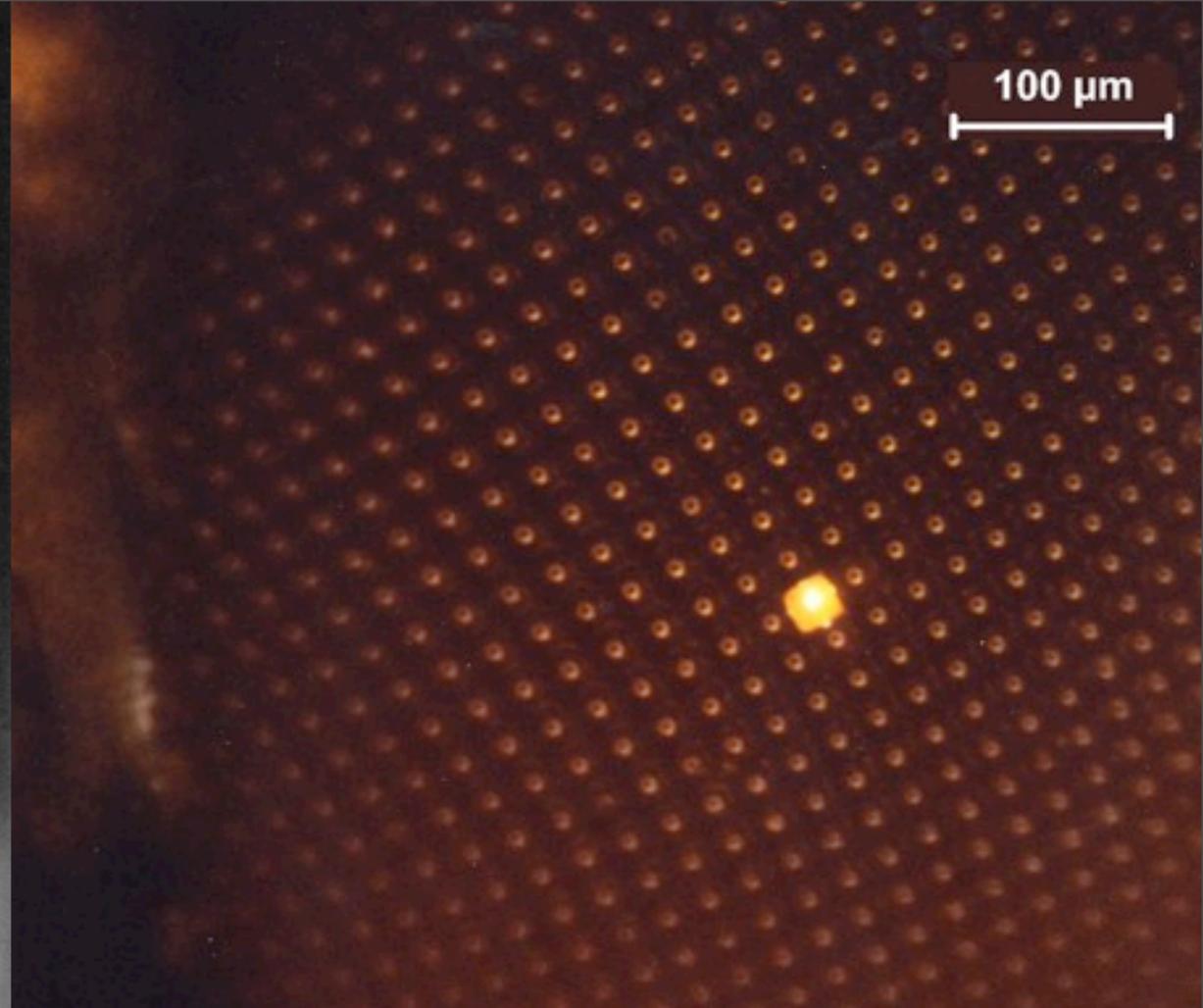
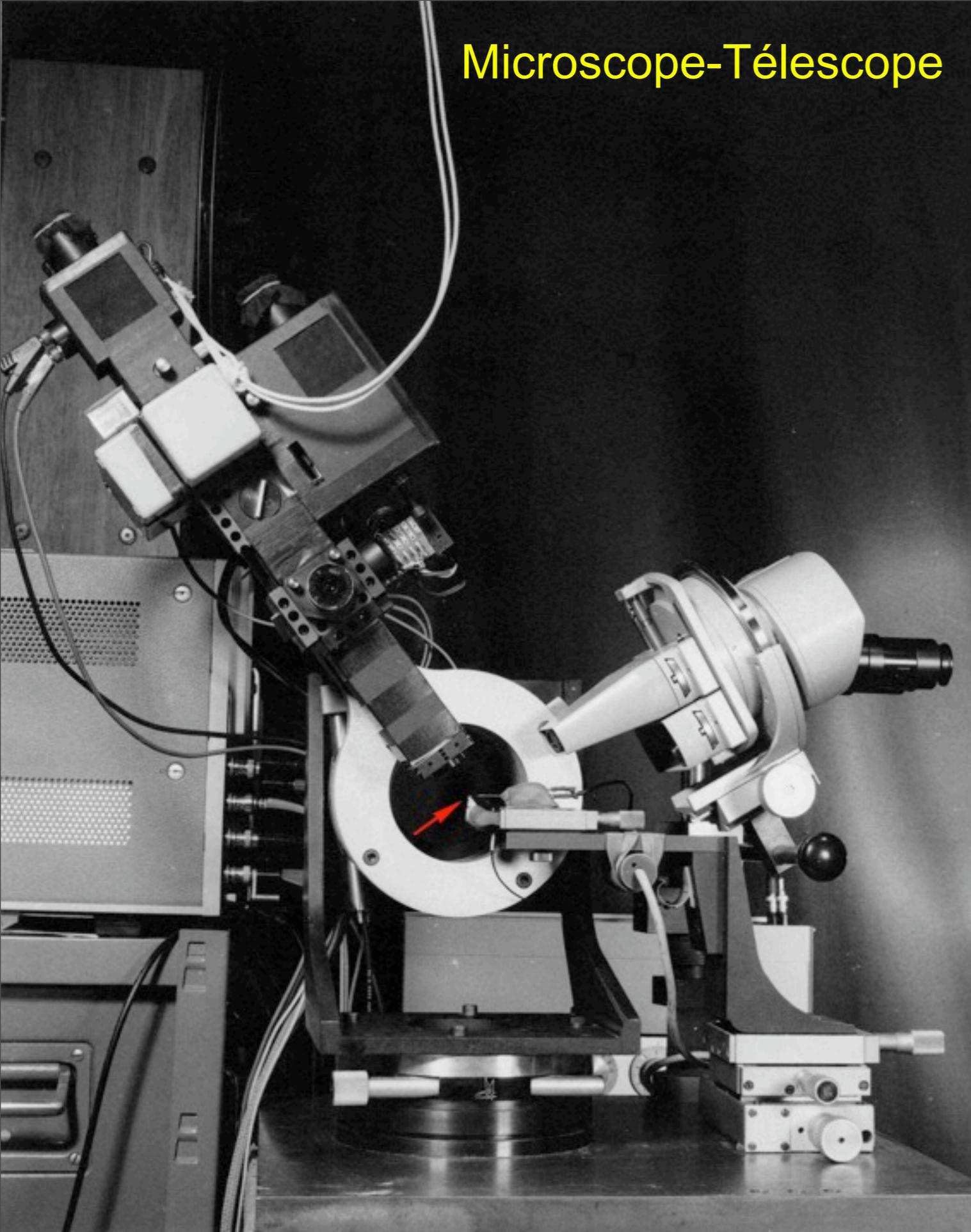
Horridge

2% de la rétine
de la mouche



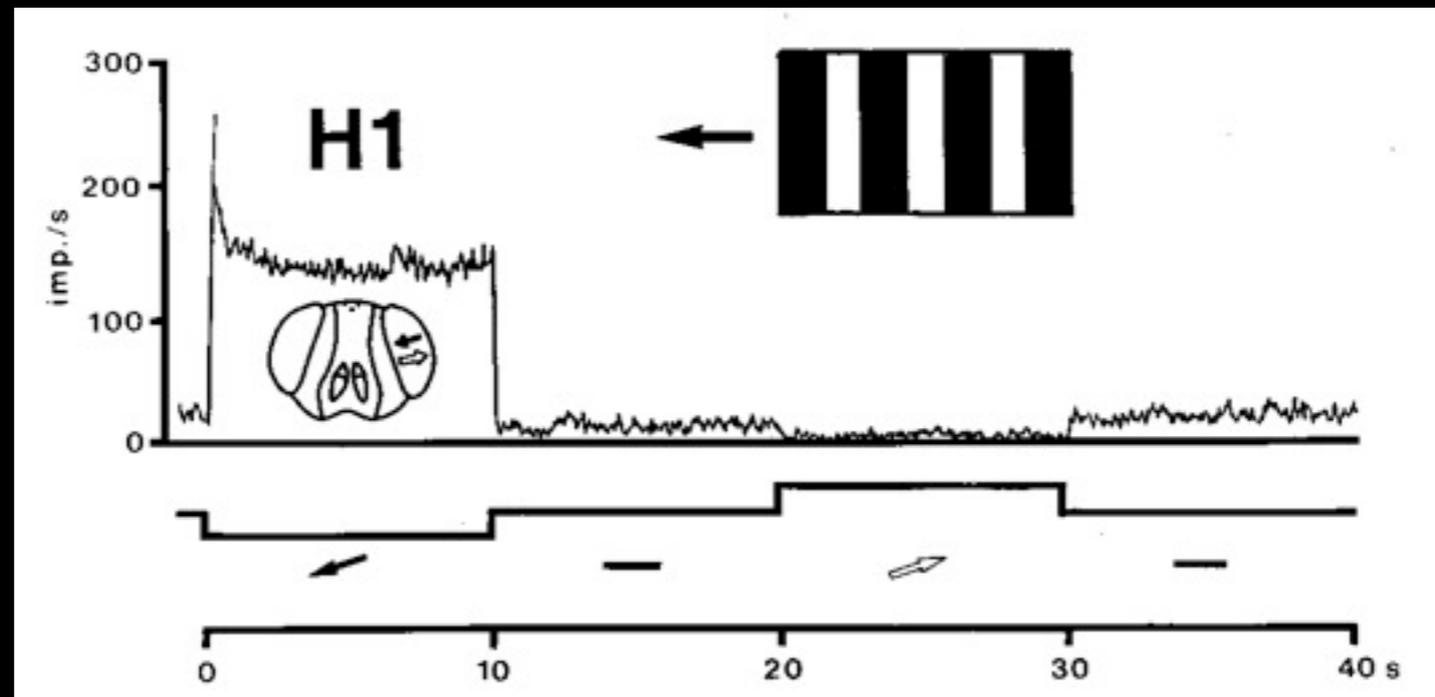
15 μm

Microscope-Télescope



Analyse d'un DEM de mouche

Neurone détecteur de mouvement

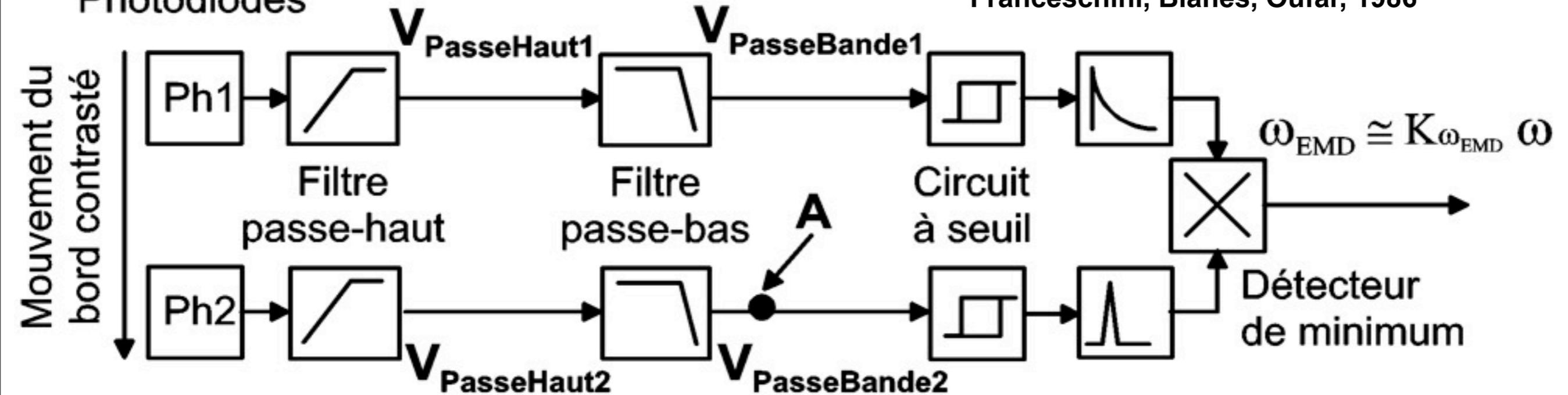


Ce neurone fait la somme des signaux émis par des milliers de
petits neurones: les
Détecteurs Elémentaires de Mouvement (DEM)

DEM : Détecteur Élémentaire de Mouvement

Photodiodes

Franceschini, Blanes, Oufar, 1986



- Ce diagramme fonctionnel s'appuie sur l'analyse électro-physiologique des neurones DEM de la mouche (Caractérisation dynamique, nombreuses non-linéarités ...)

Franceschini 1985, Franceschini and al. 1989

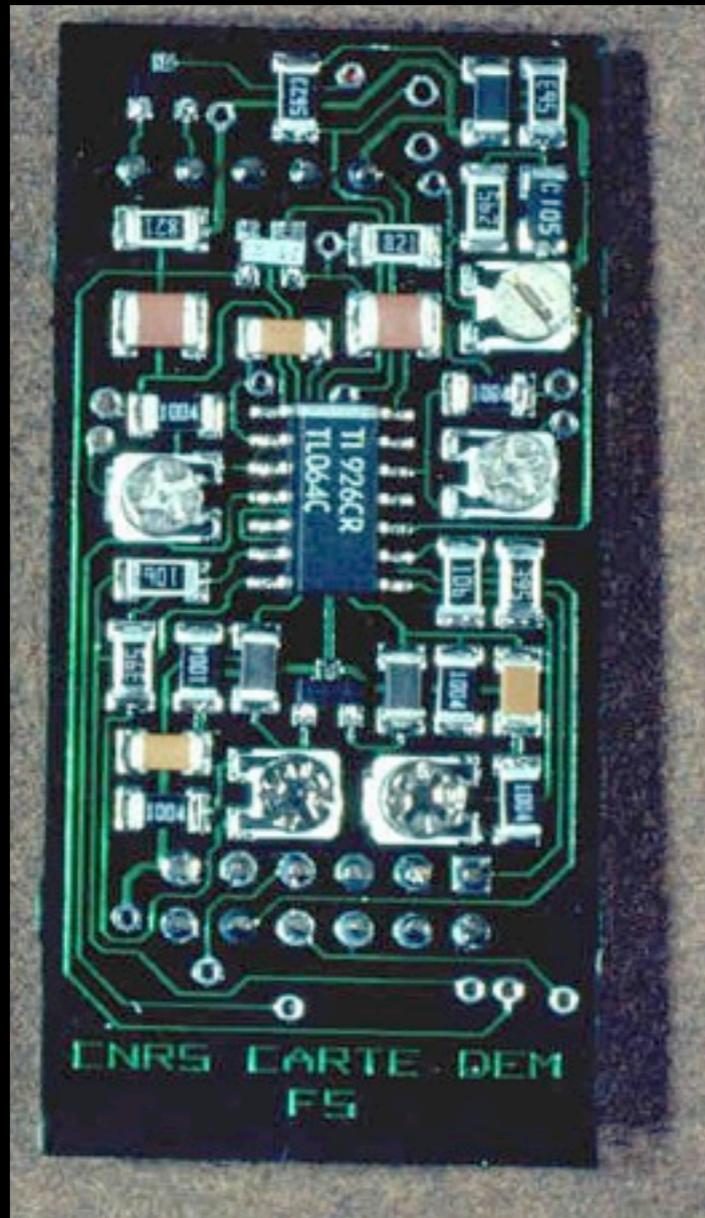


Masse : 2,5 grammes (avec l'optique)

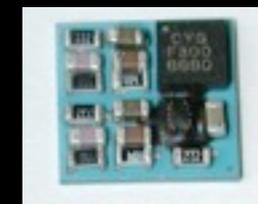
Consommation : 40mW

Ruffier, Viollet, Amic, Franceschini IEEE ISCAS 2003

Réalisation d'un DEM de mouche en électronique

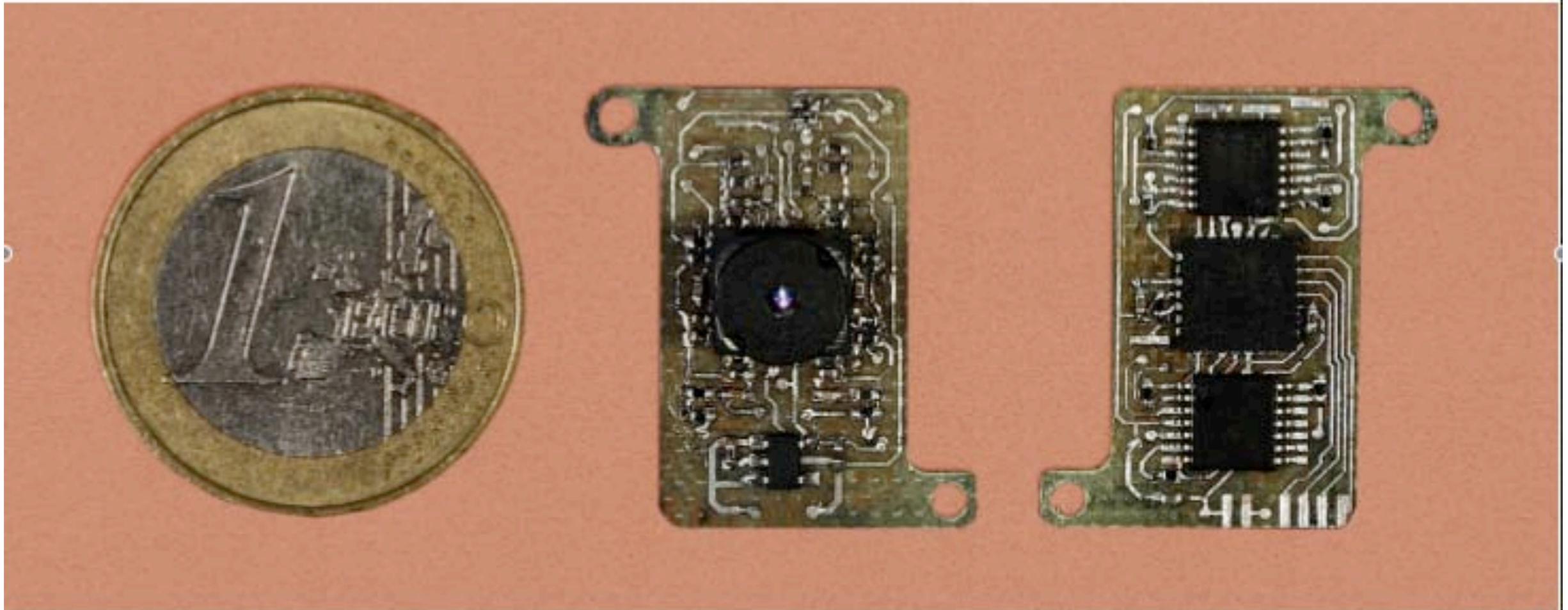


version 1989 (5 g)



version 2005 (0,2 g)

Micro-capteur de flux optique de 1 gramme



Micro-carte EVA basée sur le LSC équipé de son objectif

Roubieu, Ruffier, Expert, Boyron, Viollet (in prep)

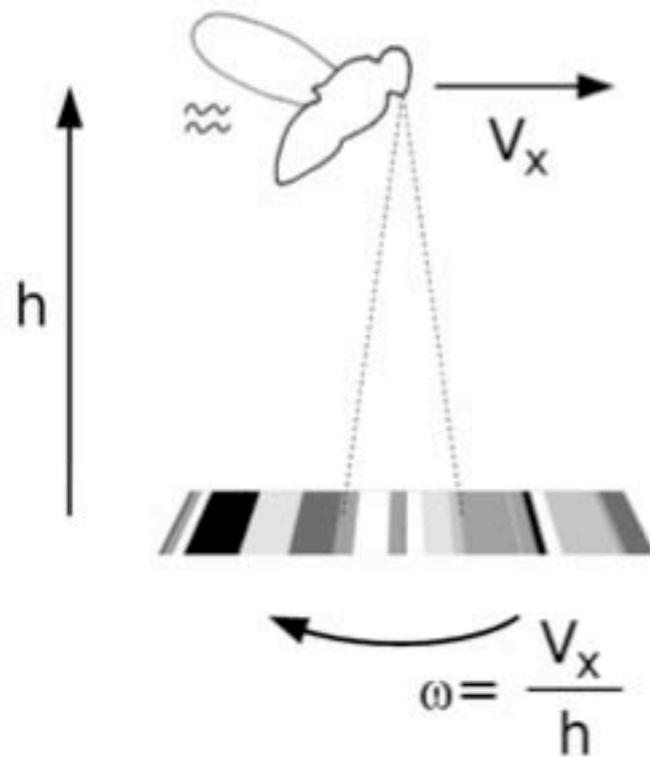






Translational optic flow

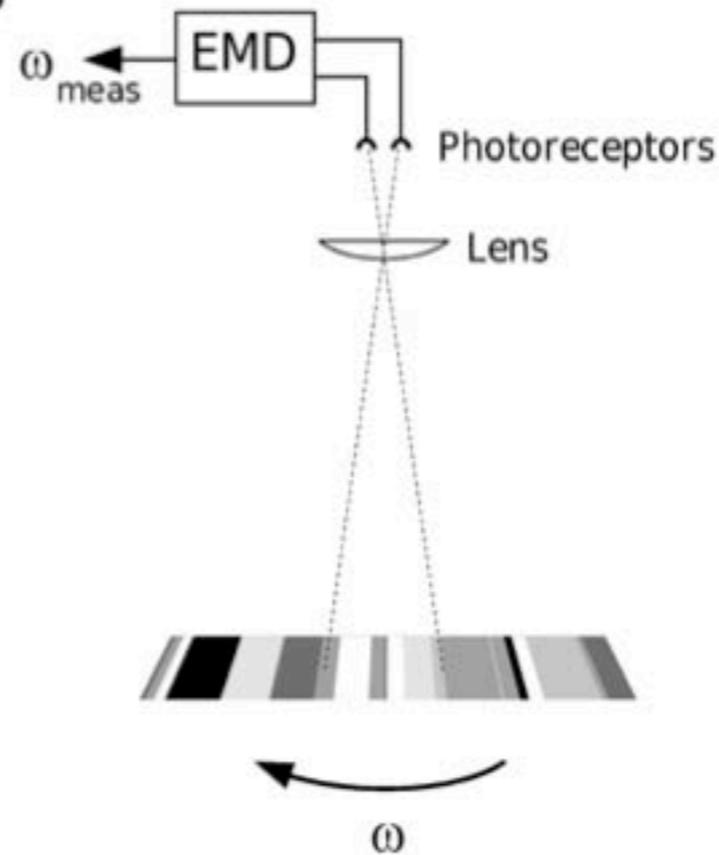
A



Generation of a sweeping ground speed (ventral Optic Flow)(°/s)

July 19 - 2010

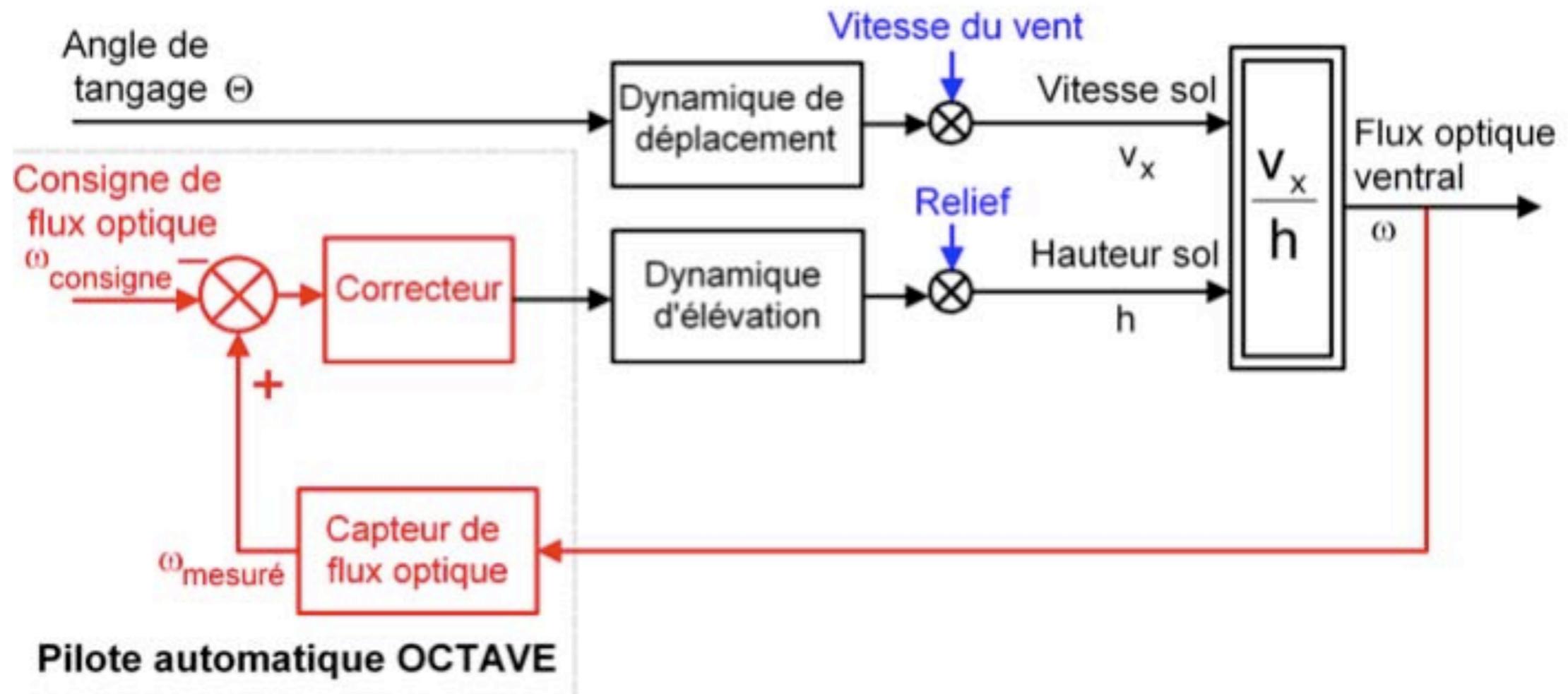
B



Measurement of the ventral Optic Flow (°/s)

Franceschini, Ruffier, Serres 2007

5.

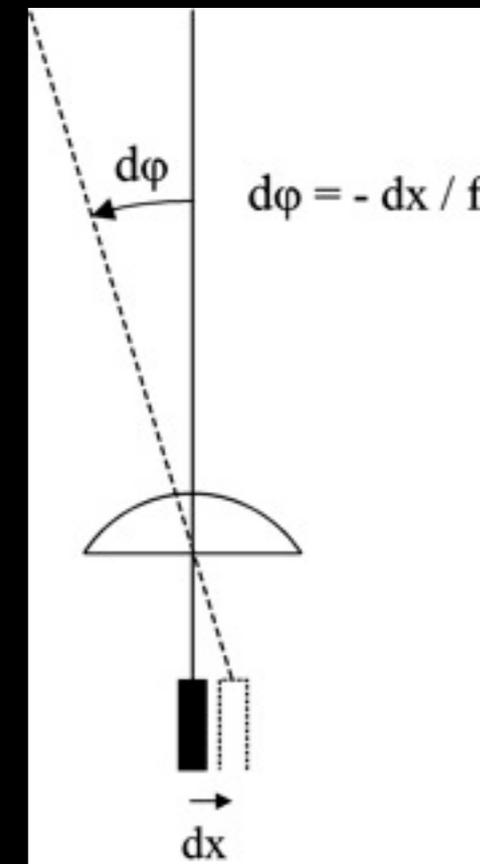
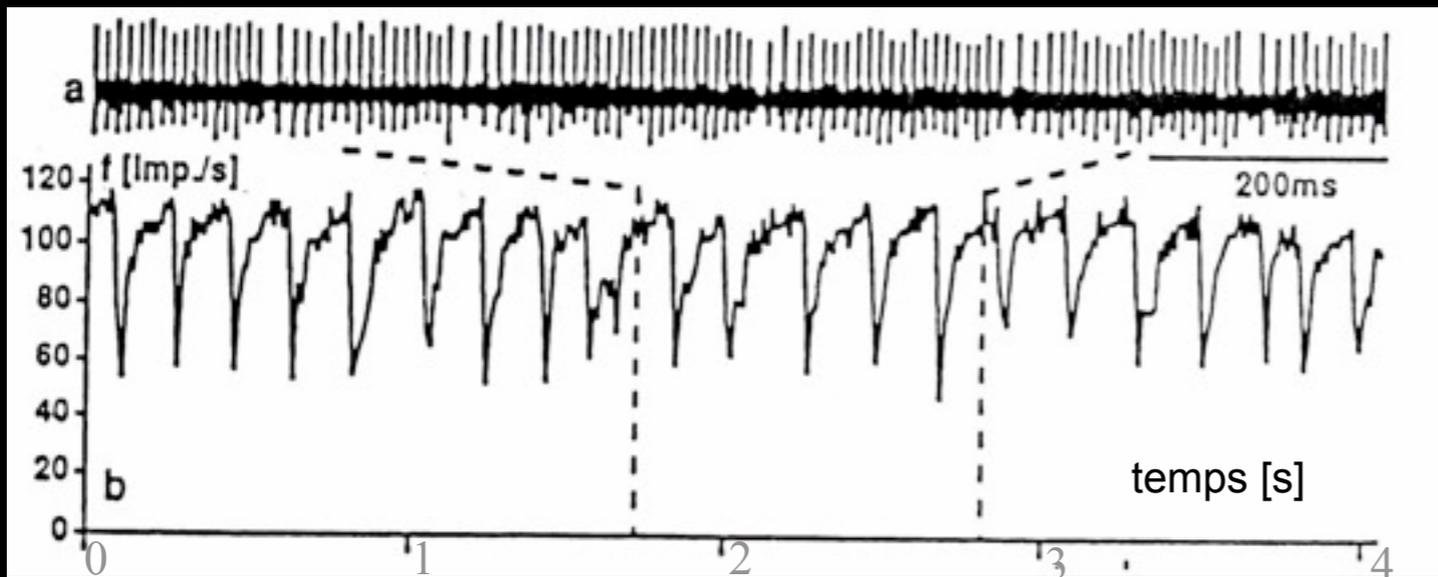
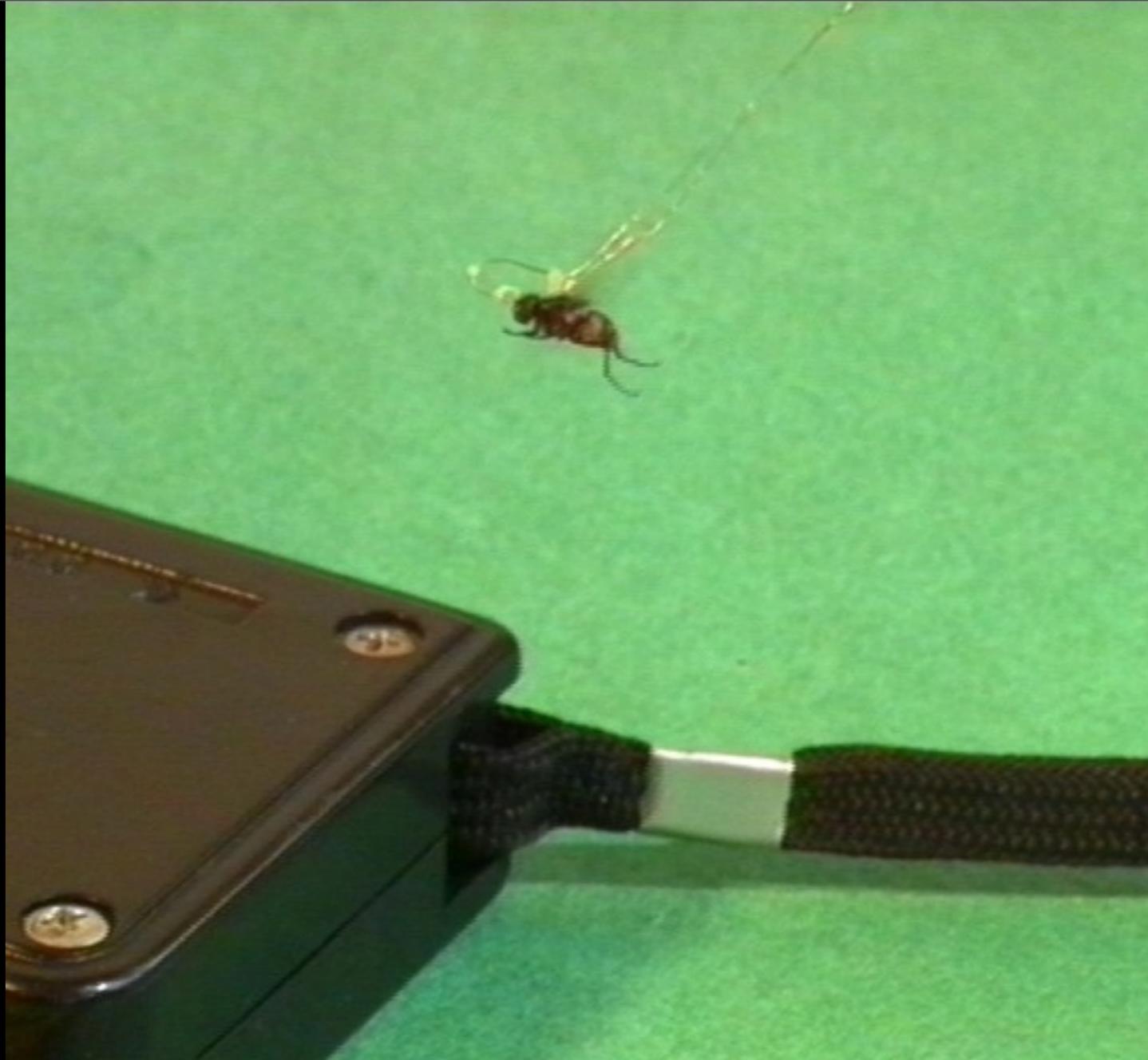


CNRS Equipe Biorobotique

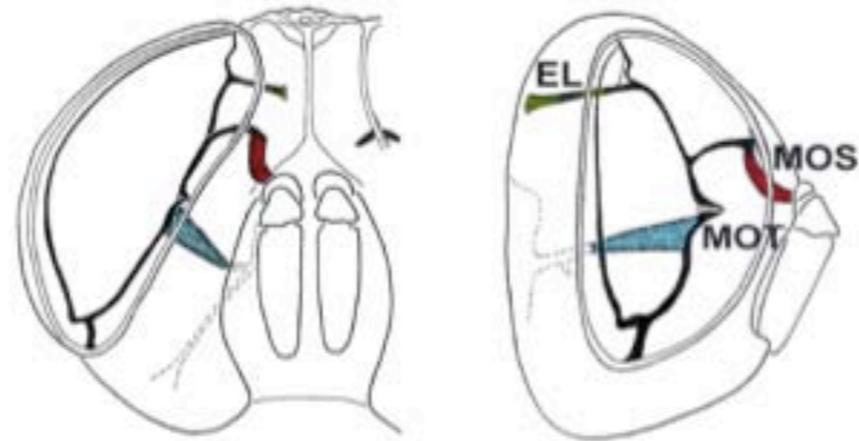
Laboratoire Mouvement et Perception

Marseille

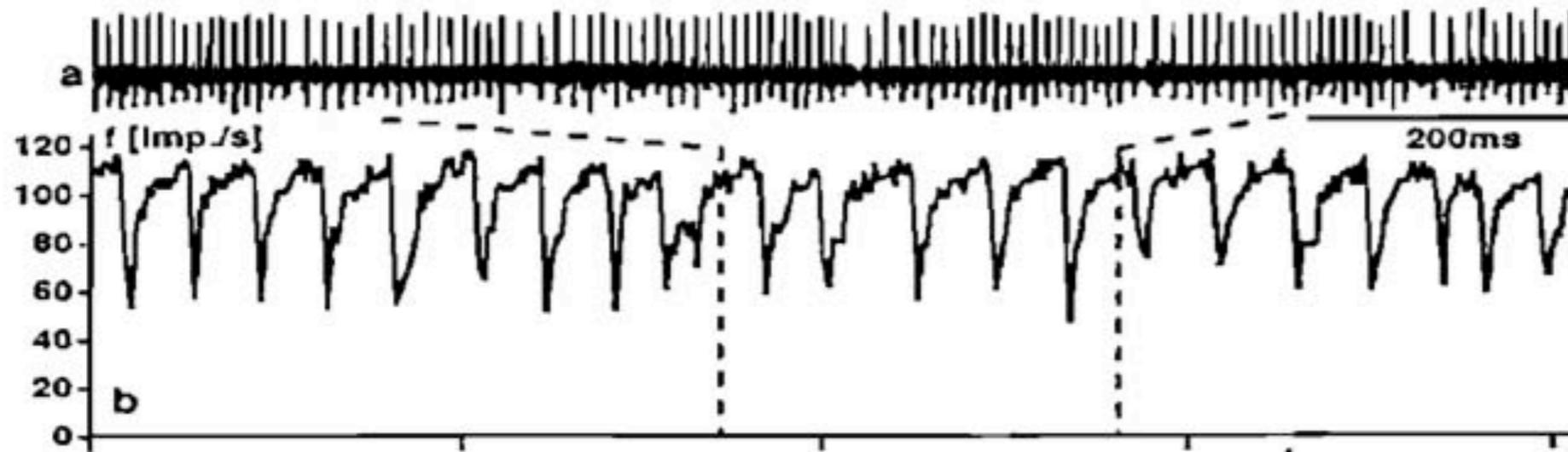
« Enregistrement en vol »



Vibrating retinæ of the fly

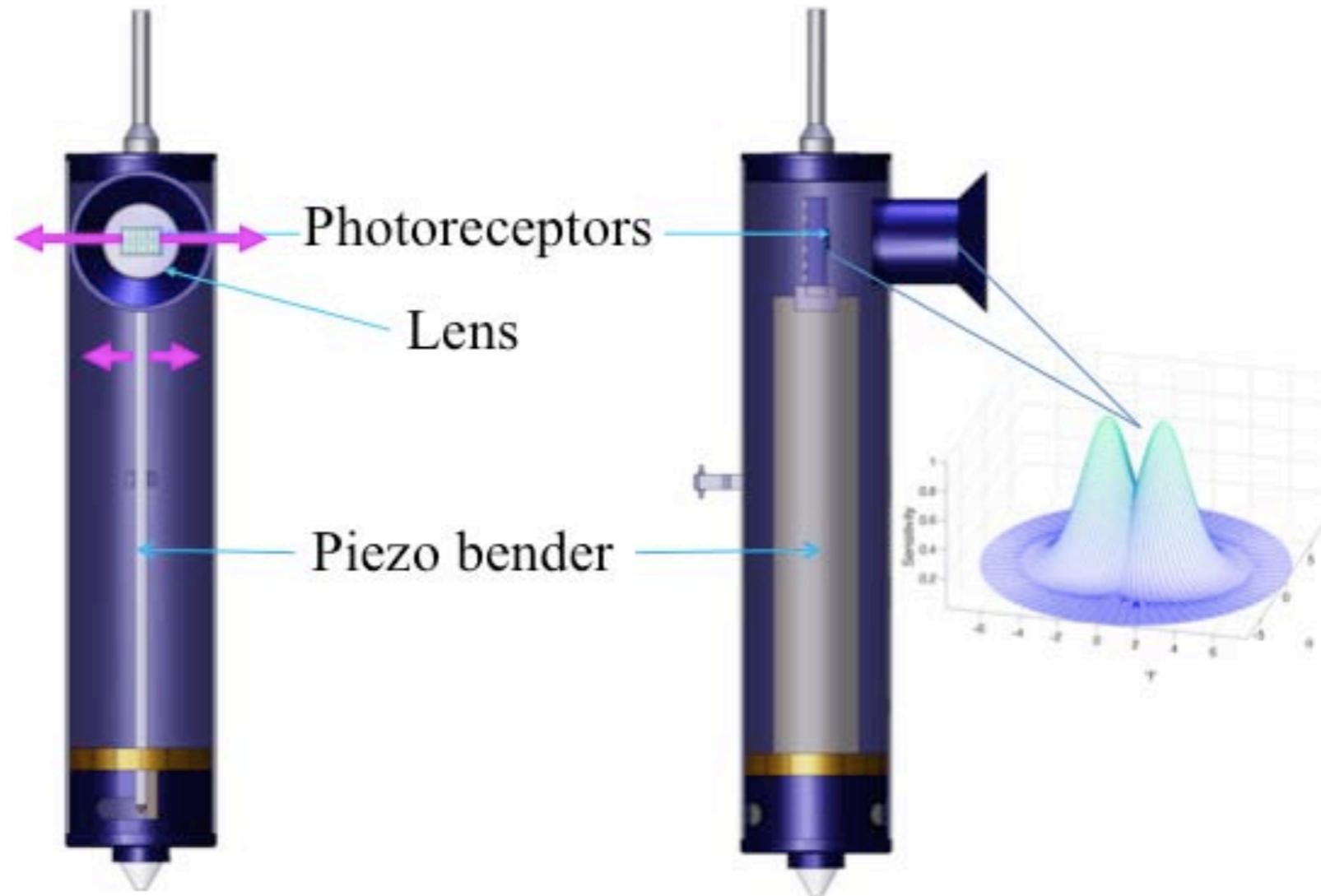


Mücke, Franceschini (1991)



Franceschini, Chagneux (1997)

Vibrating retina of a sensor



Viollet and Franceschini (2004)

OSCAR 2 ROBOT

