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Biocompatible flexible photosensors based on 2D materials and crystalline organic semiconductors

2nd Cycle Integrated Project - MEFT

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Vision degeneration

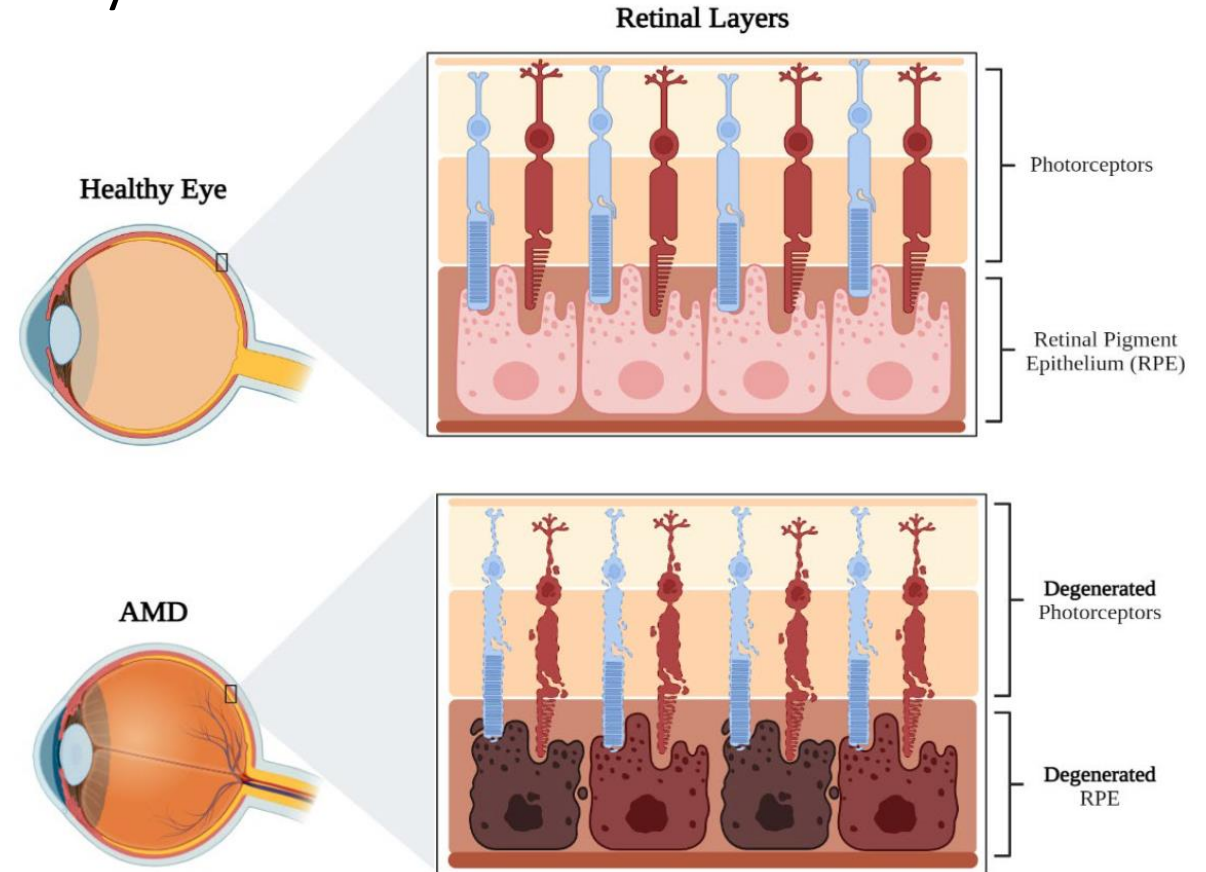


Vision relies on the natural photoreceptors in the eye.

Diseases (e.g. Age-Related Macular Degeneration) lead to the **degeneration** of the natural **photoreceptors**.

Possible Solution

Implantation of artificial photodetectors in the retina.



S. Rao and J. Eliason, Journal of Student Research, 2022

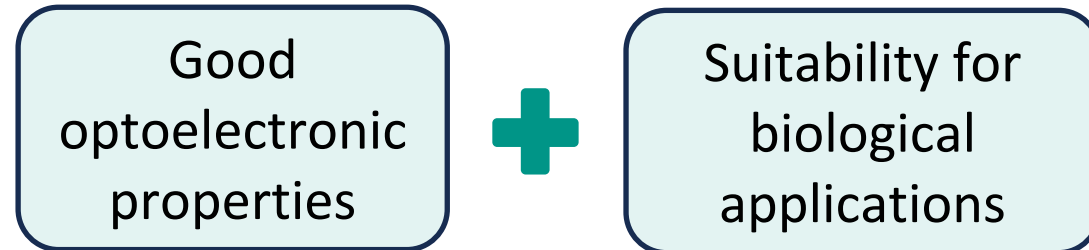
Proposal



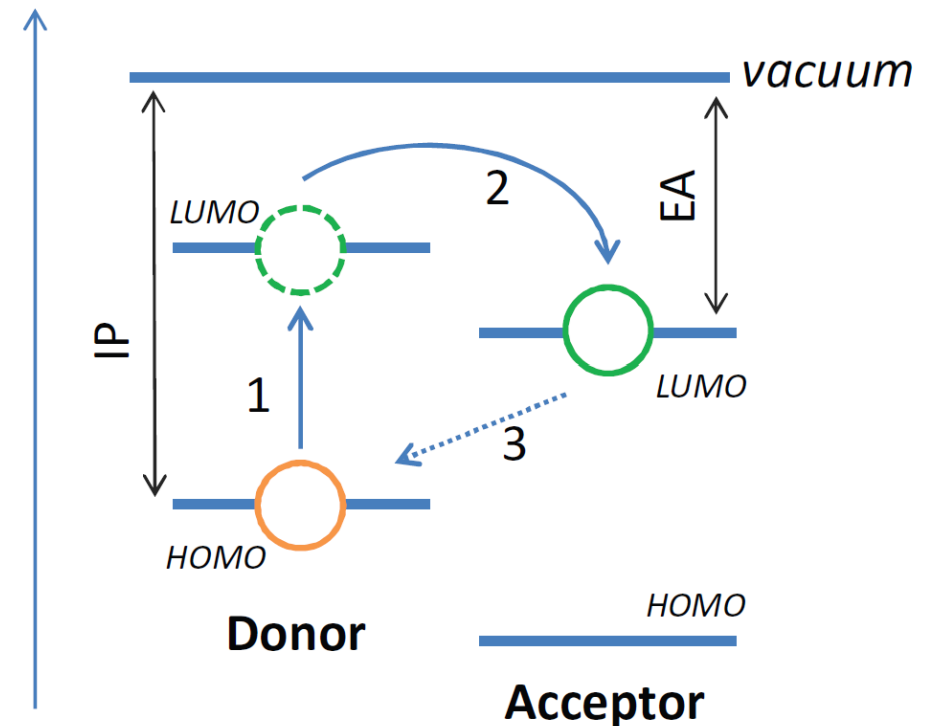
Proposal: fabrication and characterization of **photodetectors** based on three **organic semiconductor** materials.

Focus: efficient **photoabsorption** and **photogeneration**, **color** sensing.

Organic semiconductors combine



Photocurrent generation is **enhanced** by **D/A interfaces**, which promote exciton **dissociation**.



K. J. Baeg *et al*, *Advanced materials*, 2013.

Proposal – experimental steps



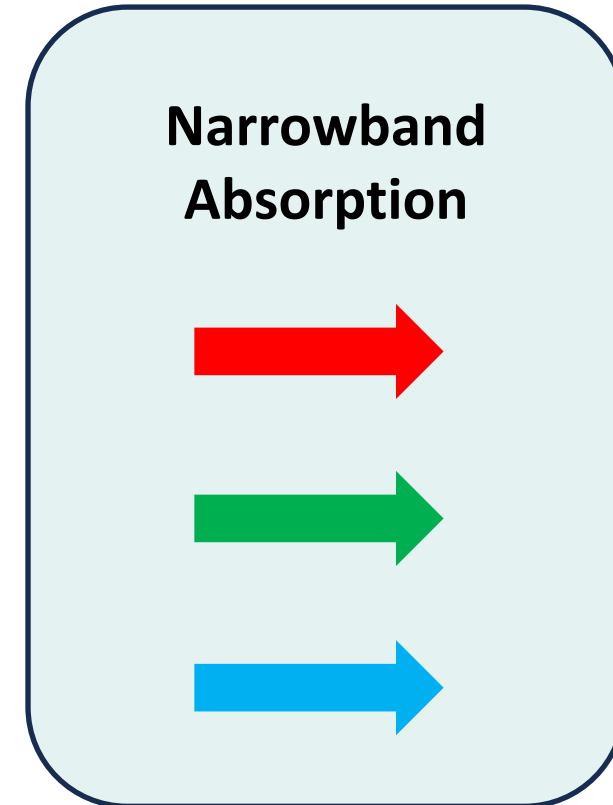
1: Selection of 3 narrowband organic semiconductor materials

2: Single crystal growth, using Physical Vapor Transport

3: Photosensor fabrication:

- 3.1.** Single layer detector
- 3.2.** Individual **photodiodes**
- 3.3.** Photodiodes in **stacked** structure or **pixel** array

4: Optical characterization



Proposal – experimental steps



1: Selection of 3 narrowband organic semiconductor materials

2: Single crystal growth, using Physical Vapor Transport

3: Photosensor fabrication:

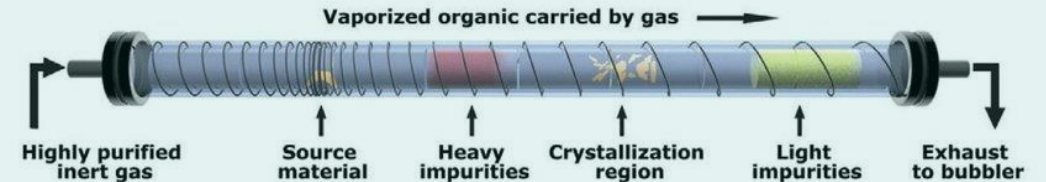
3.1. Single layer detector

3.2. Individual photodiodes

3.3. Photodiodes in stacked structure or pixel array

4: Optical characterization

Physical Vapor Transport (PVT)



C. Reese and Z. Bao, Materials Today, 2007

Proposal – experimental steps



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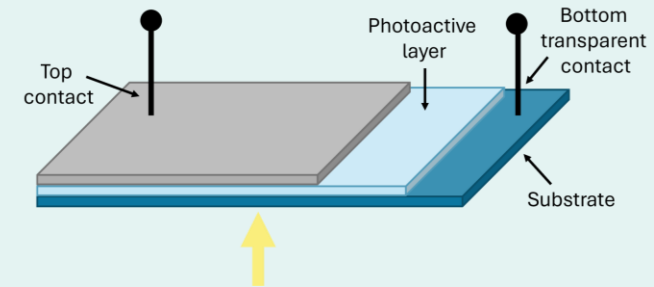
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4: Optical characterization

Photodiode



Pixel array



Stacked structure



Proposal – experimental steps



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3: Photosensor fabrication:

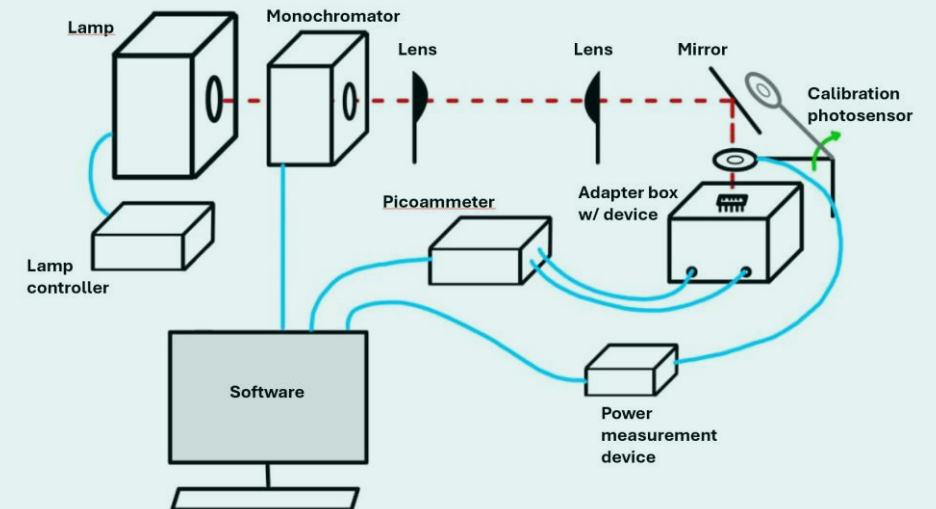
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3.2. Individual photodiodes

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4: Optical characterization

Optical characterization setup



Thank you!