PUMRS

Materials Today

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PRISM

Bacteria prompt a new look at the dynamics of collective behavior

Mar. 24, 2022 | Tom Garlinghouse | Princeton News, Department of Physics

Caring for the less fortunate for the collective good is a common survival strategy across animal species, including humans. However, this behavior was observed in E.coli cells in a hydrogel matrix by a team of researchers led by Professor Sujit Datta. In their work published on *eLife*, the researchers describe how bacteria populations remain well-organized when subjected to obstacles and maneuver to promote an equal share of limited nutrients when presented with incentives.

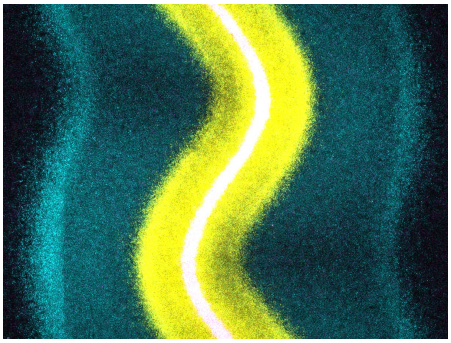


Photo derived from Princeton Engineering News and provided by Sujit Datta

Specifically, cells closer to the nutrients moved slower while the ones farther behind moved fast. The initial squiggled line formation smoothed out. The smoothing movement was first attributed to random movement by diffusion, yet the timescale was unreasonable as the spread was fast. Much of what the researchers learned from this profound research is countering the idea of maximizing individual survival. The team is hoping that their work will motivate others to study this phenomenon of collective migration in other contexts.

Read more on Princeton Engineering News
Read more on eLife

PUMRS Highlight

March 25 - Jammin' Crepes Study Break

Hao Nghi Luu 23' (left), Hee Joo Choi (middle), Stanley Cho 23' (right)

The study break was organized by Stanley Cho, Loren Ormënaj, Yaxin Duan, Hao Nghi Luu, Zihan Lin, Francesca DiMare, and Bridget Denzer. We welcomed a total of 17 participants including undergraduate and graduate students! "I think the study break went really well! I remember that two graduate students sat at my table and my friends and I asked them a lot of questions about graduate school." PUMRS President Hao Nghi Luu said. "We also want to host a movie night with everyone's favorite drinks from Junbi's and Kungfu Tea before the semester ends!"

Notes From the Editor:

Welcome to the fourth edition of the PUMRS newsletter, *Materials Today*. For the past three months, our team has been experimenting with different designs for the newsletter. For this issue, we adopted a new monochromatic design that will be the future theme of *Materials Today*. Additionally, the newsletter will also be uploaded on to the PUMRS webpage every month.

The Princeton Institute of Materials Symposium is right around the corner (Wed. April 6)! Be sure to register for this fantastic event organized by the PRISM staff and faculty.

I would like to thank everyone who contributed to the content of this issue. Please feel free to contact me and provide feedback on our current design.

— Zihan Lin

Upcoming deadlines:

- **April 15th** - Summer 2022 Opportunity in Transportation Systems Research focused on Smart Driving Cars - see information sent by Traci Miller!
- **May 19th** - Funding for unpaid summer projects internships with nonprofits
- American Physical Society (APS) Student Ambassador Program

Materials News

A fabric that "hears" your heart's sounds

Mar. 16, 2022 | Jennifer Chu | MIT New Office

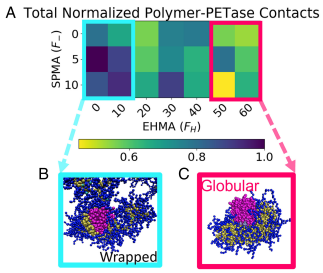
Imagine if your shirt could check your heart rate, or even take your phone calls. New research led by Wei Lan of the Massachusetts Institute of Technology on acoustic fibers has sparked ideas for wide-ranging applications. The team wove a flexible piezoelectric fiber into a fabric that bends in response to nanoscale vibrations. This bending creates a current in the fiber to allow the researchers to read in sound as electrical signals. The team thinks their fabrics could be used in a wide range of applications from detecting cracks in buildings, to collecting data about space dust hitting rockets, and even as microphones for our phones.

Read More on Nature

Upcyling polyester could reduce plastic waste

Mar. 21, 2022 | Northwestern University | ScienceDaily

Researchers at Northwestern University have developed a method to aid enzymes in breaking PETs down into monomer units, opening up a way for more efficient upcycling of plastics and reducing plastic wastes. PETase is an enzyme known to be able to break down PETs, but PETase unravels and becomes ineffective at high temperatures, which is a condition needed to melt PETs. Now, the Northwestern University-led team has turned to synthesize a different polymer that could encapsulate and protect the enzymes from high temperatures while still allowing the enzymes to break down PETs. The polymer is synthesized using free radical polymerization and consists of a hydrophobic backbone and a calculated amount of negative charge to ensure the polymer can wrap around the PETase surface without dissolving it.



Derived from PNAS: Functional enzyme–polymer complexes

Read More on Proceedings of the National Academy of Sciences

Biodegradable implant could help doctors monitor brain chemistry

Mar. 22, 2022 | Penn State | ScienceDaily

Neurotransmitters, chemicals that send signals between neurons, are useful for monitoring the brain's condition, especially concerning degenerative brain diseases. However, it is difficult to gather this data, seeing as it would require the implementation of an implant, which necessitates two surgical operations–one to insert it, one to remove it. In response, researchers at Penn State have developed and tested a silicon-based implant with a transition metal dichalcogenides semiconductor in the basal ganglia region of mice brains, by which they detect dopamine levels. The implant is biodegradable, thus negating the need for a second procedure to remove it, and holds the potential to be implemented in human medicine.

Read More on Advanced Matter

Predicting Semiconductor Solar Cell Performance From Terahertz and Microwave Spectroscopy

Mar. 4, 2022 | Helmholtz-Zentrum Berlin für Materialien und Energie | ScienceDaily

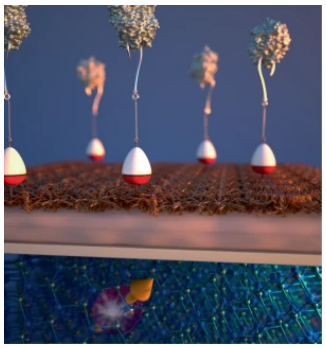
Mobility and lifetime of electrons and holes are critical measurements for assessing solar cell semiconductor performance. However, spectroscopic methods using terahertz or microwave radiation for measurements produce wildly different data in the literature. A team from Helmholtz-Zentrum Berlin für Materialien und Energie delved into these differences. They sent reference samples of perovskite semiconductor compound $(Cs,FA,MA)Pb(I,Br)_3$ to 15 international laboratories for measurements. The results were significantly more precise. The findings will greatly benefit the solar cell community as they allow for more accurate predictions of solar cell performance and the identification of flaws.

Read More on Advanced Energy Materials

Quantum sensing goes bio

March 22, 2022 | The University of Chicago | Nature

Quantum sensors gather detailed information about biological processes. Although quantum sensors are more sensitive and have a greater scope than current biophysical and biomedical methods, difficulties arise in the need for an interface that is compatible with and facilitates the interaction between the quantum sensors and the biological subject. By layering diamond, Al2O3, and polyethylene glycol, researchers at the University of Chicago have developed an interface under 5 nm in a thickness suitable for quantum sensor functionality. This interface retains its stability under physiological conditions and successfully enables precise tethering of biomolecules to quantum sensors.



Derived from Nature Reviews Materials
Photo Credit: P.C. Maurer

Read More on Nature Reviews Materials

Enhancing the electromechanical behavior of a flexible polymer

Mar. 24, 2022 | Penn State | ScienceDaily

Researchers at Penn State have developed a polymer with robust piezoelectric effectiveness that had not been achieved previously. Piezoelectric materials are used to convert mechanical stress into electricity, but using polymers as piezoelectric materials has not been efficient. The researchers at Penn State have successfully synthesized a piezoelectric polymer by doping and stretching the polymer that achieves 70% efficiency in electricity generation. Flexible piezoelectric polymers can find applications in medical imaging, underwater hydrophones, and pressure sensors.

Read More on Science

PRISM Seminar

- Apr. 13, 2022, 12:00 pm—1:00 pm (Registration Required)- "**Mechanics-Guided 3D Assembly of Complex Mesostructures and Functional Devices**"
- Apr. 18, 2022, 12:30 pm—1:30 pm - "**Putting the Squeeze on Phase Separation**"
- Apr. 20, 2022, 12:00 pm—1:00 pm - "**Coupling Formulation and Processability for the Design and Manufacture of Polymeric Materials**"
- Apr. 27, 2022, 12:00 pm—1:00 pm - "**Chemically Controlled Shape-morphing of Elastic Sheets**"

2022 PRISM Symposium (April 6) open for registration

Source: PRISM

Registration opened for the 2022 MRS Exhibit!

Source: MRS