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Ultra-thin Heteroprotein Films

Scientists from the Institute of Advanced Study in Science and Technology (IASST) have developed ultra-thin monolayer heteroprotein films.

- **Formation** - These ultra-thin heteroprotein films were usually developed from bulk solutions.
- In the above-mentioned study, the ultrathin **monolayer** protein films were developed consisting of two **globular proteins**:
    1. Bovine serum albumin (BSA) and
    2. Lysozyme (Lys).
- This is the first time **Langmuir-Blodgett (LB) technique** was used to produce these films, which gives the films the thickness in nanometer.
- As a result of **electrostatic attraction** & **hydrophobic interactions** between the two proteins, a complex was formed at **pH of 9.2.**
- This monolayer complex was formed at the **air-water interface**, which was later transferred to the silicon substrates.
- **Advantages** - These soft heteroprotein films of the BSA and Lys are more **flexible** than other protein or plastic films.
- These films can be used to **fabricate highly stable biodegradable thin films** of different protein complexes for expanding its applications in the area of thin-film technology.
- The monolayers at the air-water interface can hold its **intrinsic structure for a sufficiently longer time period** due to the complexation forming a highly stable film.
- These films have an excellent **thermal**, **mechanical** and **pH stability**.
- So, they can pave the way for expanding applications of thin films in biomedical and food packaging industries.
- To make the protein film free standing for diverse applications, diverse physicochemical methods such as
    1. Parameter alteration or
    2. Incorporation of different fatty acids or polyol moieties (glycerol, starch, gelatin, etc.) into this complex can be done.

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Prithvi-II

A successful training launch of Prithvi-II was carried out from the Integrated Test Range, Chandipur, Odisha.

- Prithvi-II is a **surface-to-surface Short-Range Ballistic Missile.**

- This **single-stage** missile powered by **liquid propulsion twin engines** is capable of carrying 500-1,000 kg of warheads.
- It uses advanced **inertial guidance system** with manoeuvering trajectory to hit its target with a very high degree of precision.
- It was India's first indigenous ballistic missile developed in 1983.
- It was inducted into the armory of Indian defence forces in **2003**.
- Prithvi is the **first missile** to have been developed by the Defense Research & Development Organization (**DRDO**) under the **Integrated Guided Missile Development Programme** (IGMDP).

Integrated Guided Missile Development Programme

- Integrated Guided Missile Development Programme (IGMDP) was a Ministry of Defence programme to **research and develop missiles**.
- The project was started in 1982–1983 under the leadership of Dr APJ Abdul Kalam. It accomplished its design objectives by **2012**.
- The Defence Research and Development Organisation (DRDO) and erstwhile Ordnance Factories Board (OFB) managed the programme with other Indian government political organizations.
- After India test-fired the Prithvi missile (1988), the Missile Technology Control Regime (MTCR) decided to restrict access to any technology that would help the Indian missile development program.
- [The MTCR group, which was then an informal group, was formed in 1987 by the G-7 industrialized countries.]
- To counter the MTCR, the IGMDP formed a consortium of DRDO laboratories, industries and academic institutions to build the sub-systems, parts and materials for the missiles.

Five Missiles developed under the IGMDP	
PRITHVI	Short range surface-to-surface ballistic missile India's first indigenous ballistic missile
AGNI	Medium to intercontinental surface-to-surface missile Backbone of India's land-based nuclear deterrent
TRISHUL	Short range low-level surface-to-air missile
AKASH	Surface-to-air missile with multi-target handling system
NAG	3rd generation "fire & forget", "top attack" anti-tank missile

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Asian and Pacific Council

The 7th ministerial conference of the Asian and Pacific Council (ASPAC) was concluded emphasising the peaceful and non-military nature of the Council.

- The Asian & Pacific Council (ASPAC) was formed in Seoul (South Korea) in **1966** by **9 non-**

Communist Asian and Pacific nations.

- It is a regional organization in the Far East and in the western part of the Pacific Ocean.
- This Council is **not a political or military** arrangement directed against other nations. But it was formed to preserve their integrity and sovereignty in die face of external threats.
- ASPAC was an organisation for regional co-operation pursuing peace and progress in the Asian and Pacific region.
- It would devote its efforts to promote co-operation in **economic technical, social, cultural, and other fields**.
- **Members** - Japan, Australia, New Zealand, Thailand, the Philippines, Malaysia, South Korea, South Vietnam, and Taiwan
- The Council has an **open door policy**, which means that the organisation has permit open membership to all non-member countries of the region, regardless of ideologies.

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Google LaMDA

An engineer at Google claimed that the company's chatbot Language Model for Dialogue Applications (LaMDA) had become "sentient".

- **Google's** Language Model for Dialogue Applications (LaMDA) is an AI-based **chatbot** that produces text in response to user input.
- It is a **generative language model** for the dialogue applications which can assure that the app will be able to converse on any topic.
- Based on the user's inputs, LaMDA can engage in a **free-flowing way** about a seemingly endless number of topics. This is possible due to its language processing model which has been trained on ample dialogue.
- **Sentience** - Becoming "sentient" means to attain sentience, or consciousness, or even intelligence.
- But, the fundamental difficulty is understanding the relationship between physical phenomena and our mental representation of those phenomena.
- This is what Australian philosopher David Chalmers has called the "**hard problem" of consciousness**.
- One common view of how consciousness can arise from physical systems is called **physicalism**.
- Physicalism is the idea that consciousness is a purely physical phenomenon. If this is the case, there is no reason why a machine with the right programming could not possess a human-like mind.
- Australian philosopher Frank Jackson challenged the physicalist view with a famous thought experiment called the '**knowledge argument'**.

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Micro-swimmers

Researchers from the Max Planck Institute for Intelligent Systems (MPI-IS) have developed micro-swimmers that use light as a fuel to move in real-body conditions.

- The micro-swimmers are microbots that can move inside a human body. They are made from the 2-dimensional compound poly (heptazine imide) carbon nitride (aka PHI carbon nitride).
- These microbots range from 1-10 micrometre in size, and can self-propel when energised by shining light.
- These microbots can be moved inside the bloodstream for intelligent **drug-delivery** that is selectively sensitive to cancer cells.

  At the microscopic level, the viscosity of water is overwhelmingly high. Any effort by the bots to push backwards and thus generate forward motion would be hindered by the high viscosity of the water.

- **Working** - The PHI carbon nitride microparticles of the micro-swimmers are **photocatalytic**.
- Like in a solar cell, the incident light is converted into electrons and holes. These charges drive reactions in the surrounding liquid.
- This reaction, combined with the particle's electric field, makes the micro-swimmers swim.
- As long as there is light, electrons and holes are produced on the surface of the swimmers, which in turn react to form ions and an electric field around the swimmer.
- These ions move around the particle and cause fluid to flow around the particle. So this fluid flow causes the micro-swimmers to move.
- With light, we not only **move the microbots** but can **direct their motion towards a specific goal**.
- The ions move from the bright surface of the micro-swimmer to the rear end. The diffusion of the swimming medium in one direction propels the micro-swimmer in the opposite direction.
- The particles are nearly spherical, and the incident light illuminates one-half of the sphere, leaving the other dark.
- As photocatalysis is light-driven, it occurs only on the brightened hemisphere. As the ions move from the bright side to the dark side, micro-swimmers march towards the direction of the light source.
- **Drug delivery** - In addition to transporting salt ions from the fluid, the voids and pores on the microparticles worked as cargo bays and could soak up large amounts of drug.
- By changing the pH of the solution or by triggering it with light, the drug release could be activated.
- **Treating Cancer** - The material also has an intelligent charge-storage property to store electrons when light is present.
- The environment of cancer cells is characterised by low oxygen.
- The stored electrons are sensitive to it. We use that to deliver drugs, targeting the cancer cells.

  In 2021, researchers at Cornell University developed a type of "micro-swimmer" that's powered by **ultrasound waves**.

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