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1. RaIDer-X: Explosive Detection Device

Why in News?

An **explosive detection device, RaIDer-X,** was unveiled at the National Workshop on Explosive Detection (NWED-2020) in Pune (Maharashtra).

- The Workshop was organized by the **High Energy Materials Research Laboratory (HEMRL), Pune**.

Key Points

- RaIDer-X has been **co-developed by HEMRL, Pune and the Indian Institute of Science, Bangalore.**
- RaIDer-X has the capability to detect 20 explosives within a distance of about 2 metres.
    - Bulk explosive in concealed condition can also be detected by the device.
- The data library can be built in the system to expand its capability to detect a number of explosives in pure form as well as with the contaminants.
- **Significance**
    - RaIDer-X are important in thwarting the threat from homemade explosives, which have been used in the recent terrorist attacks.
    - The device has **various applications** including narcotics, for local police, for customs and other detection agencies who need to detect various elements which may be explosive or non-explosive in nature.

High Energy Materials Research Laboratory(HEMRL), Pune

- HEMRL Pune is a **premier laboratory of the Defence Research and Development Organisation (DRDO.)**
- It is involved in basic and applied research in the area of **high energy materials.**
- It provides a platform to scientists, technocrats and users to share knowledge, experience and updated information on the technological advancements made in the recent past.
- In 1963, it was placed under DRDO control as a full-fledged R&D laboratory.

High Energy Materials

- They are compounds which store chemical energy.
- Such materials, on stimulation by mechanical, thermal or electrical devices, undergo rapid decomposition giving out heat, light, sound and large volumes of gases.
- The amount of energy released varies with the properties of the material

such as composition, structure, density, heat of formation and decomposition, etc.

- **Examples:**
  - Propellants used in rockets,
  - Pyrotechnics used in festivities,
  - Explosives used for military purposes,
  - Blasting chemicals used in construction activities, etc.

2. Ink to Curb Fake Printing

Why in News?

Council of Scientific and Industrial Research (CSIR) - National Physical Laboratory has developed a bi-luminescent security ink which glows in red and green colours when illuminated.

Key Points

- Scientists from CSIR-National Physical Laboratory have come with a security ink which can prevent fake printing of passports and counterfeiting of currency notes.
- The formulation can be used to check the authenticity of passports, Government documents, tamper evident labels, identity cards, etc.

CSIR (Council of Scientific and Industrial Research)

- CSIR was established by the Government of India in September 1942 as an autonomous body.
- It is known for its cutting edge R&D knowledge base in diverse S&T areas.
- Council of Scientific and Industrial Research (CSIR) has been ranked first in the Nature Ranking Index-2020.
- The Nature Index provides a close to real-time proxy of high-quality research output and collaboration at the institutional, national and regional level.

3. Endophytic Actinobacteria

Why in News?

Researchers at the Institute of Advanced Study in Science and Technology (IASST) Guwahati have discovered plant-growth-promoting and antifungal properties of Endophytic Actinobacteria, which can be helpful for tea plants.

- The Institute of Advanced Study in Science and Technology (IASST), Guwahati is an **autonomous institute** under the Department **of Science & Technology.**

Key Points:

- Endophytic actinobacteria have the potential to exhibit multiple growth-

promoting traits that positively influence tea growth and production and can hence be used in the management and sustainability of tea crops.

- Application of endophytic actinobacteria could reduce the need of chemical inputs in tea plantations.
- In recent years, due to higher demand of chemical residue-free made tea by the importing countries, the export of Indian tea has declined.
- The use of endophytic actinobacteria on tea plantations is expected to benefit the Indian tea market.

4. Indigenously Developed Flow Diverter Stents

Why in News?

The research team of Sree Chitra Thirunal Institute of Medical Science and Technology (SCTIMST) has developed an innovative intracranial flow diverter stent.

- SCTIMST, Thiruvananthapuram, is an Institute of National Importance under the Department of Science and Technology.

Key Points

- Flow diverter stents are used for the treatment of aneurysms of the blood vessels of the brain.
    - Brain aneurysm is also known as Intracranial aneurysm.
    - Intracranial aneurysm is a localised ballooning, bulging or dilation of arteries in the brain, caused by progressive weakening of the inner muscles of the wall of the blood vessels.
- Flow diverter stents when deployed in the artery in the brain bearing the aneurysms, divert blood flow away from the aneurysm.
    - It thus **reduces the chances of its rupture** from the pressure of blood flow.
    - Spontaneous rupture of the aneurysm can result in **subarachnoid hemorrhage (SAH)** which can lead to paralysis, coma or death.
- The weave shape of the designed stent makes it **resistant to kinking or twisting** when it is placed in complex-shaped arteries.
- Currently, **the flow diverter stents are imported** and are not manufactured in India.
- The availability of indigenous technology will help to manufacture these stents at a much lower price within the country.
- It is made up of **Nitinol, a superelastic alloy with shape memory** acquired from National AeroSpace Laboratories, Bengaluru (CSIR-NAL).
    - A shape-memory alloy is one that can be deformed when cold but returns to its pre-deformed ("remembered") shape when heated.

Nitinol

- Nitinol is a **nickel-titanium alloy** distinguished from other materials by its **shape memory and superelastic characteristics.**
- It is discovered while searching for materials that could be used in tools for dismantling magnetic mines.
- It is widely used in various kinds of industries but **majorly used in the medical industry due to its narrow temperature range.**

5. Fuel Cell Technology for Disaster Management

Why in News?

- International Advanced Research for Powder Metallurgy & New Materials (ARCI), has developed Polymer Electrolyte Membrane fuel cells (PEMFC).
    - ARCI is an autonomous R&D Centre of the Department of Science and Technology (DST) located at Hyderabad.

Polymer Electrolyte Membrane Fuel Cells

- PEMFC converts the chemical energy stored in hydrogen fuel directly and efficiently to electrical energy with water as the only byproduct.
- These cells work without grid power as required by conventional battery backup systems.
- These cells can operate at low- temperature, energy efficient, emit less pollutants.

Key Points

- ARCI has developed in-house PEMFC systems in the power range of 1 to 20 kiloWatt (kW) for Disaster Management
- ARCI is planning to set up a PEMFC system at Tamil Nadu State Emergency Operation Centre (TN SEOC) as a disaster management measure.
    - Tamil Nadu is generally affected by five to six cyclones every year, of which two to three are severe and is followed by frequent power cuts.
- In general Emergency Operation Centres (EOC) backed with 10 kW systems is being planned as a natural disaster management measure.
    - An emergency operations center (EOC) is a central command and control facility responsible for carrying out the principles of emergency preparedness and emergency management, or disaster management.

6. ICONSAT 2020

Why in News?

- The International Conference on NanoScience and NanoTechnology (ICONSAT) is being held at Kolkata focusing on the recent advances in this frontier research field.
    - ICONSAT is a series of biennial international conferences.
    - It is under the aegis of Nano mission, Department of Science and Technology.

Key Points

- The event emphasised on 5Ms – Mechanical, Material, Machines, Manufacturing and Manpower, and integration of these 5 Ms with nano-science and technology.
- It also aimed to integrate nanotechnology with sustainable development and new technology.
- It emphasized the need to create a network of experts in nano-science and to collaborate the knowledge across sectors like energy, agriculture, transport, health.
- It also aims to provide a potential platform for young researchers and students from within the country and abroad to keep pace with the latest development in the emerging areas of Nano Science and Technology.

Nano Mission

- The Nano Mission was launched in 2007 by the Ministry of Science and Technology.
- It is steered by a Nano Mission Council chaired by an eminent scientist.
- It is an "umbrella capacity-building programme".
- **Objectives**
    - Basic research promotion
    - Infrastructure development
    - Nano applications and technology development
    - Human Resource development
    - International collaboration

Significance of Mission

- The Nano Mission has established national dialogues to promote R&D in the development of standards for nanotechnology.
- India's rank improved from 4th to the 3rd position in scientific publications in nanoscience and technology as a result of efforts under the Nano Mission.