

## SnT PYQs

12 December 2021 15:20

What are the R&D achievements in applied biotech? How will these achievements help to uplift the poorer sections of the society? (15, 2021)

Intro	
Body	
Conclusion	

The Nobel Prize in Physics of 2014 was jointly awarded to Akasaki, Amano and Nakamura for the invention of Blue LEDs in 1990s. How has this invention impacted the everyday life of human beings? (15, 2021)

Intro	
Body	
Conclusion	

Intro	
Body	
Conclusion	

1. What do you understand by nanotechnology and how is it helping in health sector? (10, 2020)

Intro	- Nanotechnology = technology dealing with materials that has at least one dimension at the scale of nanometre ( $10^{-9}$ m), at which significantly different properties are exhibited due to the dominance of quantum physics rather than classical Newtonian.
Body	<p><u>Nanotech in health sector</u></p> <ul style="list-style-type: none"> <li>- Disease Diagnosis</li> <li>- Treatment -- tissue engg</li> <li>- Drug delivery -- through active agents in the body</li> <li>- Nano-pharmaceutical -- nanotech + pharma + biomedical science for targeted drug delivery</li> <li>- Medical nanorobot - navigate human body, transport imp molecules, manipulate microscopic objects, communicate w/ physicians</li> <li>- Key to stopping superbugs and AMR</li> </ul> <p><u>Challenges</u></p> <ul style="list-style-type: none"> <li>- May disrupt cellular, enzymatic and other organ related function</li> <li>- Info asymmetry</li> <li>- Lack of infra and human resources; poor lab-firm integration</li> <li>- High costs of tech + IPR challenges</li> <li>- Governance issues due to multidisciplinary nature</li> <li>- Ethical consequences -- privacy, use in warfare...</li> <li>- Effect on developing and underdeveloped countries</li> </ul>

Conclusi on	
<p>? Doubt here -- is it okay to mention challenges when it is not asked for specifically; esp when we don't have adequate points supporting demand of the question</p>	
<p>Status of Nanotech in India</p> <ul style="list-style-type: none"> <li>- 3rd in no. Of researchers after China, USA</li> <li>- 2007: Mission on Nano Science &amp; Technology by DST</li> <li>- ASSOCHAM study: India expected to contribute 25% of 2mn reqd professionals from 2015 onwards</li> </ul>	
<p><b>2. How is science interwoven deeply with out lives? What are the striking changes in agriculture triggered off by the science-based technologies? (10, 2020)</b></p>	
Intro	-
Body	<p><u>Interweaving of science in our lives</u></p> <ul style="list-style-type: none"> <li>- Basis of Industrial revolution</li> <li>- Necessities</li> <li>- Understanding simple and complex phenomena</li> <li>- Inventions to ease life</li> <li>- Modern IT</li> <li>- Nanotech, quantum computing</li> <li>- Navigation</li> </ul> <p><u>Agri &amp; Science</u> (present this as change -&gt; brought about by these scientific endeavours)</p> <ul style="list-style-type: none"> <li>- HYV seeds - increase productivity</li> <li>- Fertiliser</li> <li>- Soil testing -- for appropriate crop choice and nutrient inputs</li> <li>- GM crops -- decrease vulnerability to pest attacks</li> <li>- Food processing -- increase shelf life</li> <li>- Technology for harvesting -- reduce wastage, improve yield, reduce labour requirement</li> <li>- Food fortification</li> <li>- Extension services</li> <li>- Remote sensing + satellites -- weather prediction, aerial surveys</li> <li>- Role in animal husbandry <ul style="list-style-type: none"> <li>• Artificial insemination</li> <li>• Genetic improvement of breeds</li> <li>• Increase nutritional quality of milk, poultry</li> </ul> </li> <li>- Role in fisheries <ul style="list-style-type: none"> <li>• Scientific mgmt of breeds, __</li> </ul> </li> </ul>
Conclusion	
<p><b>3. COVID-19 pandemic has caused unprecedented devastation worldwide. However, technological advancements are being availed readily to win over the crisis. Give an account of how technology was sought to aid management of the pandemic. (15, 2020)</b></p>	
Intro	<ul style="list-style-type: none"> <li>- COVID 19 - once in a century pandemic;</li> <li>- ES: lives vs livelihoods challenge</li> </ul>
Body	<p><u>Technology aiding mgmt of COVID pandemic</u></p> <ul style="list-style-type: none"> <li>- Medical - COVID <ul style="list-style-type: none"> <li>• RT-PCR for testing</li> </ul> </li> </ul>

- Vaccines
- Hydroxychloroquine to manage
- Plasma transfusion therapy
- Oxygen concentrators & low cost ventilators
- Medical - non-COVID
  - Home delivery of essential medicines eg diabetes, etc
  - Online consultation
- Livelihoods
  - Video-conferencing in WFH
- Service delivery
  - Online payment systems
  - Education
    - E-classes
- Crowd mgmt

#### Challenges

- High cost
- Poor access
- Exclusionary -- deepens existing divides (eg farmer had to sell cattle to buy phone for children's online classes)
- Poor infra base for rapid expansion
- Sudden demand spike -> scarcity of strategic elements reqd in mfg of electronic goods
- Physical distancing restrictions -> halting of domestic industry

#### Way forward

- Preparedness of infra
- Medical facilities
- Robust digital infrastructure
- Better databases for targeted support delivery

Conclusion

**4. Why is there so much activity in the field of biotechnology in our country? How has this activity benefitted the field of biopharma? (15, 2018)**

Intro

Body

Conclusion

**5. Stem cell therapy is gaining popularity in India to treat a wide variety of medical conditions including Leukaemia, Thalassaemia, damaged cornea and several burns. Describe briefly what stem cell therapy is and what advantages it has over other treatments? (15, 2017)**

Intro

- Stem cell therapy = aka regenerative medicine -- promotes repair response of diseased/ dysfunctional or injured tissue using stem cells or their derivatives

Body

Features of stem cells & stem cell therapy  
 - Stem cells = special human cells with ability to specialise into various cell types  
 - 3 types -- embryonic, adult, iPSC

Gaining popularity ??

- Increasing cord banks -- preservation of umbilical cord for stem cells
- —

Advantages

- Can treat hitherto untreatable diseases
- Help enhance growth of new healthy skin tissue
- Enhance collagen production
- Stimulate hair development after incisions or loss
- Help substitute scar tissue with newly developed healthy tissue
- Possibility of new treatment discoveries -- Alzheimer's, Parkinson's, cancer, schizophrenia, etc
- Aids understanding human growth and development processes
- Helps testing a number of potential medicines and drugs w/o carrying out any tests on human and animals
- Cure development defects \*before\* they happen

Challenges/ Limitations

- Immune rejection of donor cells by host immune system
- Ethical dilemma -- usually obtained from embryo destruction
- Limited technology -- diff to upscale
- High costs, poor accessibility
- Difficulty in finding an exact match
- Potential use in bio-weapons, WMDs

Way forward

- Infrastructure
- Increase GERD (at 0.3% rn) + increase share of medical research
- Legal framework
- International collaborations
- Utilise IndiGen database to focus on India specific diseases and work towards their treatment discovery to maximise benefit-cost ratio

Conclusion

**6. India's Traditional Knowledge Digital Library (TKDL) which has a database containing formatted information on more than 2 million medicinal formulations is proving a powerful weapon in the country's fight against erroneous patents. Discuss the pros and cons making this database publicly available under open-source licensing. (12.5, 2015)**

Intro

TKDL - The Traditional Knowledge Digital Library is an Indian digital knowledge repository of the traditional knowledge, especially about medicinal plants and formulations used in Indian systems of medicine. Completed 20 years in 2021

Body

Salient features

- Estd in 2001
- By CSIR + Dept of ISM&H Indian Systems of Medicine & Homoeopathy
- To thwart misappropriation of India's traditional knowledge
- Inspired by learnings from patent battles w/ int'l patent offices over grant of IPR on turmeric, neem, basmati rice etc

	<ul style="list-style-type: none"> <li>- Database so far available only to patent examiners through TKDL Access (Non-Disclosure Agreement)</li> <li>- Success -- 239 patent applications set aside/ withdrawn based on this</li> </ul> <p><u>Pros of open source</u></p> <ul style="list-style-type: none"> <li>- Enable new utilisations of existing knowledge</li> <li>- Promote research and quantify effectiveness</li> <li>- Systematic discovery of interlinkages b/w various systems of medicine</li> <li>- Access to common people</li> </ul> <p><u>Cons of open source</u></p> <ul style="list-style-type: none"> <li>- Misappropriations</li> <li>- Patents would be intentionally worded to escape TKDL formulations while still using the knowledge here</li> <li>- —</li> </ul>
Conclusion	Cautious approach in public availability; must be preceded by campaigning and acceptance of traditional knowledge protection measures in WTO TRIPS agreement + recognition & patenting of India's traditional knowledge c

**7. What are the areas of prohibitive labour that can be sustainably managed by robots? Discuss the initiatives that can propel research in premier research institutes for substantive and gainful innovation. 2015**

Intro	<ul style="list-style-type: none"> <li>- Robotics = how robots are designed, manufactured, programmed and used.</li> <li>- IEEE data: world's robot population had reached 4.5 mn in 2008; expected to triple by 2035</li> <li>- By 2020: automation + AI expected to reduce employee requirements in business shared-service centres by 65%</li> </ul>
Body	<p><u>Applications of robots</u></p> <ul style="list-style-type: none"> <li>- Provides organisations w/ the ability to reduce staffing costs and human error</li> <li>- Cost savings on recruitment and training + error reduction through automation of low-value tasks</li> <li>- Helpful in tasks endangering human lives/ degrading for social status <ul style="list-style-type: none"> <li>• Eg sewerage system cleaning by <u>Bandicoot</u></li> </ul> </li> <li>- Competitive edge in national security</li> <li>- Use in conflict areas for detection and safe diffusing of landmines</li> <li>- Targeted service delivery due to COVID like pandemic and lockdowns <ul style="list-style-type: none"> <li>• Eg <u>KARMI</u> Bot in Kerala -- for food and medicines to COVID patients</li> </ul> </li> <li>- Automotive industry -- largest use of robotics <ul style="list-style-type: none"> <li>• 30% increase in new industrial robots installation in 2017</li> </ul> </li> <li>- Use in electronics, food packaging, education, banking sector for routine jobs</li> <li>- In healthcare for surgeries</li> </ul> <p><u>Initiatives</u></p> <ul style="list-style-type: none"> <li>- Higher GERD</li> <li>- Industry linkage of universities to enable gaining benefits from their work</li> <li>- Industry linkage also helps in solving specific problems faced by industries</li> <li>- Make research careers more attractive</li> </ul>

- Opportunity for startups from research
  - Eg IIT Delhi has waived thesis requirements for students incubating their research product on campus
- Establish inter-sectoral linkages
- Int'l collaboration
- Collaboration w/ various public depts + opportunities for direct recruitment to govt labs

#### Challenges

- Low adoption rate
- Not standardised processes in India's mfg
- High cost of deployment
- Elimination of jobs -- India labour abundant nation vs robots capital intensive

#### Way forward

- Intelligent deployment through use of ML + AI
- Have a broader vision
- Govt -- major role to play in infra, applications in public sector, policy & regulations, tech dvpment

Conclusion

### 8. In a globalised world, intellectual property rights assume significance and are a source of litigation. Broadly distinguish between the terms – copyrights, patents and trade secrets. 2014

Intro	- Significance clearly underlined by a separate TRIPS agreement under WTO			
Body	- Growing significance			
	- Source of litigation			
		Copyright	Patents	Trade secrets
	defn	Protects original textual works and visual or artistic expressions	Protects new, useful, non-obvious inventions/ ideas. An invention can be a device, structure, process, machinery etc	Protect valuable secret info like ideas that must be kept confidential. Others to whom it has been disclosed is also kept confidential. May extend perpetually.
	- Trademark: protects source identifications, usually for brands, slogans, logos or designs. Protection may extend perpetually			
Conclusion				

### 9. What do you understand by Umpire decision review in cricket? Discuss its various components. Explain how silicon tape on the edge of a bat may fool the system? 2013

Intro	-- not doing -- irrelevant
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Body	
Conclusion	

### 10. What is an FRP composite material? How are they manufactured? Discuss their applications in aviation and automobile industry 2013

Fibre-reinforced plastic (FRP) (also known as fibre-reinforced polymer) is a composite material made of a polymer matrix reinforced with fibres. Composites are established as an alternative material system to traditional materials such as steel, wood, aluminium and concrete. Bakelite was the first fibre-reinforced plastic.

#### Materials used as Fibres in FRP composites

Glass, carbon, basalt or aramid and at times fibres such as paper, wood or asbestos are also used.

#### Materials used as Polymers in FRP composites

The polymer used is usually an epoxy, vinylester or polyester thermosetting plastic or phenol formaldehyde resin.

#### Manufacturing of FRP Composite Material

FRP involves two distinct processes, the first is the process whereby the fibrous material is manufactured and formed, the second is the process whereby fibrous materials are bonded with the matrix during moulding.

#### Applications of FRP in aviation and automobile industry

- Fibre-reinforced plastics are best suited for any design program that demands weight savings, precision engineering, finite tolerances, and the simplification of parts in both production and operation.
- A moulded polymer artefact is cheaper, faster, and easier to manufacture than cast aluminium or steel artefact, and maintains similar and sometimes better tolerances and material strengths.

From <<https://www.clearias.com/frp-composite-material-applications/#/>>

### 11. Bring out the circumstances in 2005 which forced amendment to section 3(d) in the Indian Patent Law, 1970. Discuss how it has been utilized by Supreme court in its judgment rejecting Novartis patent application for "Glivec". Discuss briefly the pros and cons of the decision. 2013

Intro	
Body	<p>- Something related to compulsory licensing and evergreening</p> <p>- One unique provision of the Indian Patent Act is embodied in Section 3, clause (d). This provision prevents patenting of minor improvements in chemical and pharmaceutical entities unless the invention results in the <u>enhancement of known efficacy</u> of that substance. This provision is a <u>safeguard for public health purposes</u> and sets a <u>higher threshold</u> for granting pharmaceutical patents. In January, Gilead Sciences (a US company) was denied a patent by the Indian Patent Office for its drug Sofosbuvir that cures Hepatitis C, owing to application of Section 3(d)</p> <p>- Section 3(d) has been extremely contentious since its introduction in 2005. The transnational pharmaceutical industry regards it as establishing an <u>unacceptably high barrier to patenting</u>, as do many foreign governments. But many observers, including the <u>United Nations Programme on HIV/AIDS</u> and civil society groups, defend 3(d) and point to India as a <u>model for developing countries</u> attempting to use TRIPS flexibilities to promote public health</p>

	<ul style="list-style-type: none"> <li>- In 2013, pharma giant Novartis lost a six-year legal battle after the Indian supreme court ruled that small changes to its leukaemia drug Glivec did not deserve a new patent</li> <li>- This gives a clear distaste in India for 'evergreening' - the practise of big pharma firms to make small changes to drugs whose licenses are about to expire, simply to renew their licenses. In such cases, India has started giving out 'compulsory licenses'</li> <li>- The best thing is that India broke no TRIPS laws; it's decision is valid under TRIPS, but so far countries had just been too scared to try it</li> </ul>
Conclusion	

### 12. How does the 3D printing technology work? List out the advantages and disadvantages of the technology. 2013

Intro	- 3D printing = additive manufacturing
Body	<p><u>Advantages</u></p> <ul style="list-style-type: none"> <li>- Enable fast and cost-effective mfg</li> <li>- Participation in GVCs</li> <li>- Aids development of new materials and tech which are more energy and resource efficient</li> <li>- Alleviate carbon footprint of growing needs + upholds energy security</li> <li>- Allows for removing design constraints without high expenditure -&gt; boost innovation in product development process</li> </ul> <p><u>Disadvantages/ challenges</u></p> <ul style="list-style-type: none"> <li>- High cost of equipment &amp; material</li> <li>- Lack of AM ecosystem -- as service providers in India are limited, most are not equipped w/ competitive AM tech</li> <li>- Lack of skilled manpower</li> <li>- Monopoly of AM market by foreign Original Equipment Manufacturers</li> <li>- Legal and ethical issues -- IPR, trademark &amp; design violations</li> </ul> <p><u>Way forward</u></p> <ul style="list-style-type: none"> <li>- Govt policies and incentives</li> <li>- Int'l R&amp;D partnership</li> <li>- Skilling &amp; upskilling</li> </ul>
Conclusion	

### 13. What do you understand by fixed dose drug combinations (FDCs)? Discuss their merits and demerits. 2013

Intro	
Body	
Conclusion	

### 14. What is India's plan to have its own space station and how will it benefit our space programme? 2019

-- more relevant on India's manned space mission



Intro	Indian Human Spaceflight Programme - IHSP - initiated in 2007 by ISRO to develop the technology needed to launch crewed orbital spacecraft into LEO Govt has also released a Draft Humans in Space Policy for India - 2021
Body	<p><u>Salient features of Gaganyaan</u></p> <ul style="list-style-type: none"> <li>- Designed to carry 3 astronauts to LEO for a period of 5-7 days</li> <li>- It will take off on a <b>GSLV Mk III</b> which is capable of launching 4-tonne satellites in the GTO Geosynchronous Transfer Orbit</li> <li>- Gaganyaan National Advisory Council -- created w/ members from diff institutions and industries to deliberate on various aspects of the mission</li> <li>- Gaganyaan includes <ul style="list-style-type: none"> <li>• <b>Space Capsule Recovery Experiment SRE-2007</b></li> <li>• Crew module Atmospheric Reentry Experiment CARE-2014</li> <li>• <b>GSLV Mk-III (2014)</b></li> <li>• <b>Reusable Launch Vehicle Technology Demonstrator RLV-TD</b></li> <li>• Crew Escape System</li> <li>• Pad Abort Test</li> </ul> </li> </ul> <p><u>Significance of Gaganyaan</u></p> <ul style="list-style-type: none"> <li>- Add value to India's space activities</li> <li>- Re-establish India's role as a key player in the new space industry</li> <li>- Improve int'l collaboration giving space to Space Diplomacy</li> <li>- <b>Securitisation</b> of outer space has an impact on national security as a result of which outer space is increasingly seen as a 'strategic domain'</li> <li>- <b>Spinoff</b> technologies, attraction of talent to scientific careers, scientific knowledge, etc</li> <li>- Leverage existing experience - of ISRO, national research institutions, academia, industry, etc</li> <li>- Bolster technological innovation, advancement and scientific discovery -- regenerative life support system, rendezvous and docking systems, inflatable habitats, extravehicular activity suits</li> <li>- Industrial competitiveness</li> <li>- <b>Employment</b> generation <ul style="list-style-type: none"> <li>• ISRO Chief - 15,000 new jobs; 13000 in pvt sector</li> </ul> </li> <li>- Enhance public involvement in human space programmes</li> <li>- Fulfil ISRO's long term objective</li> </ul> <p><u>Challenges</u></p> <ul style="list-style-type: none"> <li>- Financial - <ul style="list-style-type: none"> <li>• Highly technology intensive - need exorbitant huge investments</li> <li>• Limited budget outlay; budget cuts in Gaganyaan</li> </ul> </li> <li>- Technological <ul style="list-style-type: none"> <li>• Mastering of complex re-entry and recovery tech</li> <li>• Crew escape system in case of a faulty launch</li> <li>• Developing regenerative environment in the spacecraft</li> <li>• Need of heavier rockets</li> </ul> </li> <li>- Training of astronauts</li> <li>- Awareness of celestial objects in the path of a rocket/ satellites and communication</li> </ul> <p><u>Way forward</u></p> <ul style="list-style-type: none"> <li>- Leveraging private sector</li> <li>- Expanding int'l collaboration</li> </ul>

	<ul style="list-style-type: none"> <li>- Doing away w/ bureaucratic hassles</li> <li>- Capacity building <ul style="list-style-type: none"> <li>• ISRO -- Yuvika programme for 10th students</li> </ul> </li> </ul>
Conclusion	

**15. How is the government of India protecting traditional knowledge of medicine from patenting by pharmaceutical companies? 2019**

Intro	
Body	TKDL Doesn't allow patenting of biological processes
Conclusion	

**16. Discuss the work of 'Bose-Einstein Statistics' done by Prof. Satyendra Nath Bose and show how it revolutionized the field of Physics. 2018**

Intro	
Body	
Conclusion	

**17. India has achieved remarkable successes in unmanned space missions including the Chandrayaan and Mars Orbiter Mission, but has not ventured into manned space mission, both in terms of technology and logistics? Explain critically. 2017**

Intro	
Body	Done above
Conclusion	

**18. Give an account of the growth and development of nuclear science and technology in India. What is the advantage of fast breeder reactor programme in India? 2017**

Intro	
Body	
Conclusion	

**19. Discuss India's achievements in the field of Space Science and Technology. How the application of this technology has helped India in its socio-economic development? 2016**

Intro	
Body	
Conclusion	

**20. Why is nanotechnology one of the key technologies of the 21st century? Describe the salient features of Indian Government's Mission on Nanoscience and Technology and the scope of its application in the development process of the country. 2016**

Intro	- Nanotech are the design, characterisation, production and application of structures, devices and systems by controlling shape and size on a nm scale
Body	<u>Why nanotech key</u> - At nanoscale, material undergoes alteration in physiochemical, biological,

- mechanical, optical, electronic properties
- Wide applications
- Medical
  - Disease diagnosis & treatment
  - Drug delivery
  - Medical nanobots
  - Superbugs and AMR
- Defence - precision guiding tools, supplement to traditional weaponry for close combat situations
- Envi - water treatment & remediation through nanomembranes, desalination & detoxifications, nanosensors for detection of contaminants and pathogens
- Construction -- make asphalt and concrete more robust to water seepage; heat resistant nanomaterials to block UV & IR Radiation
- Energy -- novel hydrogen storage systems based on carbon nanotubes and other lightweight nanomaterials; C nanotubes in composite film coating
- Agriculture
  - FPI - antimicrobial nanoemulsions for decontamination of food equipment, nanobased antigen detecting biosensors for identification of pathogen contamination
  - NAIPS Nano Agri Input products
  - NAPs Nano-Agri Products

#### Salient Features of Nano Mission

- Umbrella programme for capacity building
- Objectives
  - Basic research promotion
  - Infra development for Nano Science & Tech Research
  - Nano Applications and Technology Development Programmes
  - HRD
  - Int'l Collab

#### Other initiatives

- 18 SAIFs Sophisticated Analytical Instruments Facilities estd by DST across India
- Centre of Excellence in Nanoscience & nanotech by DST
- TUEs Thematic Units of Excellence
- Visveswaraya PhD fellowships by MeitY
- INSPIRE Scheme

Conclu  
sion

**21. What do you understand by 'Standard Positioning Systems' and 'Protection Positioning Systems' in the GPS era? Discuss the advantages India perceives from its ambitious IRNSS programme employing just seven satellites. 2015**

Intro	
Body	
Conclusion	

**22. Scientific research in Indian universities is declining, because a career in science is not as attractive as our business operations, engineering or administration, and the**

universities are becoming consumer oriented. Critically comment. 2014

Intro	
Body	
Conclusion	

23. Can overuse and the availability of antibiotics without doctor's prescription, the contributors to the emergence of drug-resistant diseases in India? What are the available mechanisms for monitoring and control? Critically discuss the various issues involved. 2014

Intro	AMR Anti-microbial resistance = when microorganisms change when they are exposed to antimicrobial drugs. These microbes are referred to as superbugs.
Body	<p><u>Reasons</u></p> <ul style="list-style-type: none"> <li>- Inappropriate use of medicine -- overuse, underuse and misuse of medicines drives development of drug resistance</li> <li>- Lack of quality medicine -- weak drug quality assurance systems</li> <li>- Animal husbandry -- <u>sub-therapeutic doses</u> in animal rearing -&gt; spread to humans</li> <li>- Poor infection prevention and control -- increase spread of drug-resistant infections. Hospitalised patients are one of the main reservoirs of resistant microorganisms</li> <li>- Weak surveillance systems --</li> </ul> <p><u>Why is AMR a concern</u></p> <ul style="list-style-type: none"> <li>- New resistance mechanisms are emerging and spreading globally</li> <li>- Growing list of infections are becoming difficult to treat -&gt; reducing effectiveness of antibiotics</li> <li>- Medical procedures, major surgery become highly risky without effective antimicrobials for prevention and treatment of infections</li> <li>- AMR increases the cost of healthcare -- lengthier stays in hospitals and more intensive care required</li> <li>- Puts gains of MDGs at risk; endangers SDG achievement</li> </ul> <p><u>WHO initiatives to address AMR</u></p> <ul style="list-style-type: none"> <li>- GLASS Global Antimicrobial Resistance Surveillance System</li> <li>- AWaRE tool -- aimed at guiding policy makers and health workers to use antibiotics safely and more effectively <ul style="list-style-type: none"> <li>• <b>Access + Watch + Reserve</b> --</li> </ul> </li> <li>- GARDP Global Antibiotic R&amp;D Partnership - PPP R&amp;D</li> <li>- IACG Interagency Coordination Group on AMR -- by UN</li> <li>- <b>Global Action Plan</b> -- ensure prevention and treatment of infectious diseases w/ safe &amp; effective medicine</li> <li>- <b>One Health</b> Approach</li> </ul> <p><u>AMR Situation in India</u></p> <ul style="list-style-type: none"> <li>- <b>ICMR</b> - in 2/3 healthy persons have antibiotic resistant organisms in digestive tracts</li> <li>- Reported in several water sources</li> <li>- Antimicrobial agents are used in abundance to increase productivity in animal husbandry</li> </ul>

	<p>Steps taken in India</p> <ul style="list-style-type: none"><li>- National AMR Resistance <b>Research &amp; Surveillance Network</b></li><li>- National Action Plan to combat AMR</li><li>- <b>Red Line Campaign</b> for antibiotics packaging -- to curb over-the-counter sale</li></ul>
Conclu sion	

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