

**SCIENCE AND TECHNOLOGY**❖ **AlphaFold: A tour de force in science**

❖ **CONTEXT:** DeepMind, a company based in London and owned by Google, announced that it had predicted the three-dimensional structures of more than 200 million proteins using AlphaFold. This is the entire protein universe known to scientists today.

❖ **What is AlphaFold?**

- AlphaFold is an AI-based protein structure prediction tool. It is based on a computer system called deep neural network.
- Inspired by the human brain, neural networks use a large amount of input data and provides the desired output exactly like how a human brain would.
- The real work is done by the black box between the input and the output layers, called the hidden networks.
- AlphaFold is fed with protein sequences as input. When protein sequences enter through one end, the predicted three-dimensional structures come out through the other. It is like a magician pulling a rabbit out of a hat.

❖ **How does AlphaFold work?**

- It uses processes based on “training, learning, retraining and relearning.” The first step uses the available structures of 1,70,000 proteins in the Protein Data Bank (PDB) to train the computer model.
- Then, it uses the results of that training to learn the structural predictions of proteins not in the PDB. Once that is done, it uses the high-accuracy predictions from the first step to retrain and relearn to gain higher accuracy of the earlier predictions.
- By using this method, AlphaFold has now predicted the structures of the entire 214 million unique protein sequences deposited in the Universal Protein Resource (UniProt) database.

❖ **What are the implications of this development?**

- Proteins are the business ends of biology, meaning proteins carry out all the functions inside a living cell.
- Therefore, knowing protein structure and function is essential to understanding human diseases. Scientists predict protein structures using x-ray crystallography, nuclear magnetic resonance spectroscopy, or cryogenic electron microscopy.
- These techniques are not just time-consuming, they often take years and are based mainly on trial-and-error methods.
- The development of AlphaFold changes all of that. It is a watershed movement in science and structural biology in particular.
- AlphaFold has already helped hundreds of scientists accelerate their discoveries in vaccine and drug development since the first public release of the database nearly a year back.

❖ **What does this development mean for India?**

- From the seminal contribution of G. N. Ramachandran in understanding protein structures to the present day, India is no stranger to the field and has produced some fine structural biologists.
- The Indian community of structural biology is strong and skilled. It needs to quickly take advantage of the AlphaFold database and learn how to use the structures to design better vaccines and drugs.
- This is especially important in the present context. Understanding the accurate structures of COVID-19 virus proteins in days rather than years will accelerate vaccine and drug development against the virus.
- India will also need to speed up its implementation of public-private partnerships in the sciences.
- The public-private partnership between the European Molecular Biology Laboratory’s European Bioinformatics Institute and DeepMind made the 25-terabyte AlphaFold dataset accessible to everyone in the scientific community at no cost.
- Learning from this, India could facilitate joint collaborations with the prevalent hardware muscle and data science talent in the private sector and specialists in academic institutions to pave the way for data science innovations.

❖ **Is AlphaFold one-of-a-kind tool in predicting protein structures?**

- Although a tour-de-force in structural biology, like any other method, AlphaFold is neither flawless nor the only AI-based protein structure prediction tool.
- RoseTTaFold, developed by David Baker at the University of Washington in Seattle, U.S., is another tool. Although less accurate than AlphaFold, it can predict the structure of protein complexes.
- The development of AlphaFold is sure to make many scientists feel vulnerable, especially when they compare their efforts from years of hard work in the lab to that of a computer system. However, this is the time to adjust and take advantage of the new reality.
- Doing this will reinventorize scientific research and accelerate discovery.

**DEFENCE**❖ **The dwindling fighter strength of the IAF**

- ❖ **CONTEXT:** In a tragic accident, a MIG-21 trainer jet of the Indian Air Force (IAF) crashed in Rajasthan killing both the pilots onboard, Wing Commander M. Rana and Flight Lieutenant Advitiya Bal. This has once again put the focus on the MIG-21 jets as well as on the IAF's fighter strength and modernisation.
- ❖ **What is the status of the MIG-21 jets in the IAF?**
  - The MIG-21 was inducted into the IAF in the early 1960s and since then more than 800 variants of the supersonic fighter were inducted into service. It remained the frontline fighter jet of the force for a long time. During this period, there were over 400 accidents involving the jet which claimed the lives of around 200 pilots.
  - Currently, there are four MIG-21 squadrons in service consisting of the upgraded Bison variant.
  - There are only four squadrons of the MIG-21 aircraft, the IAF informed the Parliamentary Standing Committee on defence as per a report tabled in March 2022.
  - As and when the technical life is complete, IAF can't keep them extra even for a day. Life extension is done for some aircraft.
  - In that regard, IAF now have the Bison aircraft remaining, which are upgraded, but still old.
  - With delays in new inductions, the IAF has been forced to continue the last four MIG-21 Bison squadrons in service.
  - One squadron is set to be phased out in the next few months, while the remaining three squadrons are planned to be phased out in the next three years. This phase out was worked out much before last week's tragic incident.
- ❖ **What is the present fighter strength of the IAF?**
  - The IAF has an authorised strength of 42 fighter squadrons. As time passes, the drawdown is increasing as the total technical life is completed.
  - However, the rate of new inductions is not matching the drawdown, depleting the overall number of fighter squadrons. Additionally, several frontline aircraft in the inventory including the Jaguars, MIG-29s will begin phasing out by the end of the decade.
  - For instance, by 2027-28 the first of the MIG-29s, inducted in the late 1980s, will start going out.
  - In the last few years, the IAF has inducted two squadrons of the indigenous Light Combat Aircraft (LCA) Tejas and two squadrons of Rafale fighter jets procured from France which pushed the squadron strength to 32.
  - In January 2021, the IAF had signed a contract with Hindustan Aeronautics Limited (HAL) for 83 of the more advanced LCA MK-1A which it will start receiving from early 2024 onwards.
  - Along with that the to-be-acquired 114 Multi-Role Fighter Aircraft (MRFA) will help arrest the drawdown.
  - A larger and even more capable LCA-MK2 as well as the fifth generation Advanced Medium Combat Aircraft (AMCA) is under development. However, their availability in enough numbers will take some time.
- ❖ **What is the roadmap to shore up the fighter strength?**
  - The IAF has acknowledged that they will not be able to achieve the desired strength for the time being and that they are doing the best they can.
  - In addition to the indigenous aircraft coming up, the IAF is confident that increasing the low availability rates of Su-30 and other fighters in service will offset some of the shortfall in the interim.
  - However, that could be potentially impacted due to the war in Ukraine and western sanctions.
  - According to IAF there is also a very large number of Sukhoi-30 and other fighters on ground. Serviceability state has been low. Once IAF get that, the existing strength itself can ramp up before the new aircraft come in.
  - In the last seven to eight years, several steps have been taken to increase the serviceability rates of the Russian equipment in use, especially the Su-30MKI fleet which constitutes a significant number in the IAF inventory.
  - Part of the measures is long term spares and support agreements as well as joint ventures in India with Russian original equipment manufacturers for faster turnaround.

#### **POLITY**

- ❖ **Over 59 lakh cases pending in High Courts, and where 96 women judges are serving**
- ❖ **CONTEXT:** Over 59 lakh cases were pending in the High Courts until July 22, Law Minister Kiren Rijiju said in a written reply in [Rajya Sabha](#). In reply to another question, the Minister tabled data on women judges serving in various courts, including 4 in the Supreme Court and 96 in the High Courts, as of July 25.
- ❖ **Pendency of cases**

- Replying to a question from Rijju provided a break-up for a backlog of 59,57,454 cases in 25 High Courts. Allahabad High Court has the highest number of pending cases at over 10 lakh. Next are the High Courts of Rajasthan (just over 6 lakh) and Bombay (just under 6 lakh).

CASES PENDING IN HIGH COURTS ALL INDIA: 59,57,454			
High Court	Pending cases*	High Court	Pending cases*
Allahabad	10,26,417	Telangana	2,58,932
Rajasthan	6,05,215	Patna	2,20,403
Bombay	5,92,583	Andhra Pradesh	2,35,482
Madras	5,63,595	Calcutta	2,15,859
Punjab & Haryana	4,50,527	Odisha	1,85,567
Madhya Pradesh	4,17,003	Gujarat	1,58,512
Karnataka	2,96,965	Delhi	1,05,814

\*As of July 22, 2022

- While noting that disposal of pending cases in courts is within the domain of the judiciary, and that the government has no direct role in their disposal.
- The Central Government is fully committed to speedy disposal of cases in accordance with Article 21 of the Constitution and reducing pendency. The Government has taken several initiatives to provide an ecosystem for faster disposal of cases by the judiciary like virtual courts and videoconferencing, and filling up of vacant positions.

WOMEN JUDGES IN HIGHER JUDICIARY		
SUPREME COURT: 4		
Women judges	High Courts	Total
12 each	Delhi, Madras	24
9	Telangana	9
8	Bombay	8
7 each	Calcutta, Punjab & Haryana	14
6 each	Gujarat, Kerala	12
5 each	Allahabad, Karnataka	10
4	Andhra Pradesh	4
3	Madhya Pradesh	3
2 each	Gauhati, Himachal Pradesh, J&K and Ladakh, Rajasthan	8
1 each	Chhattisgarh, Jharkhand, Odisha, Sikkim	4
Nil	Manipur, Meghalaya, Tripura, Patna, Uttarakhand	0
<b>Grand total</b>	<b>25 High Courts</b>	<b>96</b>

Figures as of July 25, 2022

❖ **Women judges**

- The Minister presented the details on women judges in reply to a question. The 4 women judges in the Supreme Court are against a sanctioned strength of 34 judges, and the 96 women judges in the High Courts are against a sanctioned strength of 1,108 judges.

**WOMEN JUDGES IN DISTRICT & SUBORDINATE COURTS**

Civil judges (junior division)	Civil judges (senior division)	District judges
All India 3,719	All India 1,611	All India 1,435
UP 404	UP 170	UP 220
Maharashtra 346	Maharashtra 139	Rajasthan 126
MP 300	MP 133	Maharashtra 112
Rajasthan 260	Rajasthan 121	Tamil Nadu 112
Bihar 256	Karnataka 120	MP 103

Figures as of July 25, 2022

Source: Ministry of Law & Justice, Rajya Sabha reply

- Out of the 96 women judges in the High Courts, Delhi and Madras HCs between them account for one-fourth, at 12 women judges each. Telangana has 9 women judges, Bombay has 8, and Calcutta and Punjab & Haryana have 7 each.
- Five HCs — Manipur, Meghalaya, Tripura, Patna, and Uttarakhand — do not have a single woman judge.

**PRELIMS**

**1. School Innovation Council**

❖ **CONTEXT:**The School Innovation Council was launched and has been introduced to all schools of all the states.

- The School Innovation Council (SIC) is an initiative taken by the Ministry of Education's Innovation Cell (MIC) and the All India Council for Technical Education (AICTE).
- SIC is a council of teachers, students, and experts from industry and academia to conduct year-round activities for students and teachers on Innovation and Entrepreneurship.
- SIC will enable mindset change, awareness, and training on Ideation, Innovation and Entrepreneurship, design thinking, Intellectual Property Rights, start-up finance, and HR among School teachers and students.

- SIC will promote out of box thinking in school education as envisioned in National Innovation and National Education Policy 2020.
- It will also enable the ranking system for schools on the level of innovation-oriented activities.
- To implement the SIC council in all schools across the nation, SIC portal has been developed where schools can register themselves.
- SIC will link schools with Innovation Councils established by MIC at Higher Education Level to further provide exposure to school students.

❖ **School Innovation Ambassador Training Program**

- School Innovation Ambassador Training program (SIATP) was launched to strengthen the mentoring capacity of teachers for cultivating and handholding innovative and ingenious ideas from students.
- The SIATP program has been conceptualised by MIC and AICTE to train the school teachers across country.
- Under SIATP, teachers undergo 72 hours of training, and those who qualify all the following five modules with a minimum 50% as passing marks are recognized as “Innovation Ambassadors”.

- Design Thinking & Innovation;
- Idea generation & Idea hand-holding;
- Finance/Sales/HR;
- Intellectual Property Rights (IPR);
- Entrepreneurship and Prototype/ Product Development.

- The “Innovation Ambassadors” are competent to nurture the young school students on Ideation, IPR, product development, design thinking, problem-solving, critical thinking and skills of entrepreneurship.

2. **Corporal Punishment**

❖ **CONTEXT: Three private school teachers in Pune have been booked under the Juvenile Justice Act over allegedly thrashing three Class 10 students, and threatening to grade them poorly in internal assessments.**

- Corporal punishment means punishment that is physical in nature.
- There is no statutory definition of 'corporal punishment' targeting children in the Indian law.
- However, the Right of Children to Free and Compulsory Education (RTE) Act, 2009 prohibits ‘physical punishment’ and ‘mental harassment’ under Section 17(1) and makes it a punishable offence under Section 17(2).

- According to the Guidelines for Eliminating Corporal Punishment in Schools issued by the National Commission for Protection of Child Rights (NCPCR):

- Physical punishment is understood as any action that causes pain, hurt/injury and discomfort to a child, however light. Examples include hitting, kicking, scratching, pinching, biting, pulling the hair, boxing ears, smacking, slapping, spanking, hitting with any implement (cane, stick, shoe, chalk, dusters, belt, whip), giving electric shock and so on.

- It also includes making children assume an uncomfortable position (standing on bench, standing against the wall in a chair-like position, standing with school bag on head, holding ears through legs, kneeling, and forced ingestion of anything, detention in the classroom, library, toilet or any closed space in the school.

- Mental harassment is understood as any non-physical treatment that is detrimental to the academic and psychological well-being of a child including sarcasm, calling names and scolding using humiliating adjectives, intimidation, using derogatory remarks for the child, ridiculing or belittling a child, shaming the child and more.

❖ **What are provisions under the law against such punishment?**

- Section 17 of the Right to Education Act, 2009, imposes an absolute bar on corporal punishment. It prohibits physical punishment and mental harassment to children and prescribes disciplinary action to be taken against the guilty person in accordance with the service rules applicable to such person.

- Section 75 of the Juvenile Justice Act prescribes punishment for cruelty to children. In case of Corporal punishment, the accused would be penalised with rigorous imprisonment upto five years and fine up to Rs 5 lakh.

- In theory, corporal punishment is covered by all the provisions under Indian law that punish perpetrators of physical harm. While these provisions make no distinction between adults and children, in practice, corporal punishment in schools and other institutions tends not to be prosecuted because it is still accepted socially at several places.

❖ **National Commission for Protection of Child Rights (NCPCR) guideline**

- The NCPCR guidelines for eliminating corporal punishment against children require every school to develop a mechanism and frame clear cut protocols to address grievances of students.

- Drop boxes are to be placed where the aggrieved person may drop his complaint and anonymity is to be maintained to protect privacy.

- Every school has to constitute a 'Corporal Punishment Monitoring Cell' consisting of two teachers, two parents, one doctor, one lawyer (nominated by DLSA), counsellor, an independent child rights activist of that area and two senior students from that school.
- This CPMC shall look into complaints of corporal punishment.

**ANSWER WRITING**

**Q. Account for the present location of Iron and Steel industries away from the source of raw material, by giving examples.**

**Introduction:** The iron and steel industry is a basis for the development of a number of industries in the global economy: the Defence industry, transportation and heavy engineering, energy and construction (including aeronautical and shipping construction). At global level in 2018, the world crude steel production reached 1789 million tonnes (mt) and showed a growth of 4.94% over 2017. China remained world's largest crude steel producer in 2018 (928 mt) followed by India (106 mt), Japan (104 mt) and the USA (87 mt).

**Reasons behind it are away from its source of raw material:**

- Near Coastal regions: As iron and coal were depleted the need for imported coal and iron increased. This made factories to shift to newer areas in the coastal regions. The coastal factories depended on imported iron or coal and lowered cost of transportation from factory to port. Iron ore and coal producing regions have a bi-directional relationship. The wagons that transported coal to iron ore regions would return empty so un-economical use. Hence the wagons would return with iron ore towards the coal producing regions. Thus in both these areas iron and coal industries flourished. E.g: Pittsburg-Lake Superior, Bokaro-Rourkela.
- Modern Technology: New technologies available for steel production reduced the pull factor of coalmines. Modern technology such as electric smelters, open hearth system etc have helped in shifting steel industries away from coal and iron ore reserves by making efficient use of scrap metal and also reducing energy requirement. For example: Bhushan steel plant in Ghaziabad.
- Oxygen converter process and electric smelters used less energy and now such mini-steel plants can be located away from mines and towards cities. Mini Steel plants are located in Eastern India and have a high gestation period. They are integrated complexes with the entire process from raw material processing to final conversion into alloys and steel products being done. Mini Steel Plants are located near cities and they recycle waste steel to produce finished products. They avoid competition with integrated steel plants by locating away from them.
- Strategic reasons: After WWII, USA and USSR adopted a policy to not allow concentration of industries in one region. Thus in USA some plants were setup in western region such as California and USSR and some in the eastern side towards pacific coast. India too used licensing to locate industries in backward areas as they might promote development.

**Conclusion:** Even after local coal-iron resources are depleted, the Iron and steel industries do not frequently shift their location because of Industrial Inertia and reasons like: Labor is available abundantly and skilled in industrial areas. But if the industry moves to a newer location such labor might not be available. Rail, road and transportation facilities towards markets and ports are well developed in the industrial locations. The same facilities aren't developed in newer locations and so it is more convenient to import raw materials and modernize operations. Secondary industries don't shift even when the primary industry might move. So the entrepreneurs are dissuaded from shifting their locations as it might affect their market base.

**MCQs**

1. Consider the following statement with reference to corporal punishment in schools
  1. Right to Education Act, 2009, defines and imposes an absolute bar on corporal punishment
  2. Juvenile Justice Act prescribes only fine in case of Corporal punishment, the accused would be penalised with fine up to Rs 5 lakh.

Choose the correct statement using the following codes

  - a) 1 only
  - b) 2 only
  - c) Both 1 and 2
  - d) Neither 1 nor 2**
2. With regards to School Innovation Council (SIC) consider the followings
  1. It is a statutory body establish under the Right to Education Act 2009.
  2. Recently it has been constituted for the first time in some industrial cities on pilot basis.
  3. It is a council of teachers, students, and experts from industry and academia to conduct activities for students and teachers on Innovation and Entrepreneurship.

Which of the above statement /s is/are not correct?

  - a) 1 and 2 only**
  - b) 2 and 3 only
  - c) 1 and 3 only

- d) All of the above
3. National Commission for Protection of Child Rights (NCPCR) constituted under which of the following Act?
- a) Juvenile Justice Act 2015  
b) Right to Education Act 2009  
c) **Commission for Protection of Child Right 2005**  
d) National Human Rights Commission Act 1995
4. Terms like “RoseTTaFold” “AlphaFold” often in news are associated with which of the following?
- a) Recently developed Super computers  
b) **AI-based protein structure prediction tool**  
c) Newly developed rocket fuels  
d) Augmented reality glasses
5. G. N. Ramachandran is a renowned scientist in which of the following field?
- a) **Biophysics**  
b) Astronomy  
c) Nano technology  
d) Metallurgy
6. Mines and Minerals (Development and Regulation) Act is in news for its proposed amendments and it opposed by some states with reference to this consider the following statements.
1. State Assemblies can make laws on such minerals within the territory of the State concerned.  
2. Make laws on such minerals within the territory of the State concerned is a Constitutional right of the State under Article 246(3)
- Choose the correct statement using the codes given below
- a) 1 only  
b) 2 only  
c) **Both 1 and 2**  
d) Neither 1 nor 2
7. A task force headed by V.K. Paul recently constituted by Union Government is associated with which of the following?
- a) **To monitor and provide guidance on the expansion of diagnostic facilities and to explore vaccination against the Monkeypox infection in the country**  
b) To study novel chimp adenovirus intranasal vaccine for COVID, which is likely to prevent infection and transmission.  
c) To step up vigil at vulnerable locations and conduct combing operations on possible hideouts of terror suspects of IS handlers  
d) None of the above
8. ‘AL NAJAH IV’ is a joint military exercise conducted between India and which of the following country?
- a) **Oman**  
b) UAE  
c) Qatar  
d) Iraq
9. Mission Amrit Sarovar is implemented by which of the following ministry?
- a) Ministry of Social justice  
b) **Ministry of Rural development**  
c) Ministry of Jal shakti  
d) Ministry of Railway
10. The term “EOS-02” recently seen in news is associated with which of the following?
- a) NASA  
b) ROSCOSMOS  
c) JAXA  
d) **ISRO**