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# समाचार पत्रों से चयित अंश Newspapers Clippings

A Daily service to keep DRDO Fraternity abreast with DRDO Technologies, Defence Technologies, Defence Policies, International Relations and Science & Technology

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*Thu, 06 Aug 2020*

## **Expect successful results from joint research with India on COVID-19 rapid test: Israeli envoy**

New Delhi: The joint research between India and Israel on rapid tests for COVID-19 is progressing according to plan and is expected to bring successful results soon, Ambassador of Israel to India Ron Malka said on Wednesday.

India and Israel are conducting trials here on a large sample of patients for four different kinds of technologies, including a breath analyser and a voice test, that have the potential to detect COVID-19 rapidly, according to a statement from the Israeli embassy.

Malka and Niti Aayog CEO Amitabh Kant visited the special testing site created at the Dr Ram Manohar Lohia (RML) Hospital to see the ongoing trials, the statement said.

The statement quoting Malka said the joint research on rapid tests for COVID-19 between Defense Research and Development Directorate of the Israeli Ministry of Defence, India's Defence Research and Development Organisation and Principal Scientific Advisor, India is advancing according to plan.

"Honored to visit the testing site at RML hospital with Mr. @amitabhk87. The joint research on rapid tests for #Covid19 bet DDRD & PSA and DRDO is advancing according to the plan and we hope that it will bring successful results soon," Maika said in a tweet.

"Not only are we confident about the scientific and technological capabilities of India, but once the R&D stage is over, we are also looking to collaborate with India for manufacturing as they have excellent industrial infrastructure for large scale production," he said in the statement.

Kant said if their cooperation produces the expected results, this will be a path breaking development for the entire world.

"I see immense potential here for continuing scientific and technological cooperation, and India will provide all the necessary expertise, personnel and resources needed for this and future missions," Kant was quoted as saying in the statement.

The trials began on July 28 and are being conducted under the guidance of the Israeli delegation at six locations in Delhi – Dr Ram Manohar Lohia Hospital, Lok Nayak Hospital, Sir Ganga Ram Hospital, the DRDO office in Rohini, Akash Hospital and Lady Hardinge Hospital, the statement said.

The data collected in Delhi, along with the samples previously collected in Israel, will assist in developing and validating the algorithm of the AI technologies used in the tests, the statement said.

"Such technologies will not just be restricted to coronavirus, but also have the potential to overcome any biological threat or pandemic of such scale in the future," it said.

Four different technologies are being developed for quick detection of coronavirus, and the success of even one of them could provide a breakthrough globally.

The first is a breath analyser that requires a person to blow through a tube, after which a high frequency scan is used to analyse the humidity in the breath and detect the presence of the virus in less than a minute.

The second test is a thermal test which requires a saliva swab and has the potential to be purchased off the shelves and used at home, similar to an at-home pregnancy test.

The third technology uses polyamino acids which can detect the proteins present in the virus in 45 seconds.

Lastly, an audio recording test is also being developed that can be downloaded and used as a mobile phone application. The test will detect the changes in a person's voice to detect COVID-19 and other lung diseases, it said.

"Once the technologies are validated, the aim is to make the tests accessible to the masses at low rates and achieve higher accuracy rates than the current PCR test," the statement said.

*(Disclaimer: This story has not been edited by Outlook staff and is auto-generated from news agency feeds. Source: PTI)*

<https://www.outlookindia.com/newscroll/93-more-test-covid-positive-in-nagaland-tally-rises-to-2498/1909923?scroll>

**TIMESNOWNEWS.COM**

Thu, 06 Aug 2020

## **Delhi: Milestone achieved as several COVID-19 samples tested with Israeli technologies; results being studied**

***Coronavirus pandemic: With 9, 897 active COVID-19 cases in Delhi, the coronavirus tally in the national capital took over 1,25,226-mark and death toll reaches 4,033***

New Delhi: Israeli rapid test kits for coronavirus that gives report within half an hour achieved a new milestone with a collection of thousands of samples tested across six hospitals in the national capital. It includes Lok Nayak Jayprakash (LNJP) hospital, Lady Hardinge Medical College (LHMC), Ram Manohar Lohia (RML), Sir Ganga Ram Hospital, DRDO COVID facility centre, and Akash Super Speciality hospitals.

As per the *TOI* report, results were being analysed, says Commander Yaniv Meirman from Directorate of Defense Research and Development (DDRD), the Israeli ministry of defence.

With the help of Artificial Intelligence (AI) that uses four technologies which includes patient's voice, breath analyser test, isothermal testing that allows identification of COVID virus in saliva, and another test that detects proteins of the virus.

Yaniv Meirman also said that except the voice test, the target for trials of all rest three tests have been completed. "Some of the tests, for example, isothermal testing, can in future be done at home using a self-help kit, like a pregnancy test," Israeli officer added.

In his recent visit to RML hospital, Israeli Ambassador Ron Malka witnesses the trials being conducted there for the last three days for rapid COVID-19 testing.

According to the reports, newly developed tests have been jointly done by Israel's Directorate of Defense Research and Development (DDRD) and India's Defence Research and Development Organisation (DRDO), and Council of Scientific and Industrial Research (CSIR).



File photo | Photo Credit: IANS

As per the Union Ministry of Health and Family Welfare (MoHFW), India's COVID-19 tally continues to surge with total 19,08,254 COVID-19 cases, which includes 5,84,244 active cases, and 12,82,215 recovered cases. The total death tolls mount to 39,795 due to COVID-19 as of August 05.

The Health Ministry, in its Wednesday update on its website, published that the maximum number of COVID-19 cases have been reported in Maharashtra followed by Tamil Nadu and Andhra Pradesh. The total number of COVID-19 cases are 139,156 in Delhi which include 9,897 active cases in the national capital.

<https://www.timesnownews.com/delhi/article/covid-19-in-delhi-milestone-achieved-as-20000-tested-with-israeli-technologies-results-being-analysed/632276>



**The Sentinel**  
*of this land, for its people*

Thu, 06 Aug 2020

## **Defence Research Laboratory contributes to mitigate COVID-19**

*Defence Research Laboratory (DRL) of Defence  
Research and Development Organization (DRDO)*

Tezpur: Defence Research Laboratory (DRL) of Defence Research and Development Organization (DRDO), Ministry of Defence, Government of India, is the only laboratory in Northeast India which is involved in the research and development activities for the benefit of armed forces and civil populace since 1962. Soon after the outbreak of COVID-19 in the country, DRL has taken various initiatives to carry out certain important first line defence activities, including making of WHO recommended hand rub sanitizers, their distribution, formulation of mass scale disinfectant, spraying, fogging and awareness among society to counter COVID-19 in the region.

Apart from this, on the request of the Government of Assam, DRL has also taken initiative to get approval for the testing of COVID-19 on the basis of expert scientists/technicians/staff and existing analytical facilities in the laboratory. State Health Minister Dr Himanta Biswa Sarma inaugurated the DRL Centre for COVID-19 Testing (DCCT) facility on May 28 in the



presence of other dignitaries of Assam Government. The created laboratory is fully equipped with BSL II capacity for testing of samples of individuals suspected with COVID-19. Testing of COVID-19 samples commenced from June 8. DRL, Tezpur has successfully completed testing of more than 10,000 COVID-19 samples.

<https://www.sentinelassam.com/north-east-india-news/assam-news/defence-research-laboratory-contributes-to-mitigate-covid-19-493283?infinitemscroll=1>



## India and Israel collaborate on rapid COVID-19 test

*Assuming that the trial successful, both countries would produce the rapid test in India and co-market the product to the world under a monetization scheme*

*By Cody Levine*

The Indian and Israeli governments are jointly working on a coronavirus clinical trial utilizing patients in India and Israeli technology in order to develop a rapid testing system that could detect the virus in under 30 seconds, according to a report from the scientific news website Trialsite on Monday.

Assuming that the trial successful, both countries would produce the rapid test in India and co-market the product to the world under a monetization scheme. The project was developed via coordination between the Indian Defense Research and Development Organization (DRDO), a branch of the Indian Ministry of Defense, and the Directorate of Defense Research and Development (DRDD) from Israel's Defense Ministry.

The trials will determine those infected with coronavirus via tests such as audio, breath, thermal and polyomino to isolate proteins associated with COVID-19. Following the arrival of a 35-member team of Israeli scientists in India, the process for engaging in human trials was quickly expedited by the DRDO, in which they even waived the seven-day quarantine team f. Nevertheless, the commencement of testing will only begin after receiving the endorsement of a full committee at the DRDO, which is reported to occur at some point in August.

Using four different Israeli technologies that may be able to detect coronavirus rapidly, samples taken from the Indian patients, which will be transferred back to Israel, is still currently waiting approval for use in Israeli labs.

"The people of India have greeted us with great enthusiasm. At the moment, we are still doing massive testing at 5 different sites, gathering data on patients using cutting-edge technologies. It will still take awhile to analyze all the data," said Dr. Nati Keller, Sheba Medical Center's senior clinical microbiologist who was part of the delegation.

The study focuses on samples taken from 5,000 Indian patients, and includes an active coronavirus sample, with this test serving as a "research validation" study that may allow for mass production of rapid tests in the near future.

<https://www.jpost.com/health-science/india-and-israel-collaborate-on-rapid-covid-19-test-637640>



An Indian and Israeli scientist standing together at the testing site in India. photo credit: NATI KELLER - SHEBA MEDICAL CENTER)

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## Indian Army considering Tata WhAP armoured vehicle for Eastern Ladakh

*Tata WhAP has been co-developed with a DRDO laboratory and has been rigorously tested to perform in extreme conditions, including high altitude areas*

### Key Highlights

- **Tata WhAP has been developed in partnership with DRDO**
- **It is an armoured amphibious vehicle and can carry 10 to 12 personnel**
- **If selected, Tata WhAP will be used in Eastern Ladakh area for quick movement of troops**

The Indian Army is currently looking for an armoured vehicle to be used in high altitude areas like Eastern Ladakh. For this, it has shortlisted three vehicles, including an indigenous vehicle. According to IANS report, the army is currently considering Tata Wheeled Armoured Protection (WhAP) vehicle along with Humvee and America Stryker Infantry Combat vehicle. The vehicle is reportedly required for quick movement of troops in Eastern Ladakh area where the Chinese army is already using several armoured vehicles for its troops.

It is being reported that the indigenous Tata WhAP has higher chances of being commissioned as compared to the other two vehicles. Tata WhAP has been co-developed with a DRDO (Defence Research and Development Organisation) laboratory and has been rigorously tested to perform in extreme conditions, including high altitude areas. It is based on Tata Defence Combat Wheeled Armored Amphibious Platform and gets Amphibious Drive Mode as well as independent suspension with hydro-pneumatic struts. Tata WhAP can carry around 10 to 12 personnel and be used as a reconnaissance vehicle, infantry carrier, or logistics carrier.



Indian Army considering Tata WhAP armoured vehicle for Eastern Ladakh | Representative image

However, the vehicle has never been in service before. The Humvee and American Stryker armoured vehicles, on the other hand, have served extensively in the US defence forces. So, it needs to be seen if the Indian army will go for WhAP as opposed to the other armoured vehicles.

In case you didn't know, Tata Motors has had a long association with the armed forces and has supplied several armoured and combat vehicles. The Indian army is currently using especially made Safari Storme as patrolling vehicle in many parts of the country.

<https://www.timesnownews.com/auto/features/article/indian-army-considering-tata-whap-armoured-vehicle-for-eastern-ladakh/632169>

Thu, 06 Aug 2020

## Indian Army looking for new armoured vehicles for Ladakh, Tata among contenders

- *Humvee and American Stryker Infantry Combat Vehicle are the two others who are also being considered by the Indian Army to deliver such vehicles.*

Seeking to provide highly mobile armoured protection vehicles to its soldiers in high altitude terrains like Eastern Ladakh, the Indian Army is looking to choose from three different vehicles including the indigenous Tata Wheeled Armoured Protection along with American Stryker Infantry Combat Vehicle and Humvee.

The Indian Army has a need for armoured infantry combat vehicles for quick movement of troops in the Eastern Ladakh area where the Chinese have deployed their armoured personnel carriers in large numbers. The force is looking at the three options which include the Tata WhAP and the American Stryker and Humvee, defence sources told ANI.

The options are being evaluated by the force at the moment and a decision in this regard would be taken soon, they said.

Sources said during the evaluation process, the indigenous platform would certainly have preference over the foreign products in meeting the requirements of the Army.

While the Tata vehicle is yet to enter service, the Stryker and Humvee have been part of the American defence forces for a long time now.

Tata WhAP, which has been co-developed with a DRDO laboratory, has undergone several trials in recent times including high altitude tests.

The Strykers and Humvee are reportedly capable of being dropped from transport aircraft including the C-130J and the C-17s which are also operated by the Indian Air Force.

During the ongoing standoff with the Chinese in Eastern Ladakh, the Chinese troops had come to the Line of Actual Control at multiple points including Galwan Valley, Hot Springs, Gogra and Patrolling Point 15 using heavy vehicles including Armoured Personnel Carriers.

The Indian Army uses a large number of Russian-origin BMP infantry combat vehicles, which are used by the Mechanised Infantry regiments of the Indian Army in deserts, plains, and high altitude locations.

*(This story has been published from a wire agency feed without modifications to the text. Only the headline has been changed.)*

<https://auto.hindustantimes.com/auto/news/indian-army-looking-for-new-armoured-vehicles-for-ladakh-tata-among-contenders-41596594968615.html>



Photo of a Tata Defence Combat Light Armored Multi Role Vehicle



## India's quest for armed drones gets a boost as US looks to ramp up arms sales

*India is now looking at acquiring 6 armed drones from the US instead of the planned mix of 30 armed and non-armed drones. It is also in talks with Israel*

*By Snehash Alex Philip*

New Delhi: India's long quest for armed drones has received a boost from the US, which is looking at ramping up arms sales to New Delhi amid the ongoing stand-off with China in Ladakh.

Citing US officials and congressional aides, the *Foreign Policy* magazine reported Tuesday, "The Trump administration is looking to ramp up arms sales to India in the wake of the country's deadly border clashes with China, opening a new front of tensions between Washington and Beijing".

It quoted an unnamed Congressional aide as saying, "They're going to want to provide India with armed [category-1] Predators."

The development comes at a time when India is on a shopping spree to ramp up its firepower and surveillance capabilities as the ongoing tensions at the Line of Actual Control (LAC) are expected to continue well into the winter.

New Delhi has been in touch with countries like the US, France, Israel and Russia besides others for a host of equipment buys, including new assault rifles, drones, missiles, parachutes, ballistic helmets, ammunition and spares.

India has been keen on getting armed drones for a while and is in talks with both the US and Israel.

Sources in the defence and security establishment said the preference is for the American system – medium-altitude long-endurance (MALE) armed Predator-B, also called the MQ-9 Reaper.

It is capable of carrying four Hell-Fire missiles and two 500 pounds of laser-guided bombs.

Sources said that rather than opting for a mix of 30 armed and non-armed drones from the US as originally planned, India is now looking at acquiring six armed drones. But it is also in talks with Israel.

### **Armed drones – Obama rejected and Trump approved**

Over the past few years, India has remained highly interested in armed drones. The Defence Research and Development Organisation (DRDO) is working on an armed version of Rustom Unmanned Aerial Vehicle.

In December 2017, the then minister of state for defence Subhash Bhamre had informed Parliament that the government sent a letter to the US, seeking to purchase 22 MQ-9 Predator B Guardian maritime patrol remotely piloted vehicles from General Atomics for the Indian Navy.

"A request for Information (RFI) for Predator 'B' Sea Guardian was issued to the US Office of Defence Cooperation on November 14 and the response is awaited," he had said.

The Obama administration had earlier turned down India's request for an armed version of the Sea Guardian.

But this policy changed after the Trump administration came to power in 2016. It amended rules that restrict the sale of military-grade drones to foreign partners like India.

India moved a proposal to acquire 30 of these armed drones last year but the high cost, estimated to be over \$3 billion, halted the deal.

However, with the tensions rising at the LAC, the IAF has been keen on armed drones. A proposal for possible procurement of half a dozen armed drones is in the works.

The *Foreign Policy* magazine said Trump has sought to increase arms sales worldwide, viewing it as a blunt instrument of US power around the world and an engine for job growth at home.

“The administration has even floated plans to end congressional review of U.S. weapons sales abroad to expedite the process, angering some lawmakers who view the review process as an important part of congressional oversight,” it said.

<https://theprint.in/defence/us-is-looking-to-ramp-up-arms-sales-to-india-including-military-grade-drones-says-report/475075/>

## Defence News

### Defence Strategic: National/International



Thu, 06 Aug 2020

## जबलपुर की जीआइएफ में बनेगा भारतीय वायुसेना के लिए '250 केजी' बम

**रक्षा मंत्रालय के निर्देश पर जीआइएफ के प्लांट नंबर एक  
व दो में यह नया बम बनाने को लेकर तैयारियां चल रही हैं।**

जबलपुर: ऐसे समय पर जब चीन से सीमा पर तनाव कायम है, तब मध्य प्रदेश के जबलपुर स्थित सुरक्षा निर्माणी 'ग्रे आयरन फाउंड्री' (जीआइएफ) में भारतीय वायुसेना की विशेष मांग पर '250 केजी एचएसएलडी बम' बनाए जाएंगे। निर्माणी प्रशासन ने 'मेक इन इंडिया' को बढ़ावा देकर करीब एक साल पहले इस बम का खोल ढाला था, जो सैन्य जांच में सभी पैमानों पर सफल रहे हैं। ऐसे में रक्षा मंत्रालय ने ऑर्डनेंस फैक्ट्री बोर्ड (ओएफबी) के माध्यम से जीआइएफ को 250 केजी बम के 300 नग बनाने का आदेश दिया है।

**एक साल पहले ढाला गया खोल, सैन्य जांच में सभी पैमानों पर सफल**

रक्षा मंत्रालय के निर्देश पर जीआइएफ के प्लांट नंबर एक व दो में यह नया बम बनाने को लेकर तैयारियां चल रही हैं। इस निर्माणी में आयुध निर्माणी मुरादनगर (उत्तर प्रदेश) की तर्ज पर सिर्फ 250 केजी एचएसएलडी बम बनाने का अलग प्लांट तैयार करने पर भी विचार किया जा रहा है। इसके साथ ही इस वर्ष सितंबर-अक्टूबर से इन बमों का उत्पादन शुरू करने जीआइएफ प्रशासन पूरे प्रयास कर रहा है। हालांकि, कोरोना संक्रमण के चलते रॉ-मटेरियल (कच्चे माल) की तय समय पर आपूर्ति नहीं होने से बमों का उत्पादन कुछ दिन के लिए टलने की संभावना है।



**रक्षा मंत्रालय के निर्देश पर जीआइएफ के प्लांट नंबर एक व दो में यह नया बम बनाने को लेकर तैयारियां चल रही हैं।**

## 100-110 केजी से बड़ा बम

जीआइएफ के प्लांट नंबर एक और दो में अभी 100-110 केजी गुणवत्तायुक्त बम बनाने का काम होता है। रक्षा मंत्रालय ने इसी निर्माणी को इन बमों से लंबाई व वजन में बड़े बम (250 केजी) के खोल बनाने का उत्पादन लक्ष्य दिया है। जीआइएफ वित्तीय वर्ष 2020-2021 में इन बमों के खोल का उत्पादन करेगी। इसके बाद इन बमों में बारूद भरने का काम आयुध निर्माणी खमरिया (ओएफके) में होगा।

## दुश्मनों पर भयंकर वार करेंगे

जीआइएफ में बनने वाला '250 केजी हाइ स्पीड लो ड्रग (एचएसएलडी) बम' को भारतीय वायुसेना के जवान हवा में उड़ते तेजस, सुखोई जैसे लड़ाकू विमानों से दुश्मन सेना पर बरसाएंगे। यह विध्वंसक बम 10 से 30 किलोमीटर की ऊंचाई से युद्ध मैदान और बंकर, बिल्डिंग पर गिरेंगे और दुश्मनों पर भयंकर वार करते हुए उनके हौसलों को नेस्तनाबूद कर देंगे।

## बम की लंबाई 93 इंच

श्रमिक नेता बताते हैं कि जीआइएफ में बनाए जाने वाले 250 केजी बम की लंबाई 93 इंच (कुल 237 सेंटीमीटर) होगी। इस विध्वंसक बम का कुल वजन 135 किलोग्राम होगा, जिसमें भरे गए बारूद की मात्रा 110 से 115 किलोग्राम तक होगी।

मध्य प्रदेश के जीआइएफ जबलपुर के पूर्व महाप्रबंधक अतुल गुप्ता ने कहा कि जीआइएफ ने करीब एक साल पहले 250 केजी एचएसएलडी बम का खोल बनाया, जो सैन्य परीक्षण में सफल रहा। इसके बाद रक्षा मंत्रालय ने वायुसेना के लिए तीन सौ नग उत्पादन आदेश दिए हैं। यह निर्माणी अब जल्द से जल्द 250 केजी बम बनाने का काम शुरू करेगी।

<https://www.jagran.com/news/national-250-kg-bomb-will-be-made-for-indian-air-force-in-gif-of-jabalpur-20595979.html>

**TIMESNOWNEWS.COM**

Thu, 06 Aug 2020

## At a time the Indian Army really needs it, comes more state-of-the-art military equipment

*The assault rifles will also be useful for troops along the line of control, where they are often targeted by terrorists, supported by Pakistan army commands in what is called BAT or battle action team attacks*

*By Srinjoy Chowdhury*

New Delhi: With the Ladakh face-off still on and no certainty about when it's likely to end, the Indian Army will get 73,000 Sig Sauer 716 assault rifles from the United States of America. This was today cleared by the Defence Ministry's Services Capital Acquisition Plan Categorisation Higher Committee (SCAPCHC) that includes top military officials and bureaucrats. The total cost for the rifles is about Rs 800 crore.

This is over and above the 72,400 assault rifles already purchased from Sig Sauer. As this is a repeat order, there will be no need for trials and cost negotiation, which is often time-consuming.

The assault rifles have come as part of the plan to ensure that the infantry, most in use along the line of control and also, inside Jammu and Kashmir against terrorists, the best possible weaponry possible. A consignment of light

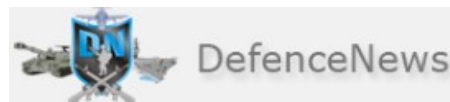


Representational Image | Photo Credit: PTI

machine guns have already been purchased and also, sniper rifles while Kalashnikov assault rifles will be manufactured in India in the future. India is also negotiating for a new carbine that the infantry urgently requires. The Sig Sauer 716 will replace the INSAS rifle that came to the infantry about 20 years ago. They will be able to use locally made ammunition.

The assault rifles will also be useful for troops along the line of control, where they are often targeted by terrorists, supported by Pakistan army commandos in what is called BAT or battle action team attacks.

<https://www.timesnownews.com/india/article/at-a-time-the-indian-army-really-needs-it-comes-more-state-of-the-art-military-equipment/632203>



*Thu, 06 Aug 2020*

## **Centre to encourage government-to-government deals to meet \$5 billion military export target**

In order to meet an ambitious target of \$5 billion worth of military exports annually by 2025, the Centre will encourage government-to-government deals, using lines of credit to friendly foreign nations and branding of home developed products at international shows.

Spelling out its export promotion strategy, the defence ministry has marked out a target for Defence PSUs and the Ordnance Factory Board achieve 25% of their revenues from exports within the next five years in a draft policy.

The targets would be difficult to meet, specially for PSUs that depend on the Indian armed forces as their only customer, necessitating a series of steps that have been spelled out, including an even more proactive role for Indian missions abroad and an aggressive marketing campaign.



An active campaign to push through direct government deals would go a long way, along the model used by top exporters like Russia and the US. "Subject to strategic considerations, domestically manufactured defence products will be promoted through government-to-government agreements and lines of credit or funding," the draft policy reads.

The government is also looking to position some PSUs as export promotion agencies for specific nations, with their earnings directly linked to the business generated, incentivising performance. These PSUs are yet to be identified but would be companies that have exposure in the identified nations.

Among major systems India is looking at offering through direct government talks are the Brahmos cruise missile system, the Akash air defence system, the Tejas Light Combat Aircraft and a range of choppers manufactured indigenously. Other products include torpedoes, fast attack craft and a range of naval systems. Achieving the \$5 billion target is an uphill task, given that exports last year were pegged at \$1.2 billion - a huge jump from the past.

[https://www.defencenews.in/article/Centre-to-encourage-government-to-government-deals-to-meet-\\$5-billion-military-export-target-921860](https://www.defencenews.in/article/Centre-to-encourage-government-to-government-deals-to-meet-$5-billion-military-export-target-921860)

Thu, 06 Aug 2020

## Tank battles in the Himalaya Mountains? Indian T-90 Tanks Face Chinese Armor

India has deployed its Russian-made T-90 tanks against Chinese forces in the disputed border region of Ladakh.

But moving 45-ton tanks in a mountainous region with poor roads and bridges comes with its own challenges.

The Indian armor has been stationed at the desolate outpost of Daulat Beg Oldi, which lies at an altitude of 16,000 feet and features one of the world's highest airfields. The outpost is a few miles from the Chinese border and just south of the strategic Karakoram pass, which India fears could be an invasion route for Chinese troops occupying the Aksai Chin area.



“With the Chinese People’s Liberation Army (PLA) deploying close to 50,000 troops in Aksai Chin, the Indian Army for the first time has deployed a squadron (12) T-90 missile firing tanks, armored personnel carriers (APCs) and a full troop brigade (4,000 men) at Daulat Beg Oldi to prevent any Chinese aggression from the Shaksgam-Karakoram pass axis,” according to the Hindustan Times, citing top Indian military commanders.

While tempers appear to have cooled somewhat as Chinese and Indian troops disengage, both sides have sent in reinforcements. Significantly, China and India are sending tanks to the Himalayas, a vast mountain range that includes Mount Everest and a harsh climate arduous for both humans and vehicles.

China has deployed the Type 15 light tank, a 30-ton vehicle armed with a 105-millimeter cannon that can fire shells and anti-tank guided missiles. China claims that its 1,000-horsepower diesel, coupled with the Type 15’s relatively light weight, will make the tank handy in mountainous terrain.

“With a powerful engine, the Type 15 lightweight main battle tank can effectively operate in plateau regions difficult for heavier tanks, and with its advanced fire control systems and 105-millimeter caliber armor-piercing main gun, it can outgun any other light armored vehicles at high elevations,” said China’s state-controlled Global Times.

Though lighter than the 70-ton U.S. M1A2 Abrams, Russia’s 45-ton T-90 main battle tank – essentially a modernized Cold War T-72 — is significantly heavier than the Type 15. Its 125-millimeter cannon can fire shells as well as AT-11 anti-tank guided missiles. Its defensive gear includes Kontakt-5 explosive armor and the Shtora infrared jamming system to stop incoming anti-tank rockets. While Chinese Type 15s have yet to see combat, Russian T-90s have fought in Syria, with at least one being badly damaged by a U.S.-made TOW anti-tank missile fired by Syrian rebels.

India has customized its variant, the T-90S Bhishma, with non-Russian gear such as a French thermal imaging system. The Type 15’s light weight may enable it to use roads and bridges that the T-90 can’t. On the other hand, India’s 1,000 T-90s have superior firepower and armor protection.

Arzan Tarapore, a non-resident fellow at the U.S.-based National Bureau of Asian Research thinktank, believes the Indian T-90s are there as a warning to Beijing that Chinese territory is vulnerable to an Indian counteroffensive. “They are not there to defend Indian territory, but to threaten Chinese territory,” Tarapore tells me. “This is and has long been Indian doctrine: to threaten a punishing riposte against China - ideally to strengthen India’s hand in disengagement



negotiations; or in the worst case, to actually try to seize Chinese territory as a bargaining chip to reverse China's incursions."

Chinese and Indian troops engaged in several mass fistfights in June in the disputed Galwan River valley, resulting in 20 Indian deaths and dozens of Chinese casualties. Both nations fought in a brief war over Ladakh in 1962, in which China defeated poorly prepared Indian forces. Chinese now appears to be pushing against the demarcation line in response to India building a new highway to sustain its forces in the area.

This isn't the first time that India has deployed tanks to Ladakh. During the 1962 war, India airlifted French-made AMX-13 light tanks aboard Soviet-made An-12 transport planes, and T-72s were sent in 2016. In 1962, "the tank crews quickly acclimatized itself to the freezing temperature and rarified air at 15,000 feet," noted one Indian news account. "The machines, however, faced more problems than the men. Low operating pressure and rarified air created problems in the cooling systems of the tanks and the freezing temperature affected the efficiency of their engines."

Which raises the obvious question of how useful tanks will be in a mountainous area with very poor roads. During the Korean War, for example, U.S. tanks were invaluable during combat in the flatlands: once the fighting shifted to the mountains, American tanks became mobile howitzers, lobbing shells from inclined ramps at Communist troops in the hills.

And Ladakh itself is one of the most difficult places on Earth for tanks to operate. The thin air and temperatures in the region can plunge to 50 degrees below zero Fahrenheit, an Indian Army colonel told India's NDTV in 2016. Indian tanks must use special fuel and lubricants at least twice every night, and the engines must be revved-up to keep the tank's systems from freezing.

But even in the mountains, tanks still offer something unique: a big, heavily armored, mobile cannon that can deliver far more firepower than what a foot soldier can carry on his back. Modern vehicles like the T-90 also have thermal sights and other advanced sensors to spot targets at night and in fog. While there will be no armored blitzkriegs in the Himalayas, tanks can provide invaluable fire support to infantry. On the other hand, in restricted terrain, tanks will need the infantry to protect them from man-portable anti-tank rockets.

Should more clashes erupt in Ladakh, Type 15s may occasionally battle T-90s. But in the Himalaya mountains – nicknamed "the roof of the world" – the biggest danger to Chinese and Indian tanks isn't the enemy. It's the climate.

<https://www.defencenews.in/article/Tank-Battles-In-The-Himalaya-Mountains-Indian-T-90-Tanks-Face-Chinese-Armor-921861>

## Why India can't meet its urgent weapons needs

*New Delhi's military procurement nightmare remains an obstacle to the country's long-term national security*

*By Dave Makichuk*

Air Chief Marshal Rakesh Kumar Singh Bhadauria, the chief of staff of the Indian Air Force, waited patiently at Ambala airbase in the north Indian state of Haryana.

It would be an exciting day for the IAF — the first five of the thirty-six Dassault Rafale fighters that India purchased from France were due to arrive from Merignac, France.

The aircraft had been touted in the Indian press as being “game changers” in the nation’s military strength, their expedited delivery owing to an urgent request following a series of border clashes with the People’s Liberation Army along the Himalayan border.

In fact, two of these five aircraft were trainers and the original tender to acquire them had been launched in 2000 for 126 medium multi-role combat aircraft — a far cry from five Rafale fighters.

Why did it take so long to acquire these weapons?

The excruciatingly slow process of the acquisition of these aircraft is emblematic of the structural flaws that bedevil India’s defense procurement process, write Sumit Ganguly and Pushan Das of The National Interest.

It is so cumbersome and protracted that it may well imperil India’s national security — the Rafales just one example of the ongoing problems that afflict India’s flawed weapons procurement process.

A range of other weaponry, which the Indian armed forces urgently need, remain trapped in bureaucratic bottlenecks, National Interest reported.

For example, the inability of the IAF to procure six flight refueling aircraft in a process that has now run for fourteen long years. The Airbus A330 multi-role tanker transport has been shortlisted twice with the request for proposal to be eventually withdrawn.

Yet another case of India’s broken defense acquisition system involves the Indian Navy’s indigenously-built French Scorpene-class submarines which are being inducted without their primary weapon: torpedoes.

India canceled its plans to buy Black Shark torpedoes produced by WASS (Whitehead Alenia Sistemi Subacquei), as the parent company subsidiary Augusta Westland, was blacklisted in a helicopter bribery scam, National Interest reported.

With no alternative in sight, the Navy now relies on a handful of obsolescent German surface-and-underwater target torpedoes on India’s four Howaldtswerke-Deutsche Werft Shishumar-class vessels.

The reason why India is unable to streamline this process is no big secret.

The labyrinthine procurement organization which constitutes of the Ministry of Defence, Service Headquarters, the Integrated Defence Staff (now headed by the new Chief of Defence Staff) and the vast array of laboratories under the aegis of the Defence Research and Development Organization have seen little or no procedural reforms, changes in institutional structures or increased accountability.



Indian state-owned Mazagon Dock Shipbuilders Limited (MDL) launches its fourth Scorpene-class submarine, the INS Vela, for the Indian Navy. Credit: Naval Group.

This has led to a constant dependence on government-to-government defense purchases as well as resorting to “emergency procurements,” National Interest reported

Neither of these routes are very efficient and represent the failure of the present procurement system to acquire much-needed weaponry in a timely, competitive process.

Sadly, the external security threats that India confronts, especially that from the People’s Republic of China, will not disappear soon, leaving the nation acutely vulnerable to its adversaries for the foreseeable future.

<https://asiatimes.com/2020/08/why-india-cant-meet-its-urgent-weapons-needs/>



Thu, 06 Aug 2020

## Lockheed Martin to provide Airborne Low Frequency Sonar Sensors for Indian MH-60R Seahawks

***Lockheed Martin has won a \$181.7 million contract to provide Airborne Low Frequency Sonars (ALFS) to be fitted on MH-60R Seahawk helicopters operated by the U.S. Navy and India***

The modification contract provides for the production, delivery and integration of 24 Airborne Low Frequency Sonars (ALFS) for the government of India; into MH-60R Seahawk aircraft, the U.S. Department of Defence said in a statement today.

The AN/AQS-22 Airborne Low Frequency Sonar (ALFS) is the primary undersea warfare (USW) sensor of the MH-60R multi-mission helicopter. This integrated dipping sonar system



enables the MH-60R to accomplish the assigned ASW missions of submarine detection, tracking, localization and classification. It also performs missions relating to acoustic intercept, underwater communications and environmental data acquisition, according to Raytheon.

The AN/AQS-22 is the only in-service dipping sonar with multi-frequency operation. This capability enables the AN/AQS-22 to adapt its performance to varying environmental conditions. With a rapid search rate, the sonar identifies and neutralizes threats sooner, enabling it to cover a larger area. The AN/AQS-22 also permits a longer detection range over a wider area, reducing the number of helicopters required to perform active anti-submarine warfare (ASW) screening.

<http://www.indiandefensenews.in/2020/08/lockheed-martin-to-provide-airborne-low.html>

## **‘P&W Engines are the best choice to power India’s Defence Aircraft’ Ashmita Sethi, President and country head, Pratt & Whitney, UTC India**

Over the decades, P&W has established MRO capability in India for its partner airlines. Could you outline the expansion plans for India and commitment to innovation?

Pratt & Whitney’s presence in India spans seven decades starting in the 1960s, when Air India received its first Boeing 707 powered by P&W’s JT3D engines. Since then, P&W engines have powered aviation growth in India with a product portfolio across commercial, regional, business and military aviation. In 2005, our V2500 engines on IndiGo Airline’s Airbus A320 fleet helped usher in a new age for private aviation in India. Today, more than 1,250 P&W engines power more than 50 per cent of commercial aircraft in the country. From single-aisle to turbo-props, we have the largest footprint for any engine maker in the country. That’s why one in every two people flying in India fly on Pratt & Whitney’s engines.



Over the last five years, with the intent of ensuring more timely returns to operators, we have significantly grown our global maintenance, repair and overhaul (MRO) network. In fact, our global Geared Turbo Fan (GTF) MRO capacity has increased six times since 2017. We currently have eight facilities worldwide doing GTF MRO.

We recently announced our first investment in India-based MRO services. Air India Engineering Services (AIESL) will provide MRO services in support of P&W GTF engines and customers in India. AIESL will service PW1100G-JM engines at its facility in Mumbai. This will not only strengthen our MRO capacity and capabilities in India, but also open up future avenues for growth, aligned to the government’s “Make in India” vision. We remain committed to building capabilities for high value services that will help airlines get the best from their next-generation products, and creating an innovative aerospace and defence ecosystem that transforms the country’s aviation aspirations into reality.

How is P&W going to contribute in building aerospace capabilities in India?

P&W’s F117 engines power the Indian Air Force’s (IAF) 11 C-17 Globemasters — the largest C-17 fleet outside of United States — in carrying out military, humanitarian and peacekeeping missions. In fact, the C-17 has been used heavily during the Covid-19 crisis for medical repatriation flights for Indian citizens, and we are proud to play a role in the fleet’s readiness. The PT6A engines also power the Pilatus PC-7 trainers flown by the IAF. Additionally, we now offer a growing suite of sustainment solutions for engines for large and small aircraft that support the IAF’s mission readiness.

As for modernisation programmes, the IAF and the Indian Navy are in the process of upgrading some of their platforms. A few aircraft in possible consideration for different campaigns include the PW100-powered Airbus C295 light transport for the IAF and the PW210-powered Sikorsky S-76D for the Naval Utility Helicopter programme. We are confident that our engines are the best choice to power India’s defence aircraft and in meeting its modernisation needs in the future.

As India’s defence and aerospace sectors modernise, build capacity and assimilate technology, PW continues to set new standards of performance and dependability. Our GTF engine which powers the fastest growing single-aisle segment worldwide, delivers the promised fuel efficiency

and environmental benefits that Indian aviation needs for its growth. The GTF-powered A320neo provides 16 per cent better fuel efficiency from prior-generation engines, 75 per cent reduction in noise footprint, and a 50 per cent reduction in regulated emissions.

Similarly, P&W turboprop, turboshaft and turbofan engines have powered the growth of business and general aviation for decades. Today, with more than 650 engines in service powering regional, general and business aviation as well as helicopters and APUs, we are uniquely poised to power the government's Regional Connectivity Scheme (RCS) and UDAN initiative, which aim to accelerate air travel penetration, regional connectivity to drive local economies' growth and affordable flying. RCS will open up additional opportunities to serve more than 50 million passengers by 2027 and requiring an additional 200-250 aircraft for this segment.

India remains a key market for P&W, and we continue to build on our valued relationships through partnered investments in innovation, research, supply chain and sustainment. We have been working with leading Indian suppliers such as Cyient and HCL for our engineering and sourcing needs. We are deeply committed to the India market and aligned with the government's programmes including Make in India, Skill India' and Startup India' and are looking to further our investments.

P&W is actively contributing to the government's vision of making India a global manufacturing hub and developing the aerospace talent pool. Specialised training programmes at our Customer Training Centre in Hyderabad, which is DGCA and EASA certified, help create an industry-ready talent pool. This is one of our two major international state-of-the-art training centres outside of the US where trainees get to work in realtime on engines, including our world-beating GTF engine. Our Industry Capability Enhancement programme supports medium and small-scale enterprises in precision manufacturing and highly specialised engineering services, and we also collaborate with state governments to advance skills training.

We have also launched 100 e-learning centres, in collaboration with UCONN and Engineers Without Borders, to advance STEM education. Our focus on innovation helps us prepare for tomorrow's challenges. Globally, we are investing in new technologies that will power the future of aviation while reducing the carbon footprint of our industry. Digital technologies, additive manufacturing, advanced high temperature materials and hybrid electric will positively impact aviation in the coming days.

PM Modi and IAF chief talked about building more than 1,000 next-generation AMCA and Tejas Mk2 fighter aircraft but the biggest hurdle is a suitable jet engine for these aircraft. As the world's leading OEM with such capabilities, are you keen to respond to the idea of jointly developing and manufacturing engine here?

Today, more than 7,000 P&W military engines are in service with 34 armed forces worldwide, setting new standards for performance and dependability. Globally, some of the most advanced fifth-generation aircraft in the world, like the F-35 and the F-22 Raptor, also fly on Pratt & Whitney engines.

Our engines currently power the IAF's C-17 fleet and its Pilatus PC-7 trainers and are committed to serving the demands of our customers with cutting-edge innovation. In fact, India's indigenous NAL-Saras, powered by the PT6A turboprop, is a great example of our partnership with local aircraft development programmes. That said, we may be open to fulfilling any requirements and considering partnerships on key platforms with our stakeholders in country.

The government has increased FDI to 100 per cent on a case-to-case basis in defence, besides liberalising the MRO sector. As a foreign OEM, would you scale up and invest in India?

What are the challenges in setting set up a complex jet engine manufacturing ecosystem in India? We welcome the Indian government's recent announcements and are optimistic about their positive impact. The raising of the FDI limit in defence to 74 per cent and 100 per cent will certainly unleash the true potential of India's defence production capabilities. The liberalisation of the MRO sector to make it more inclusive and competitive will provide the country with a strong operational ecosystem for both domestic and international players.



Our recently announced partnership with AIESL will provide MRO services in support of Pratt & Whitney's GTF engines for Indian and global customers. The partnership demonstrates our lead and support in the engine MRO sector as such services have been previously been conducted only by international MRO hubs, and we are proud to bring this advanced capability to India.

India is looking to build 114 fighter jets under MMRCA 2.0, and General Electric is the engine supplier to all the proposed American aerospace OEMs — Boeing & Lockheed — along with 83 home-grown Tejas MK1a. Whilst P&W has the most advanced F119-PW-100 turbofan and F135 engines powering fifth generation fighter jets F-22 Raptor & F-35 Lightning II, they are limited in their scope for Indian defence. How do you look at this?

As makers of the world's first operational fifth-generation engine (F119) for the USAF F-22 and the world's most advanced fighter engine (F135) for the F-35, our history and expertise with advanced propulsion systems is unmatched in the world. When it comes to India's current requirement for 114 fighter jets, we believe that the IAF and the government will select the most capable platform that meets India's long-term mission requirements.

Looking at the future, there are indigenous platforms in very early stages of consideration and development, including the twin-engine naval variant for the Tejas and the Advanced Medium Combat Aircraft (AMCA). Such indigenous programmes will certainly advance India's defence and industrial capabilities. Engine performance and development are critical components for advancing any new platform and at P&W, we are happy to engage with our customers on any opportunities that they see fit for us in the long term.

P&W's PW1100Gs series engines for the Airbus A320neo family is undergoing overhauling to fix durability problems in challenging operating environments in India. Could you tell us about the ongoing progress?

Given that the nation has been under an extended lockdown due to the Covid-19 pandemic, the deadline for the replacement of PW1100G-JM was extended by the DGCA to August 31, 2020. We have been working with our airline customers in India to continue to upgrade their PW1100G-JM engines. Even during the recent pause in air travel, P&W has been executing upon and meeting our India targets.

More than 80 per cent of the engines already have the modified LPT to support successful return-to-service of our airline customers IndiGo and GoAir. P&W is upgrading engines through our aftermarket network and anticipates staying ahead of the return of passenger demand. We are confident that we will meet the new deadline barring any further operational complications due to Covid-19. All upgraded engines are performing in line with our expectations and have not reported any issues.

The GTF engine will drive the next generation of efficient, sustainable air travel allowing airlines and airports to open new routes and fly more people, farther, with less fuel— and much lower noise. As the aviation industry recovers from Covid-19's impact, efficiency and sustainability will be key to a robust recovery.

<https://www.defencenews.in/article/%e2%80%98PandW-Engines-Are-The-Best-Choice-To-Power-India%e2%80%99s-Defence-Aircraft%e2%80%99-Ashmita-Sethi,-President-And-Country-Head,-Pratt-and-Whitney,-UTC-India-911902>

## China begins sea trials of 1st giant amphibious assault warship

*The Type 075 class ships are among the largest amphibious assault ships in the world*

Chinese state-run media reported on Wednesday that sea trials of the first ship of a new class of amphibious assault warships for the country's navy appear to have started.

The first ship of the Type 075 class was launched at a shipyard in Shanghai in September last year.

The *Global Times* reported on Wednesday "The presumed maiden voyage will likely test the amphibious assault ship's main systems, including propulsion, navigation and communication..."

The *Global Times* noted "It usually takes a new warship a year or two to formally join military service after its first sea trial, military analysts said. This means the first Type 075 will likely be commissioned into the People's Liberation Army (PLA) Navy in 2021 or 2022."



The first Type 075 ship on sea trials | Twitter handle of dafeng cao

The Type 075 class of ships are among the largest amphibious assault ships in the world, displacing approximately 40,000 tonnes and are about 250 metres long. The ship has a large flight deck, enabling it to carry up to 30 transport and attack helicopters. It also has a 'well deck' in its hull, which allows it to launch hovercraft and other amphibious vessels capable of ferrying tanks and troops to shore. A second Type 075 class ship was launched in Shanghai in April this year. According to the US Navy's Office of Naval Intelligence, China is also building a third Type 075 class amphibious assault warship.

In terms of size, the Type 075 class ships are the largest amphibious assault ships in the world, excluding similar vessels of the US Navy. According to the Center for Strategic and International Studies, the Type 075 provides "China with greater capabilities for asserting their territorial claims in the East and South China Sea, as well as executing humanitarian assistance and disaster relief, anti-piracy, and non-combatant evacuation operations". Experts have warned China is improving its amphibious warfare capability to prepare for the eventuality of military operations in Taiwan or disputed islands in the South China Sea.

The *Global Times* report itself noted "this type of Chinese warship is widely expected to play a major role around the Taiwan Straits and the South China Sea".

China has also inducted at least five Type 071 class amphibious assault ships in the past decade. These ships are smaller in size compared with the Type-075 and displace around 25,000 tonnes each.

<https://www.theweek.in/news/world/2020/08/05/china-begins-sea-trials-of-1st-giant-amphibious-assault-warship.html>

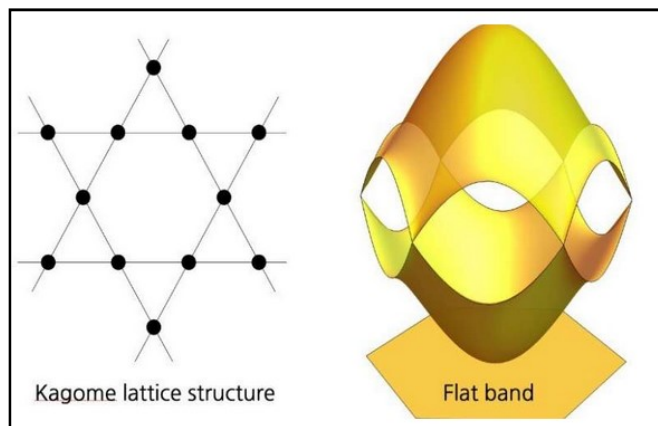
## Manifestation of quantum distance in flat band materials

The geometry of an object indicates its shape or the relationship of its parts to each other. Did you know that the electrons in solids also have geometric structures? In quantum mechanics, an electron in solids takes the form of a wave with periodicity so that the periodic electronic state, so-called the Bloch state, can be characterized by specifying its energy and crystal momentum which is proportional to its wave number. The relationship between the energy and the crystal momentum of electrons is called the band structure of solids. For electrons in solids, the Berry curvature and the quantum metric of Bloch states take the role of the curvature and the distance of an object in geometry.

In fact, the geometry of quantum states is one of the central concepts underlying diverse physical phenomena, ranging from the celebrated Aharonov-Bohm effect to the topological phases of matter developed more recently. For instance, the local Berry curvature is responsible for the anomalous Hall transport while its integral over a two-dimensional closed manifold gives the Chern number, an integer number describing the quantized Hall conductivity. However, compared to the physics of the Berry curvature, the effects of the quantum metric on physical phenomena are less understood, especially in solids, although there are several recent works proposing the physical observables related to the quantum metric. Especially, there has been no clear guideline for searching materials in which the physical properties related with the quantum metric can be observed.

Prof. Yang Bohm-Jung and Dr. Rhim Jun-Won at the Center for Correlated Electron Systems within the Institute for Basic Science (IBS) in Seoul National University, Seoul, South Korea, and Dr. Kim Kyoo at the Korea Atomic Energy Research Institute, Daejeon, South Korea, reported that they found a way to measure the quantum distance of Bloch states in solids by applying magnetic field. More specifically, the researchers have examined the energy spectrum under magnetic field, called the Landau level spectrum, of flat bands in the kagome and checkerboard lattices, and observed anomalous Landau level spreading arising from the flat band. Surprisingly, they found that the total energy spreading of the flat band's Landau level is solely determined by the maximum quantum distance between the Bloch states of the flat band. Namely, the quantum distance of the Bloch states in solid can be measured by applying magnetic field to two-dimensional materials with flat bands.

Recently, two-dimensional materials with flat bands have received a great attention as a new platform to realize intriguing electronic states. A flat band indicates an electronic band structure in which the energy does not change when crystal momentum is varied. Such intriguing flat band



(Left) The kagome lattice structure in real space. (Right) The corresponding band structure in momentum space. The bottom band is the flat band which exhibits anomalous Landau level spectrum. Credit: IBS

structures appear in various two-dimensional lattices including the kagome lattice, checkerboard lattice, etc. The theory group of the IBS CCES research team realized that, in many of the flat band systems, the Berry curvature of the Bloch states is zero due to the symmetry of the lattice. If the Berry curvature is strictly zero, one can naturally expect that the geometry of the Bloch states is solely determined by the quantum metric. This interesting aspect motivated the IBS theory team to seriously consider two-dimensional materials with flat bands as a promising playground to study physical properties related to the quantum metric.

In fact, the semiclassical quantization rule predicts that an ordinary parabolic band under magnetic field forms equally-spaced discrete Landau levels, and the energy difference between neighboring Landau levels is inversely proportional to the effective mass of the electrons. When applied to a flat band with an infinite effective mass, the semiclassical theory predicts zero Landau level spacing so that a flat band remains inert under magnetic field. In this study, the researchers observed a quite peculiar nature of the Landau level spectrum that is in sharp contrast to the conventional norm. They reported that the Landau levels of the flat bands spread into the empty region of the energy space where no electronic states are available in the absence of magnetic field.

The researchers found that the key to such an unusual Landau level spectrum is the fact that the flat band in the kagome and checkerboard lattices is crossing with another parabolic band at a point. The singularity in the wave function of the flat band arising from the band crossing point induces nontrivial geometric effect related to the quantum distance of the wave function, which in turn induces anomalous Landau level spectrum. The first author, Dr. Rhim Jun-Won states, "Understanding the role of the band crossing in flat bands was the key to describe the anomalous Landau levels. This finding provides a practical way to unambiguously extract the quantum distance in solids."

This study shows that the quantum distance or quantum metric can also play crucial roles in determining material properties as the Berry curvature does. Contrary to the previous works, this study clearly identified the candidate lattice systems in which the quantum metric effect is maximized while the Berry curvature effect is minimized, and discovered a way to directly extract the quantum distance in solids for the first time. Considering the tremendous impact of the concept of the Berry curvature on the understanding the properties of solids, it is natural to expect that this study may facilitate the future study about the geometric properties of solids related to the quantum metric and the search of materials in which the related physical responses can be observed.

Prof. Yang Bohm-Jung explains that "This result would provide a critical step towards the complete understanding of geometrical properties of quantum states in solids. As there are many two-dimensional lattice structures hosting flat bands, our study may trigger future research activities for discovering novel geometrical phenomena related to the quantum metric in various condensed matter materials."

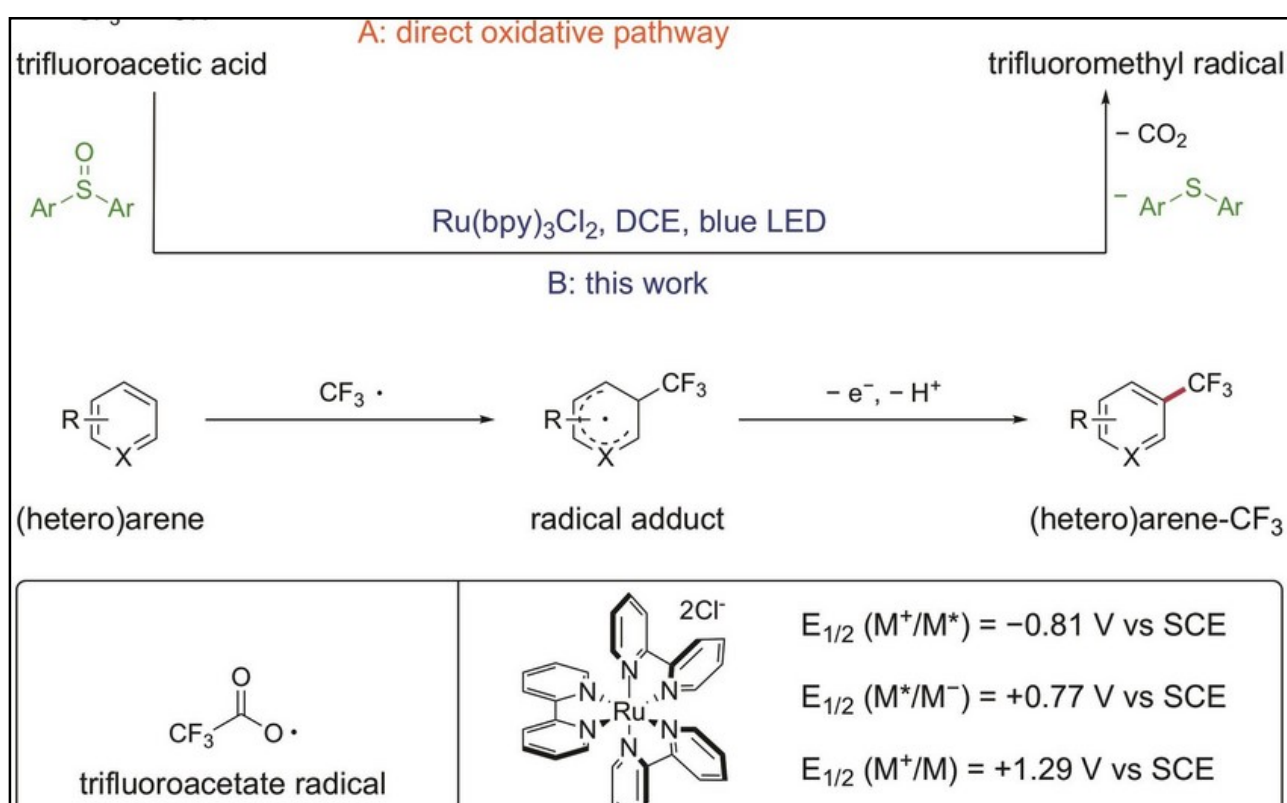
**More information:** Rhim, J., Kim, K. & Yang, B. Quantum distance and anomalous Landau levels of flat bands. *Nature* 584, 59–63 (2020). [doi.org/10.1038/s41586-020-2540-1](https://doi.org/10.1038/s41586-020-2540-1)

**Journal information:** [Nature](https://phys.org/news/2020-08-manifestation-quantum-distance-flat-band.html)  
<https://phys.org/news/2020-08-manifestation-quantum-distance-flat-band.html>

# Trifluoroacetic acid acts as trifluoromethylating agent in arene C-H functionalization

Researchers at the Shanghai Institute of Organic Chemistry of the Chinese Academy of Sciences have developed a catalytic system that directly installs the trifluoromethyl group onto arenes. The new reaction uses simple and abundant trifluoroacetic acid as the trifluoromethylating agent, and offers a milder alternative to the existing strategies.

Published on August 5 in the journal *Cell Reports Physical Science*, the reported transformation is the first to successfully use trifluoroacetic and related acids as trifluoromethyl, chlorodifluoromethyl, and perfluoroalkyl radical sources with visible light irradiation.



Trifluoromethylation, Chlorodifluoromethylation and Perfluoroalkylation of Arenes. Credit: JIN Jian

Fluorinated drugs have better membrane permeability and increased bioavailability compared with their non-fluorinated analogs because of the changes in the physical and chemical properties. Trifluoromethyl group is one of the privileged moieties in modern drug discovery.

Among the top 200 small molecule pharmaceuticals by retail sales in 2018, there were 15 drugs containing at least one trifluoromethyl group, mostly (80%) on their aryl or heteroaryl scaffolds. Therefore, simple methodologies for the incorporation of trifluoromethyl group into arenes and heteroarenes are highly desirable.

Trifluoroacetic acid (TFA) is among the most attractive trifluoromethylation reagents with respect of its low prices, ease of handling, and availability in large quantities. However, because of its exceedingly high oxidation potential, harsh conditions are required for the direct oxidation of TFA to the trifluoroacetate radical, which after prompt CO<sub>2</sub> extrusion affords the desired CF<sub>3</sub> radical.

The combination of photoredox catalysis and a diaryl sulfoxide provides a platform for the facile generation of CF<sub>3</sub> radical from trifluoroacetic acid under mild conditions. The resultant CF<sub>3</sub>



radical would then add to the (hetero) arene substrate, followed by an oxidative re-aromatization process to afford the trifluoromethylated (hetero) arene product.

This protocol is applicable for chlorodifluoromethylation and perfluoroalkylation as well. And a diverse array of arenes and heteroarenes were successfully transformed into valued fluoroalkylated compounds.

"We anticipate this visible light-promoted C-H fluoroalkylation method will find broad application," said Professor Jin Jian who led the project.

This work was supported by the Natural Science Foundation of Shanghai, the Shanghai Institute of Organic Chemistry of the Chinese Academy of Sciences.

**More information:** Dehang Yin et al. Photoredox Catalytic Trifluoromethylation and Perfluoroalkylation of Arenes Using Trifluoroacetic and Related Carboxylic Acids, *Cell Reports Physical Science* (2020). DOI: [10.1016/j.xcrp.2020.100141](https://doi.org/10.1016/j.xcrp.2020.100141)

<https://phys.org/news/2020-08-trifluoroacetic-acid-trifluoromethylating-agent-arene.html>



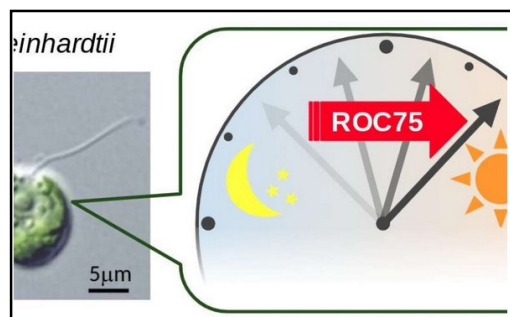
Thu, 06 Aug 2020

## Scientists find how clock gene wakes up green algae

A team of researchers from Nagoya University, Japan, has found the mechanism of the night-to-day transition of the circadian rhythm in green algae. The findings, published in the journal *PLOS Genetics*, could be applied to green algae to produce larger amounts of lipids, which are a possible sustainable source of biofuel.

Green algae are photosynthetic organisms that live mainly in lakes and ponds and produce lipids internally. Like most organisms, green algae have a circadian clock, which regulates their daily photosynthetic activities. The mechanism of their circadian clocks, however, had not been previously explained.

The team of Takuya Matsuo of the Center for Gene Research and colleagues at Nagoya University has been conducting studies on circadian clocks using *Chlamydomonas reinhardtii*, a species of freshwater green algae.



ROC75 plays a crucial role in the night-to-day transition of the circadian rhythm in *C. reinhardtii*. Credit: Takuya Matsuo

"We had previously found that a gene called ROC75 is involved in the circadian rhythm of *C. reinhardtii* in some way," says Matsuo. In the new study, the team further investigated the role of ROC75 in the same species. The results suggest that the ROC75 gene functions from dawn through the day and helps change the green alga's circadian phase from night to daytime by suppressing the activity of night-phased clock genes.

To demonstrate it, the team artificially controlled the activity of ROC75. When ROC75 was inhibited, the alga's circadian rhythm wasn't observed. Then, when the activity of ROC75 was restored, the circadian rhythm resumed. Also, through multiple experiments, the researchers found that the alga's circadian clock restarted, ticking consistently just as if the morning had come. The team thus concluded that ROC75 plays a crucial role in changing green algae's circadian phase from night to daytime.

"This study showed that by controlling the activity of ROC75, we can wake up green algae whenever we want and thereby enhance their photosynthetic activities. In this way, we could make green algae produce larger amounts of lipids that can be converted into biofuel," says Matsuo.

"The role of ROC75 that we found may reflect a survival strategy used by green algae after the species decided to continue to live in water during its evolution. I believe this study takes a step forward in understanding the mechanism and the evolutionary history of circadian clocks in green plants."

The paper, "The role of ROC75 as a daytime component of the circadian oscillator in *Chlamydomonas reinhardtii*," was published in the journal *PLOS Genetics* on June 17, 2020.

**More information:** Takuya Matsuo et al. The role of ROC75 as a daytime component of the circadian oscillator in *Chlamydomonas reinhardtii*, *PLOS Genetics* (2020). DOI: [10.1371/journal.pgen.1008814](https://doi.org/10.1371/journal.pgen.1008814)  
<https://phys.org/news/2020-08-scientists-clock-gene-green-algae.html>



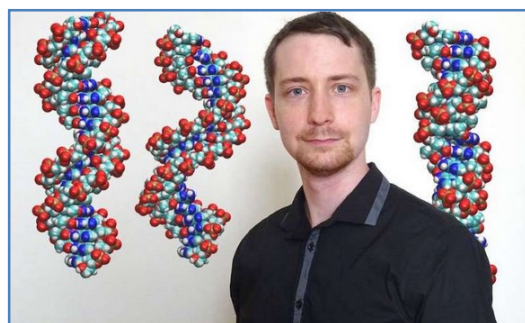
Thu, 06 Aug 2020

## Molecular forces: The surprising stretching behavior of DNA

By Florian Aigner

When large forces act on a heavy beam, for example, in bridge construction, the beam will be slightly deformed. Calculating the relationship between forces, internal stresses and deformations is one of the standard tasks in civil engineering. But what happens when you apply these considerations to tiny objects—for example, to a single DNA double helix?

Experiments with DNA molecules show that their mechanical properties are completely different from what those of macroscopic objects—and this has important consequences for biology and medicine. Scientists at TU Wien (Vienna) has now succeeded in explaining these properties in detail by combining ideas from civil engineering and physics.



Johannes Kalliauer. Credit: Vienna University of Technology

### Unexpected behavior at the molecular level

At first glance, you might think of the DNA double helix as a tiny little spring that you can simply stretch and compress just like you would an ordinary spring.

But it is not quite that simple: If you stretch a piece of DNA, you would actually expect the number of turns to decrease. But in certain cases the opposite is true: "When the helix gets longer, it sometimes twists even more," says civil engineer Johannes Kalliauer from the Institute of Mechanics of Materials and Structures at TU Wien. "Apart from that, DNA molecules are much more ductile than the materials we usually deal with in civil engineering: They can become 70 % longer under tensile stress."

These strange mechanical properties of DNA are of great importance for biology and medicine: "When the genetic information is read from the DNA molecule in a living cell, the details of the geometry can determine whether a reading error occurs, which in the worst case can even cause cancer," says Johannes Kalliauer. "Until now, molecular biology has had to be satisfied with empirical methods to explain the relationship between forces and the geometry of DNA."

In his dissertation, Johannes Kalliauer got to the bottom of this issue—and he did so in the form of a rather unusual combination of subjects: His work was supervised on the one hand by the civil engineer Prof. Christian Hellmich, and on the other hand by Prof. Gerhard Kahl from the Institute of Theoretical Physics.

"We used molecular dynamics methods to reproduce the DNA molecule on an atomic scale on the computer," explains Kalliauer. "You determine how the DNA helices are compressed, stretched or twisted—and then you calculate the forces that occur and the final position of the atoms." Such calculations are very complex and only possible with the help of large supercomputers—Johannes Kalliauer used the Vienna Scientific Cluster (VSC) for this purpose.

That way, the strange experimental findings could be explained—such as the counterintuitive result that in certain cases the DNA twists even more when stretched. "It's hard to imagine on a large scale, but at the atomic level it all makes sense," says Johannes Kalliauer.

### **Strange intermediate world**

Within the atomic models of theoretical physics, interatomic forces and distances can be determined. Using certain rules developed by the team based on principles from civil engineering, the relevant force quantities required to describe the DNA strand as a whole can then be determined—similar to the way the statics of a beam in civil engineering can be described using some important cross-sectional properties.

"We are working in an interesting intermediate world here, between the microscopic and the macroscopic," says Johannes Kalliauer. "The special thing about this research project is that you really need both perspectives and you have to combine them."

This combination of significantly different size scales plays a central role at the Institute for Mechanics of Materials and Structures time and again. After all, the material properties that we feel every day on a large scale are always determined by behavior at the micro level. The current work, which has now been published in the *Journal of the Mechanics and Physics of Solids*, is intended to show on the one hand how to combine the large and the small in a scientifically exact way, and on the other hand to help to better understand the behavior of DNA—right down to the explanation of hereditary diseases.

**More information:** Johannes Kalliauer et al. A new approach to the mechanics of DNA: Atoms-to-beam homogenization, *Journal of the Mechanics and Physics of Solids* (2020). DOI: [10.1016/j.jmps.2020.104040](https://doi.org/10.1016/j.jmps.2020.104040)  
<https://phys.org/news/2020-08-molecular-behavior-dna.html>



*Thu, 06 Aug 2020*

# India's Zydus starts phase 2 COVID-19 vaccine trial after clearing safety test

*By Nick Paul Taylor*

Zydus Cadila has completed (PDF) a phase 1 clinical trial of its COVID-19 vaccine ZyCoV-D, setting it up to move straight into a 1,000-subject phase 2 study. The Indian company said the DNA vaccine was well tolerated in the first stage of the adaptive phase 1/2 trial it initiated last month.

ZyCoV-D is designed to introduce DNA that encodes for a viral protein into human cells. By ordering human cells to make the protein, ZyCoV-D could elicit an immune response against the coronavirus. The approach is similar to that pursued by Inovio Pharmaceuticals. Like Inovio, Zydus sees the ability of its vaccine to withstand higher temperatures than some rival approaches as a differentiator.

Whether ZyCoV-D works as well as other COVID-19 vaccine candidates remains to be seen. So far, Zydus has only said that the vaccine was well tolerated by people who received it in the first phase of the trial. Zydus monitored subjects in a clinical pharmacological unit for 24 hours after dosing and in the community for seven days thereafter.

Based on the safety profile seen so far, which Zydus said was endorsed by the Data Safety Monitoring Board, the study is set to progress into its larger, 1,000-subject, placebo-controlled phase 2 portion on Thursday.

The milestone continues the speedy advance of the vaccine through the clinic. Zydus wrapped up its preclinical assessments of the vaccine and secured clearance to start clinical trials in early July. Less than two weeks later, Zydus began dosing the first subjects in an adaptive phase 1/2 study. Zydus is set to start the phase 2 portion of the trial three weeks after getting the phase 1 underway.

Zydus' progress into and through the clinic has benefited from the willingness of the Indian regulator to fast track processes. India is currently averaging more than 50,000 new cases of COVID-19 a day.

The Serum Institute of India has secured a license to AstraZeneca's COVID-19 vaccine, setting it up to make 400 million doses for low and middle-income countries by the end of 2020, but with Western governments buying up supplies of other candidates India may need more local players to step up if it is to embark on a mass-immunization program capable of ending the crisis.

Aspects of Zydus' vaccine mean that, if it is safe and effective, it may be well suited to use in India. Vaccines that use mRNA to induce an immune response, such as those in development at CureVac, Moderna and BioNTech and Pfizer, typically need to be transported along cold chains. That can make it hard to ship the vaccines in industrialized countries. In rural India, the requirement could severely limit access.

Zydus said its DNA vaccine approach achieves "much improved vaccine stability and lower cold chain requirements making it easy for transportation to remotest regions of the country." AstraZeneca's AZD1222 also has less demanding storage requirements than the mRNA vaccines.

In June, Zydus said the DNA vaccine is one of two COVID-19 candidates it is developing. Zydus is yet to share details of the approach it is taking with the second follow-on vaccine candidate.

<https://www.fiercebiotech.com/biotech/india-s-zydus-starts-phase-2-covid-19-vaccine-trial-after-clearing-safety-test>



Thu, 06 Aug 2020

## **Novavax COVID-19 vaccine elicits robust immune response in early trial**

*No serious adverse events were reported and safety follow-up continues, Novavax said after the COVID-19 vaccine trial results*

A COVID-19 vaccine developed by US-based Novavax elicited robust antibody responses and appeared to be safe in a Phase-I human trial, the company has said.

No serious adverse events were reported and safety follow-up continues, Novavax said on Tuesday, while releasing the results of the study about its Covid-19 vaccine, NVX-CoV2373.

The trial evaluated two doses of the vaccine across two dose levels -- 5 and 25 microgram -- in 131 healthy adults ages 18-59 years.

The trial was supported by funding from the Coalition for Epidemic Preparedness Innovations (CEPI) and was conducted at two sites in Australia.

"The Phase 1 data demonstrate that NVX-CoV2373 with our Matrix-M adjuvant is a well-tolerated COVID-19 vaccine with a robust immunogenicity profile," Gregory Glenn, President, Research and Development at Novavax, said in a statement.

"Using a stringent wild-type virus assay performed by investigators at the University of Maryland School of Medicine, NVX-CoV2373 elicited neutralising antibody titers greater than those observed in a pool of COVID-19 patients with clinically significant disease."

NVX-CoV2373 is a vaccine candidate engineered from the genetic sequence of SARS-CoV-2, the virus that causes Covid-19 disease.

It was created using Novavax' recombinant nanoparticle technology to generate antigen derived from the coronavirus spike (S) protein and contains Novavax' patented saponin-based Matrix-M adjuvant to enhance the immune response and stimulate high levels of neutralizing antibodies.

The company said the data of the Phase-1 trial have been submitted for peer-review to a scientific journal and to an online preprint server at medRxiv.org.

Novavax has become the third US company to release Phase-1 data of Covid-19 vaccines after Moderna and Pfizer.

Novavax was awarded \$1.6 billion by the US government as part of Operation Warp Speed (OWS), a program to deliver millions of doses of a safe, effective vaccine for Covid-19 to the US population.

The funding is being used by Novavax to complete late-stage clinical development, including a pivotal Phase 3 clinical trial, establish large-scale manufacturing, and deliver 100 million doses of NVX-CoV2373 beginning as early as late 2020, the company said. (With IANS inputs)

<https://www.dnaindia.com/world/report-novavax-covid-19-vaccine-elicits-robust-immune-response-in-early-trial-2836056>



## **Covid-19 vaccine tracker, August 5: WHO asks Russia to follow regulations; Britain says won't use Russian vaccine**

*Coronavirus (COVID-19) vaccine tracker update: The superfast speed of development and approval of the vaccine has led to scepticism*

Pune: The World Health Organisation has cautioned Russia against rushing through with its novel Coronavirus vaccine. Russia has announced plans to approve a vaccine candidate being developed by Moscow's Gamaleya Institute by the second week of this month. It has also said that the vaccine would be in market by next month, and mass vaccinations would begin by October.

The superfast speed of development and approval has led to scepticism.

"There are established practices and there are guidelines out... Any vaccine (or medicine) for this purpose should be, or course, going through all the various trials and tests before being licensed for roll-out," Christian Lindmeier, a spokesperson for WHO, was quoted by the *AFP* news agency as saying in Geneva on Tuesday.

"Sometimes individual researchers claim they have found something, which is, of course, as such, great news. But between finding or having a clue of maybe having a vaccine that works, and having gone through all the stages, is a big difference," the spokesperson said.

Russia's candidate vaccine was reported to have completed phase-I human trials in the second week of July. According to a news report in the Russia's TASS news agency at that time, the phase-II trials were started on July 13. It is not clear whether the phase-II trials have also declared to have been completed. Usually, each of these phases can take several months to be completed. But considering the prevailing emergency situation, vaccine trials are being fast-tracked across the world.

However, Russia has indicated that it planned to approve the vaccine without undertaking phase-III human trials, the final stage in which a candidate vaccine is tested for its effectiveness in real-life situations, outside laboratory conditions.

This rush to produce the vaccine is leading to a lot of discomfort. Over the weekend, while testifying before a panel of US lawmakers, Anthony Fauci, a top US public health expert and one of the most trusted voices on the Coronavirus epidemic, had expressed doubts over the vaccines being produced in China and Russia. A Chinese vaccine has already been approved for limited use, without going through phase-III trials. It is being administered only to army personnel right now.

"I do hope that the Chinese and the Russians are actually testing the vaccines before they are administering the vaccine to anyone," he had said.

Meanwhile, the *Telegraph* newspaper of London has reported that Britain was unlikely to use the Russian vaccine for its people.

The WHO spokesperson said the agency had not been informed by Russia about its plans to deploy the vaccine. "If there was anything official, then our colleagues in the European office would definitely look into this... In general terms, there are a set of guidances and regulations, rules, how to deal with safe development of a vaccine... These should be definitely followed in order to make sure that we know what the vaccine is working against, who it can help, and of course, also if it has any negative side effects," the spokesperson said.

Developers of other leading vaccine candidates have said they hope to be ready with the vaccine by early next year, if not by the end of this year itself.

## Two Indian candidates complete phase-I trials

Meanwhile, the two Indian vaccine candidates that have started human trials are also progressing at great speeds. Dr Balram Bhargava, director general of Indian Council of Medical Research, announced on Tuesday that phase-I trials of these two candidates were all but over.

Bhargava said Hyderabad-based Bharat Biotech had completed its phase-I studies for its vaccine candidate at 11 of the 12 selected sites. The company had already started phase-II trials at these places. The other vaccine candidate, being developed by Ahmedabad-based Zydus Cadila, had also started phase-II trials at 11 sites, he said.

The two companies had begun injecting the participants for their vaccine candidates around July 15. Bharat Biotech was aiming to rope in around 1,125 participants in its phase I/II trials, while Zydus was targeting around 1,048 participants.

Both these companies had got approvals to carry out phase-I and phase-II trials at one go. In phase-I trial, the vaccine is tested for its safety in human beings, while in phase-II its ability to trigger immune response in human body is assessed. In normal times, each phase of trial takes up to several months to be completed.

Entries on the Clinical Trials Registry of India for these candidates mention the estimated total duration of the trials for both these vaccines at 12-15 months. Zydus chairman Pankaj R Patel told *The Indian Express* that the first two phases of its trials would take around three months.

### HUNT FOR CORONAVIRUS VACCINE: THE STORY SO FAR

- More than 160 vaccine candidates in pre-clinical or clinical trials
- 23 of them in clinical trials
- Six in final stages, phase-III of human trials
- At least eight candidate vaccines being developed in India. Two of these have entered phase-I human trials.

(Source: WHO Coronavirus vaccine landscape of July 31, 2020)

<https://indianexpress.com/article/explained/covid-19-vaccine-updates-august-5-65382166539911/>

## MEDICALNEWS TODAY

Thu, 06 Aug 2020

# COVID-19 vaccine successfully protects macaques against virus

*A new study has found that a COVID-19 vaccine candidate is highly effective in protecting rhesus macaque monkeys from the disease*

*By Timothi Huzar*

Developing a safe and effective vaccine is central to stopping the spread of SARS-CoV-2, the virus responsible for COVID-19.

While emergency measures that authorities put in place to promote physical distancing and protect those most at risk have been important in slowing the spread of the virus, given its virulence, the resulting reduction in transmission rates is likely to be temporary.

The continued spikes in novel coronavirus infections throughout the world, many months after the first implementation of emergency measures, seem to confirm this.

Treatments for the disease that the virus causes are also an important part of the equation. They may reduce the severity of COVID-19 if a person does contract the virus or reduce their chances of getting the infection in the first place.

However, reducing the rate of infection sufficiently for societies to return to normal may be challenging if we rely on treatments alone.

Thus, much current research revolves around the search for a vaccine, which would “teach” a person’s immune system how to fight SARS-CoV-2 — in theory, stopping the virus in its tracks.

The development of a vaccine that is both effective and safe across different demographics of the global population can take a considerable amount of time, though.

Fortunately, according to the authors of a recent review article in the journal *Frontiers in Pharmacology*, “unparalleled data sharing and collaborative team efforts” between global institutions has meant that time estimates for the development of a safe and effective COVID-19 vaccine are down from the usual 10 or more years to about 12–18 months.

**Recently, a new COVID-19 vaccine candidate has shown promise, with its developers demonstrating that it is highly effective in protecting rhesus macaque monkeys from developing the disease.**

The research, which features in the journal *Nature*, is an important step in perfecting the vaccine, which researchers will now test in human clinical trials.

#### **‘Looking forward to the results of clinical trials’**

Researchers at the Beth Israel Deaconess Medical Center (BIDMC) in Boston, MA, are developing the new vaccine in collaboration with the pharmaceutical corporation Johnson & Johnson.

The team has tested the vaccine on 52 rhesus macaque monkeys to ascertain its potential.

The vaccine uses a common cold virus to transport SARS-CoV-2 proteins into the host cells, where they stimulate an immune response.

The researchers gave 32 of the monkeys a single shot of one of seven initial variations of the vaccine. These included the variation that they had identified as the optimal candidate: Ad26.COVS.2.S.

They administered a placebo to the remaining 20 monkeys, which acted as a control group.

At 6 weeks after the immunization, the team exposed all of the monkeys to SARS-CoV-2.

All of the control group of monkeys became infected with SARS-CoV-2, with the researchers finding significant amounts of the virus in their lungs and nasal passages.

**However, of the six monkeys that received the optimal vaccine variation, none had the virus in their lungs, and only one had the virus in its nasal passage.**

According to Dr. Dan Barouch, Director of BIDMC’s Center for Virology and Vaccine Research and a co-author of the current study, “[the] data show that a single immunization with Ad26.COVS.2.S robustly protected rhesus macaques against SARS-CoV-2 challenge.”

“A single-shot immunization has practical and logistical advantages over a two-shot regimen for global deployment and pandemic control, but a two-shot vaccine will likely be more immunogenic, and thus both regimens are being evaluated in clinical trials. We look forward to the results of the clinical trials that will determine the safety and immunogenicity and, ultimately, the efficacy of the Ad26.COVS.2.S vaccine in humans.”

– Dr. Dan Barouch

The researchers have started phases I and II of human clinical trials based on these findings. Depending on the outcomes of these trials, they aim to begin phase III trials involving 30,000 participants in September.

<https://www.medicalnewstoday.com/articles/covid-19-vaccine-successfully-protects-macaques-against-virus>

Thu, 06 Aug 2020

# NIH-Moderna investigational COVID-19 vaccine shows promise in mouse studies

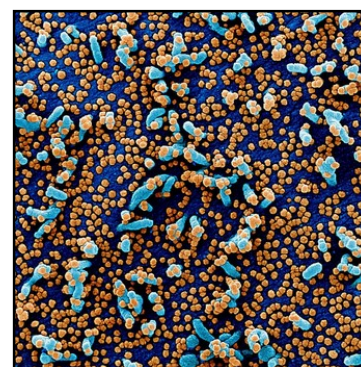
*Vaccine currently being evaluated in Phase 3 clinical testing*

## What

The investigational vaccine known as mRNA-1273 protected mice from infection with SARS-CoV-2, the virus that causes COVID-19, according to research published today in *Nature*. Scientists at the National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health, and the biotechnology company Moderna, based in Cambridge, Massachusetts, along with collaborators from the University of North Carolina at Chapel Hill, Vanderbilt University Medical Center in Nashville, and the University of Texas at Austin conducted the preclinical research. NIAID Vaccine Research Center (VRC) scientists worked with investigators from the University of Texas at Austin to identify the atomic structure of the spike protein on the surface of the novel coronavirus. This structure was used by VRC and Moderna in the development of the vaccine candidate.

The findings show that the investigational vaccine induced neutralizing antibodies in mice when given as two intramuscular injections of a 1-microgram (mcg) dose three weeks apart. Additional experiments found that mice given two injections of the 1-mcg dose and later challenged with SARS-CoV-2 virus either 5 or 13 weeks after the second injection were protected from viral replication in the lungs and nose. Importantly, mice challenged 7 weeks after only a single dose of 1 mcg or 10 mcg of mRNA-1273 were also protected against viral replication in the lung.

The investigational vaccine also induced robust CD8 T-cell responses in mice. It did not induce the type of cellular immune response that has been linked to vaccine-associated enhanced respiratory disease (VAERD). This rare, allergic-type inflammation was seen in individuals vaccinated with a whole-inactivated respiratory syncytial virus (RSV) vaccine in the 1960s. VAERD can occur when a vaccine induces an immune response that is not strong enough to protect against infection. The investigators vaccinated mice with sub-protective doses of mRNA-1273 and then challenged the mice with SARS-CoV-2. The mice showed no evidence of enhanced lung pathology or excessive mucus production, indicating the vaccine did not cause enhanced disease, the authors write.



heavily infected with SARS-COV-2 virus particles (orange), isolated from a patient sample. Image captured and color-enhanced at the NIAID Integrated Research Facility (IRF) in Fort Detrick, Maryland.NIAID

The authors note that the data from these studies, combined with data from studies in nonhuman primates and Phase 1 clinical testing, support the evaluation of mRNA-1273 in clinical efficacy trials. They also explain how their prior research on a candidate MERS-CoV vaccine paved the way for a rapid response to the COVID-19 outbreak. “This is a demonstration of how the power of new technology-driven concepts like synthetic vaccinology facilitates a vaccine development program that can be initiated with pathogen sequences alone,” the authors write.

## Article

KS Corbett *et al.* SARS-CoV-2 mRNA Vaccine Development Enabled by Prototype Pathogen Preparedness. *Nature* DOI: 10.1038/s41586-020-2622-0 (2020).

## Who

Barney S. Graham, M.D., Ph.D. Chief, Viral Pathogenesis Laboratory and Translational Science Core, part of NIAID's Vaccine Research Center, is available for comment. Kizzmekia S. Corbett, Ph.D., senior research fellow in the Viral Pathogenesis Laboratory, is also available for comment.

This media advisory describes a basic research finding. Basic research increases our understanding of human behavior and biology, which is foundational to advancing new and better ways to prevent, diagnose, and treat disease. Science is an unpredictable and incremental process — each research advance builds on past discoveries, often in unexpected ways. Most clinical advances would not be possible without the knowledge of fundamental basic research.

NIAID conducts and supports research — at NIH, throughout the United States, and worldwide — to study the causes of infectious and immune-mediated diseases, and to develop better means of preventing, diagnosing and treating these illnesses. News releases, fact sheets and other NIAID-related materials are available on the NIAID website.

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<https://www.nih.gov/news-events/news-releases/nih-moderna-investigational-covid-19-vaccine-shows-promise-mouse-studies>



