

Sept
2020

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

Volume: 45 Issue: 222 22 September 2020



रक्षा विज्ञान पुस्तकालय
Defence Science Library
रक्षा वैज्ञानिक सूचना एवं प्रलेखन केंद्र
Defence Scientific Information & Documentation Centre
मेटकॉफ हाउस, दिल्ली - 110 054
Metcalf House, Delhi - 110 054

CONTENT

S. No.	TITLE	Page No.
DRDO News		1-3
DRDO Technology News		1-3
1.	Future Strike: First look at new VL-SRSAM launch system for Indian Navy by DRDO	1
2.	भारत-चीन तनाव के बीच सेना में क्यों शामिल किए जा रहे दो कूबड़ वाले ऊंट? जानें इनकी खासियतें	2
3.	Trial of howitzer guns stopped	3
Defence News		4-14
Defence Strategic National/International		4-14
4.	J-K govt signs MoU with Army to operationalise Kishtwar Airstrip	4
5.	Sino-Indian Army Comdrs hold 12-hr long talks	5
6.	LAC पर गरजा राफेल, फॉरवर्ड एयरबेस पर भरी उड़ान, जवानों की मदद को आगे आए लद्दाख के लोग	6
7.	राफेल उड़ाएंगी भारत की बेटियां, भारतीय वायुसेना के गोल्डन ऐरो बेड़े में जल्द शामिल होंगी पहली महिला पायलट	7
8.	Exclusive: IAF's Rafale squadron to get 1st woman fighter pilot	8
9.	Permanent Commission for women in Indian Army: Know about the mandatory Battle Physical Efficiency Test	9
10.	Women leading from front in armed forces	10
11.	Goa Shipyard begins production of stealth frigates for Navy, delivery likely by 2026	12
12.	DGCA approves third-party drone certification scheme	12
Science & Technology News		14-34
13.	India-Japan moon mission: Isro forms study group	14
14.	Scientists invent faster, cheaper strategy for designing infrared-emitting materials	15
15.	Spin Hall effect in Weyl semimetal for energy-efficient information technology	16
16.	Highly efficient perovskite solar cells with enhanced stability and minimised lead leakage	18
17.	Strontium-iridium oxide used for customization as an electronic material	20
18.	Researchers identify new type of superconductor	22
19.	Researchers combine photoacoustic and fluorescence imaging in tiny package	24
COVID-19 Research News		26-34
20.	Long-term COVID-19 containment will be shaped by strength, duration of immunity	26
21.	BCG vaccination in infancy does not protect against COVID-19, Swedish data indicate	28
22.	Low-cost, frequent COVID-19 screening of asymptomatic people could decrease infections, deaths and be cost-effective	30
23.	What is the 'Feluda' test for Covid-19 approved by India?	32
24.	Covid-19 vaccine with 50% effectiveness: Astrazeneca releases 111-page blueprint	33



Tue, 22 Sept 2020

Future Strike: First look at new VL-SRSAM launch system for Indian Navy by DRDO

India's State Owned DRDO has started work on VL-SRSAM (Vertically Launched -Short-range Surface Air to Missile) System based on Astra beyond-visual-range air-to-air missile.

VL-SRSAM will be developed in two variants for Air Force and Indian Navy. The air force will get high mobility Truck-mounted canister based VL-SRSAM and Navy will get Canister based VL-SRSAM for its frontline warships Each Vertical Launch Unit (VLU) houses 8 heavily modified quick reaction SAMs to engage incoming supersonic projectiles.

The cannisters are designed to launch missiles in hot-mode, i.e. ignition within the cannister itself & the VLU is designed to launch SAMs in quick succession incase there's multiple incoming projectiles.



VL-SRSAM is a quick reaction point defence system for use against supersonic sea skimming targets like ASHM etc including aircrafts , UAVs , munitions etc. While DRDO is mum on the missiles range, but capabilities of a similar missile system should ensure at least 40-50 km in Astra Mk1 configuration and in future Astra Mk2, range will jump to 80km.

Astra missiles when in its initial developmental phase were tested from a ground-based vertical launch before developmental moved on to IAF's front-line fighter aircraft like Sukhoi-30 MKIs.

DRDO keeping in mind possible development of any spin-off of a Ground-based Astra missile system had collected all telemetry data which could also validate its flight performance in the

surface to air mode and found it to be capable of performing excellently well even in a surface to air mode.

VL-SRSAM family will consist of Truck Mounted command and control unit which includes a Radar sensor and 4-6 Missile firing units and replenishments support Truck for the Airforce variant.

<https://www.defenceaviationpost.com/2020/09/future-strike-first-look-at-new-vl-srsam-launch-system-for-indian-navy-by-drdo/>



Tue, 22 Sept 2020

भारत-चीन तनाव के बीच सेना में क्यों शामिल किए जा रहे दो कूबड़ वाले ऊंट? जानें इनकी खासियतें

लेह: पूर्वी लद्दाख में भारत-चीन सीमा पर गश्त करने में सैनिकों की मदद के लिए लद्दाख के प्रसिद्ध दो कूबड़ वाले ऊंटों को जल्द ही भारतीय सेना में शामिल किया जाएगा। लेह में रक्षा अनुसंधान और विकास संगठन (डीआरडीओ) ने दो कूबड़ या बैक्ट्रियन ऊंटों पर रिसर्च की है, जो पूर्वी लद्दाख क्षेत्र में 17,000 फीट की ऊंचाई पर 170 किलोग्राम भार उठा सकते हैं।

न्यूज एजेंसी एएनआई से बात करते हुए डीआरडीओ के वैज्ञानिक प्रभु प्रसाद सारंगी ने कहा, 'हम दो कूबड़ वाले ऊंटों पर रिसर्च कर रहे हैं। वे स्थानीय जानवर हैं। हमने इन ऊंटों की धीरज सहने और भार उठाने की क्षमता पर शोध किया है। हमने पूर्वी लद्दाख क्षेत्र में शोध किया है। चीन सीमा के पास 17,000 फीट की ऊंचाई पर पाया गया कि वे 170 किलो का



भार ले जा सकते हैं और इस भार के साथ वे 12 किलोमीटर तक गश्त कर सकते हैं।'

इसके अलावा, इन स्थानीय दो कूबड़ वाले ऊंटों की तुलना एक कूबड़ वाले ऊंटों से भी की गई थी, जिन्हें राजस्थान से लाया गया था। ये ऊंट भोजन और पानी की कमी के कारण तीन दिनों तक जीवित रह सकते हैं।

सारंगी ने कहा, 'अब डिफेंस इंस्टीट्यूट ऑफ हाई एल्टीट्यूड रिसर्च (DIHAR) इन दो कूबड़ वाले ऊंटों की आबादी बढ़ाने पर ध्यान केंद्रित कर रहा है।' उन्होंने कहा कि परीक्षण किया जा चुका है और इन ऊंटों को जल्द ही सेना में शामिल किया जाएगा। इन जानवरों की आबादी कम है, लेकिन प्रजनन के बाद जब हम संख्या में पहुंच जाएंगे, तब इन्हें शामिल किया जाएगा।

बता दें कि अभी तक भारतीय सेना इन दो कूबड़ वाले ऊंटों का इस्तेमाल गश्त करने के दौरान नहीं करती थी। अभी तक सेना पारंपरिक रूप से क्षेत्र के खच्चरों का इस्तेमाल करती है, जोकि लगभग 40 किलोग्राम भार ले जाने की क्षमता रखते हैं।

दोनों देशों के बीच जारी है तनाव

भारत और चीन के बीच अप्रैल महीने से वास्तविक नियंत्रण रेखा पर तनाव की स्थिति कायम है। जून के मध्य में गलवान घाटी में दोनों पक्षों के सैनिकों के बीच हुई हिंसक झड़प के बाद हालात और अधिक तनावपूर्ण हो गए थे। इस टकराव में भारत के 20 जवान शहीद हो गए, जबकि चीन के भी कई सैनिक मारे गए थे। वहीं, अगस्त के अंत और

सितंबर महीने की शुरुआत में भी लद्दाख में चीनी सेना ने घुसपैठ की नाकाम कोशिश की थी। वहीं, पिछले एक महीने में सीमा पर तीन बार गोलीबारी हो चुकी है। तनाव को देखते हुए भारत ने लद्दाख में सैन्य ताकत को भी बढ़ा दिया है।

<https://www.livehindustan.com/national/story-india-china-standoff-double-hump-camel-soon-to-be-inducted-into-indian-army-to-help-patrol-india-china-border-3505462.html>

THE TIMES OF INDIA

Tue, 22 Sept 2020

Trial of howitzer guns stopped

Jaisalmer: The trial of final phase of Howitzer guns that was going on at Pokhran field firing range has been stopped by DRDO after the barrel of one of the guns exploded last week. The companies left with their guns on Saturday. DRDO has formed a board to investigate the explosion of barrel and a high-level inquiry has been ordered.

The trial was going on for last 10 days in the presence of DRDO and army experts. The design of this 155mm 52-caliber gun was made by Armament Research & Development Establishment, Pune and manufactured by Tata Power and Bharat Forge. The barrel of a gun during the firing at the trial blasted in which 3-4 experts suffered minor injuries.

In 2017 also barrel of a gun of the same company exploded during trials. That time the reason was problem in ammunition. This gun has power to fire at a distance of 47km and can fire 6 rounds in 30 seconds.

<https://timesofindia.indiatimes.com/city/jaipur/trial-of-howitzer-guns-stopped/articleshow/78243543.cms>



Tue, 22 Sept 2020

J-K govt signs MoU with Army to operationalise Kishtwar Airstrip

Jammu (Jammu and Kashmir) [India], September 21 (ANI): The Government of Jammu and Kashmir and the Indian Army on Monday signed a Memorandum of Understanding (MoU) for the development and operationalisation of Airstrip in Kishtwar.



J-K govt signs MoU with Army to operationalise Kishtwar Airstrip

According to an official press release, the Lieutenant Governor Manoj Sinha observed that the Airstrip would provide vital connectivity to the Kishtwar district to benefit both defense personnel and civilians, even during the severe winter and for medical and other emergencies, besides giving a fillip to the socio-economic development of the region.

Pertinently, the issue of operationalizing the airstrip was pending since 2018.

As a result of the commitment and perseverance of the government, the district, which lies at more than 210 km from the nearest airport in Jammu, has been provided with the golden opportunity to mitigate the sufferings of the people through the ambitious project, he added.

Highlighting the benefits of developing Airstrip at Kishtwar, the Lt Governor observed that the said project is aimed to benefit around 2,50,000 people of Kishtwar district.

The Lt Governor hoped that the project would deliver the results like increasing per capita earnings in the district, owing to higher tourists influx which will facilitate better and quick transport facility through operationalisation of the airstrip, better Health Indicator (HDI) - low mortality rates - the speedy and crucial transfer of a patient to better equipped Jammu hospital will be possible and this will reduce the time taken to travel from eight hours to less than 30 minutes, better monitoring and administration of the district-the reduction in travelling time (for frequent meetings in Jammu) will leave officers of the district with more time to spare for the public and Integration of people with the mainland, large parts of the district remain out of bounds for the normal people, even the residents find it difficult to commute from such far-flung areas.

The meeting was informed that in November 2017, under the UDAN (Ude Desh Ka Aam Nagrik) Phase-II Regional connectivity scheme launched by the Government of India that aims to make unserved/underserved airports in small cities operational with regular flights and other

subsidized airfares to encourage more people to fly, Kishtwar district of UT was included among 24 other districts.

According to the release Brigadier Vikram Bhan, Commander, 9 Sector RR, and S Katoch, Commissioner Civil Aviation signed the MoU in the presence of Lieutenant Governor, Manoj Sinha, and Dr. Jitendra Singh, MoS PMO, Ministry of Personnel, Public Grievances, and Pensions, Department of Atomic Energy, Space, Ministry of Development of North Eastern Region (through video conferencing) here at the Raj Bhavan.

Lt Gen. YK Joshi, GoC-in C Northern Command; Lt Gen. Harsha Gupta, GoC 16 Corps; Col. Rajneesh Giri, and Col. AK Panwar represented the Indian Army. (ANI)

<https://www.aninews.in/news/national/general-news/j-k-govt-signs-mou-with-army-to-operationalise-kishtwar-airstrip20200921205640/>

DAILYEXCELSIOR.COM

Tue, 22 Sept 2020

Sino-Indian Army Comdrs hold 12-hr long talks

New Delhi: India today pressed for an early and complete disengagement of Chinese troops from friction points in Eastern Ladakh as their senior Army Commanders held a sixth round of talks that primarily focused on implementing a five-point bilateral agreement to ease the prolonged border standoff, Government sources said.

The latest round of Corps Commander-level talks that began at around 9 am in Moldo on the Chinese side of the Line of Actual Control (LAC) across India's Chushul sector in Eastern Ladakh went on for over 12 hours and was still underway at 9 pm, the sources said.

It is learnt that the Indian delegation insisted on a time-bound implementation of the agreement finalised during the extensive talks between External Affairs Minister S Jaishankar and his Chinese counterpart Wang Yi in Moscow on September 10 on the sidelines of a Shanghai Cooperation Organisation (SCO) meet.

The Indian delegation is headed by Lt Gen Harinder Singh, the Commander of the Leh-based 14 Corps of the Indian Army. For the first time, the Indian team for the military talks also included a senior official from the Ministry of External Affairs (MEA).

MEA Joint Secretary Naveen Srivastava, who has been engaged in diplomatic talks with China on the border row under the framework of the Working Mechanism for Consultation and Coordination (WMCC) on border affairs, was part of the delegation.

The team also comprised Lt Gen PGK Menon, who is expected to succeed Singh as the Commander of the 14 Corps next month, the sources said.

The sources said the Indian team insisted on an early and complete disengagement of troops by Chinese People's Liberation Army(PLA) to end the four-and-a-half-month standoff, adding the agenda for the talks was to chart a specific timeline for implementation of the five-point agreement.

The agreement aimed at ending the tense standoff included measures like quick disengagement of troops, avoiding action that could escalate tensions, adherence to all agreements and protocols on border management and steps to restore peace along the LAC.

At the previous five rounds of Corps commander-level talks, the Indian side has insisted on complete disengagement of Chinese troops at the earliest, and immediate restoration of status quo ante in all areas of eastern Ladakh prior to April. The face-off had begun on May 5.



The fifth round of Corps Commander talks on August 2 lasted for nearly 11 hours while the fourth round went on for nearly 15 hours on July 14.

Military sources, meanwhile, said the newly-inducted Rafale jets started carrying out sorties in various forward areas in Eastern Ladakh as part of measures to give a boost to the overall combat readiness in view of the “provocative actions” by Chinese troops in the last three weeks. The deployment of French-made Rafale jets in Ladakh came less than 10 days after they were formally inducted into the Indian Air Force (IAF).

At a ceremony in Ambala on September 10 where five Rafale jets were inducted into the IAF, Defence Minister Rajnath Singh said this was crucial considering the atmosphere being created along the frontier and was also a “big and stern” message to those eyeing India’s sovereignty. The sources said the Indian Army has made elaborate arrangements to maintain the current level of troop and weapons deployment in all forward areas in Eastern Ladakh and other sensitive high-altitude sectors in the harsh winter months when the temperature drops up to minus 25 degree Celsius.

They said the situation remained tense at both the Southern and Northern Bank of the Pangong lake area as well as in other friction points.

There have been at least three attempts by the soldiers of the PLA to “intimidate” Indian troops along the Northern and Southern Bank of Pangong lake area in the last three weeks where even shots were fired in the air for the first time at the LAC in 45 years. (PTI)

<https://www.dailycexcelsior.com/sino-indian-army-comdrs-hold-12-hr-long-talks/>



Tue, 22 Sept 2020

LAC पर गरजा राफेल, फॉरवर्ड एयरबेस पर भरी उड़ान, जवानों की मदद को आगे आए लद्दाख के लोग

लद्दाख, : पूर्वी लद्दाख में एलएसी पर तनाव के बीच भारतीय वायुसेना ने भी अपनी तैयारियों को धार देना शुरू कर दिया है। भारतीय वायुसेना के राफेल लड़ाकू विमान ने सोमवार को लद्दाख के फॉरवर्ड एयरबेस पर उड़ान भरी। राफेल को भारतीय वायुसेना में 10 सितंबर को शामिल किया गया था। मालूम हो कि चीन के अड़ियल रवैये के चलते भारतीय सेना ने महत्वपूर्ण सामरिक चोटियों पर डेरा जमा लिया है। सूत्रों की मानें तो भारतीय सेना ने पूर्वी लद्दाख में 20 से ज्यादा चोटियों पर अपनी पकड़ मजबूत कर ली है।

सूत्रों का कहना है कि 29 अगस्त से सितंबर के दूसरे हफ्ते के बीच भारतीय सेना मागर हिल, गुरंग हिल, रेचन ला, रेजांग ला, मुखपरी और फिंगर-4 के नजदीक एक ऊंची चोटी पर काबिज हुई है। रणनीतिक रूप से अहम इन चोटियों से चीनी सेना की हरकतों पर नजर रखना आसान हुआ है। सूत्रों ने बताया कि एलएसी पर उक्स सामरिक चोटियां भारतीय सीमा के भीतर मौजूद हैं। बीते दिनों चीन ने इन चोटियों पर



कब्जा जमाने की कोशिश की थी। इसके चलते एलएसी पर पिछले कुछ दिनों के भीतर तीन बार गोलियां चली हैं।

इस बीच समाचार एजेंसी आइएएनएस ने अपनी रिपोर्ट में बताया है कि सेना जाड़े के मौसम के लिए तैयारियां कर रही है। इस काम में लद्दाख के लोग भी मदद कर रहे हैं। लद्दाख के लोग सेना के जवानों के लिए स्थानीय खाद्य सामग्रियां जुटाने का काम कर रहे हैं। लद्दाख के अधिकांश इलाकों में तापमान -20 से -30 डिग्री तक पहुंच जाता है।

ऐसी परिस्थिति भी सेना के जवानों के लिए स्थानीय भोजन बेहद मददगार साबित हो सकता है। स्थानीय लोग भारतीय जवानों के लिए ड्राई फूड्स भेज रहे हैं।

<https://www.jagran.com/news/national-indian-air-force-rafale-fighter-jet-flying-over-ladakh-from-a-forward-airbase-20778448.html>



Tue, 22 Sept 2020

राफेल उड़ाएंगी भारत की बेटियां, भारतीय वायुसेना के गोल्डन ऐरो बेड़े में जल्द शामिल होंगी पहली महिला पायलट

By Krishna Bihari Singh

नई दिल्ली: यदि सबकुछ योजना के मुताबिक चला तो जल्द ही देश की बेटियां राफेल विमानों को उड़ाती नजर आएंगी। वायुसेना की एक महिला लड़ाकू पायलट 'गोल्डन ऐरो' (Golden Arrows) स्क्वाड्रन में शामिल होगी। हाल ही में इस स्क्वाड्रन में राफेल विमानों को शामिल किया गया है। सूत्रों ने सोमवार को बताया कि यह महिला पायलट राफेल विमान (Rafale aircraft) उड़ाने की ट्रेनिंग ले रही हैं। इससे पहले वह मिग-21 लड़ाकू विमान उड़ाती रही है। महिला पायलट को राफेल फ्लीट (Rafale fleet) के लिए आंतरिक चयन प्रक्रिया द्वारा चुना गया है।

केंद्र सरकार ने बीते शनिवार को राज्य सभा में बताया था कि पहली सितंबर 2020 तक भारतीय वायु सेना में महिला अधिकारियों की संख्या 1,875 हो गई है। इनमें से 10 महिला अधिकारी फाइटर पायलट हैं जबकि 18 महिला अधिकारी नेविगेटर हैं। रक्षा राज्य मंत्री श्रीपद नाइक ने संसद में कहा था कि वायुसेना में रणनीतिक आवश्यकताओं को देखते हुए महिला लड़ाकू पायलटों को शामिल और तैनात किया गया है। पिछले साल 10 सितंबर को वायुसेना की 'गोल्डन ऐरो' (Golden Arrows) स्क्वाड्रन का पुनर्गठन किया गया था।



केंद्रीय मंत्री (Shripad Naik) ने एक सवाल के लिखित जवाब में बताया था कि महिला अधिकारियों को फाइटर पायलट के रूप में शामिल करने के लिए भारतीय वायुसेना ने मंत्रालय को प्रस्ताव दिया था। मंत्रालय के अनुमोदन के बाद भारतीय वायु सेना ने 2016 में फाइटर फ्लाइटिंग ब्रांच में महिला SSC अधिकारियों की भर्ती लिए योजना शुरू की जिसके तहत अब तक 10 महिला फाइटर पायलटों की नियुक्ति की गई है।

सशस्त्र बलों में नौसेना ने भी लैंगिक समानता की दिशा में बड़ा कदम उठाया है। पहली बार दो महिला भारतीय नौसेना के युद्धपोत पर तैनात होंगी। रिपोर्ट के मुताबिक सब लेफ्टिनेंट कुमुदिनी त्यागी और सब लेफ्टिनेंट रीति सिंह युद्धपोतों के डेक से संचालन करने वाली भारत की पहली महिला एयरबोर्न टैक्नीशियन होंगी। इन्हें हेलीकॉप्टर स्ट्रीम में ऑब्जर्वर के तौर पर नियुक्त किया गया है। अब तक कई वजहों के चलते महिला अधिकारियों को युद्धपोतों पर तैनात नहीं किया गया था।

<https://www.jagran.com/news/national-indian-air-force-rafale-fleet-to-have-first-woman-pilot-soon-20777603.html>

Exclusive: IAF's Rafale squadron to get 1st woman fighter pilot

The 17 Squadron of the Rafale jets stationed at Ambala air base will soon get its first woman fighter pilot. The Indian Air Force pilot will reportedly begin active duties flying Rafale jets soon

By Shiv Aroor

The Indian Air Force's all-male Rafale squadron in Ambala is all set to get its first woman fighter pilot soon.

India Today has learnt that one of the IAF's 10 current active woman fighter pilots is undergoing conversion training and will begin active duties flying Rafale jets with the 17 Squadron soon.

The IAF's first 5 Rafale fighters were ceremonially inducted into the Golden Arrows squadron on September 10 in Ambala. Since late August, the jets have flown familiarisation sorties over Ladakh, even landing in Leh on occasion as part of an operational work-up ahead of full operational readiness.

More Rafales will be arriving in October and December, with all 36 on order to be inducted by late 2021.

The woman pilot, who India Today will not identify owing to service sensitivities, has been through the full fighter training course so far and is already operational on MiG-21 fighters.

Women fighter pilots undergo an identical training regimen as their male counterparts. Once they are operational on a fighter type, they undergo conversion training, which as the phrase suggests, is a curriculum pilots need to take when they switch from flying one aircraft to another.

In this case, the woman pilot will be converting from MiG-21 Bison to the Rafale, a vastly different and more modern jet in all respects.

The IAF's 10 women pilots have flown a variety of jets so far, including the Su-30 MKI and MiG-29 UPG. Flt Lt Avani Chaturvedi, Flt Lt Bhawanna Kanth and Flt Lt Mohana Singh became the first women fighter pilots in 2016.

The government cleared women for fighter flying in 2016. So far, 10 women fighter pilots have been commissioned, with more in the pipeline each year.

"Women fighter pilots are inducted and deployed in IAF as per strategic needs and operational requirements within the laid down policy, which is reviewed from time to time," India's Minister of State for Defence stated in Parliament last week.

With a required or sanctioned pilot strength of 4,231, the Indian Air Force currently has a pilot shortage of over 300. This number is spread across fighters, transport aircraft and helicopters.

While the number of women fighter pilots entering service is still modest, it is being seen as a healthy start that should grow into higher numbers in the years ahead.

<https://www.indiatoday.in/india/story/iaf-rafale-squadron-1st-woman-fighter-pilot-1723845-2020-09-21>



Flt Lt Avani Chaturvedi (centre), Flt Lt Bhawanna Kanth (right) and Flt Lt Mohana Singh became the first women fighter pilots in 2016. (File photo)



Ten Rafale jets have been delivered to India so far. The delivery of all 36 aircraft is scheduled to be completed by the end of 2021. (Photo:IAF)

Permanent Commission for women in Indian Army: Know about the mandatory Battle Physical Efficiency Test

The Indian Army has already started detailing women officers of the rank of Lt Colonels for Junior Command (JC) course at Army War College, Mhow – these courses are being conducted in July & October

The Indian Army has made it mandatory for all women officers/cadets/women recruits to go through Battle Physical Efficiency Test (BPET). This will be applicable to those women officers too who were commissioned before 2009 and are above 35 years of age.

There is a 5-km run, a 60-metre sprint for the women. Also, there is climbing vertical rope up to a certain height, jumping a 6-feet ditch, and also traversing horizontal rope up to a certain distance.

These are as per the directions issued by the Directorate General of Military Training (DGMT) of Army Headquarters, New Delhi. These were issued earlier this year in May. These new orders supersede the directions issued in March 2011 under which the women officers who were commissioned before April 2009 and above the age of 35 years were excused BPET and had to take only the Physical Proficiency Test (PPT).



Earlier this year, in a Supreme Court Order, permanent commission to all women officers with all consequential benefits have been given.

So the new order of May 2020 has laid out new standards and the time limit in which these tasks have to be completed by the women.

What are the new time limits under the new direction?

The time taken to run at height of 5000 feet/1500 meters in the age category for women officers below 30 years should be 30 minutes or less for 'Excellent' grading.

Around 31 minutes 30 seconds for 'Good' grading and 33 minutes for 'Satisfactory' grading.

The directions of March 2011 had fixed 32 minutes for 'Excellent', 33 minutes 30 seconds for 'Good' and 35 minutes for 'Satisfactory'.

The time frame has been shortened for distance run at a height from 5000 feet to 9000 feet.

Now, in the 60 meter sprint the 'Excellent' grading time has been reduced from 16 seconds to 15 seconds; 19 seconds to 17 seconds for 'good' grade and 20 seconds to 19 seconds for 'satisfactory' grading.

Earlier this year, in a Supreme Court Order, permanent commission to all women officers with all consequential benefits have been given.

The Indian Army has already started detailing women officers of the rank of Lt Colonels for Junior Command (JC) course at Army War College, Mhow – these courses are being conducted in July & October.

This course is important as it is a mandatory requirement for promotion to the rank of colonel. As per the directions of the DGMT, following the order of the highest court in the country, those women officers who after the screening process are considered for the PC, will have to undergo the mandatory courses of their respective branches along with JC course.

<https://www.financialexpress.com/defence/permanent-commission-for-women-in-indian-army-know-about-the-mandatory-battle-physical-efficiency-test/2088208/>

Women leading from front in armed forces

The entry of women has so far been restricted to fixed-wing aircraft operating from inland bases, he said. In a short-lived experiment, women from the navy's logistics branch were deployed on warships in the mid-1990s

By Rahul Singh

New Delhi: Warships will no longer be a no-go zone for women naval aviators with two of them --- selected for the helicopter stream --- set to become the first women in the navy's history to operate from flight decks of warships and stay on board the vessels, the navy announced on Monday.

The announcement comes even as a female fighter pilot is being trained to fly the Rafale aircraft and join the Ambala-based No. 17 squadron shortly. The woman pilot, who is undergoing conversion training to fly the Rafale jet, is one of the 10 women fighter pilots in the Indian Air Force (IAF), officials said.

"Two women officers have been selected to join as observers (airborne tacticians) in the helicopter stream. They will, in effect, be the first set of women airborne combatants who will be operating from warships," a Kochi-based navy spokesperson said.



Sub Lt. Riti Singh and Sub Lt. Kumudini Tyagi, the first women airborne tacticians who will operate from deck of warships, after they passed out of Indian Navy's Observer Course, at Southern Naval Command, Kochi (PTI Photo)

The entry of women has so far been restricted to fixed-wing aircraft operating from inland bases, he said. In a short-lived experiment, women from the navy's logistics branch were deployed on warships in the mid-1990s.

The two lady officers --- Sub-Lieutenants Kumudini Tyagi and Riti Singh (daughter of a naval officer) --- are among the 17 officers who were awarded "wings" on graduating as observers at a ceremony held in Kochi on Monday. Rear Admiral Antony George, chief staff officer (training), presided over the ceremony.

As observers, the two women have been trained for a variety of roles including navigation, flying procedures, tactics employed in air warfare, anti-submarine warfare and airborne avionic systems.

It feels great to be a part of Indian Navy's history today, said Sub Lieutenant Kumudini Tyagi. "Being combat-ready platforms of navy, through the helicopters, we will be capable of carrying out combat roles including control of weapons and onboard sensors. This profile is exciting and thrilling at the same time," she said.

"Men on deck be ready to be observed. Women observers for sure will navigate you to the shore. Waiting to see women in the trenches now," said Wing Commander Anupama Joshi (retd.), from the first batch of women officers commissioned into the IAF in the early 1990s.

They will serve on board maritime reconnaissance and anti-submarine warfare helicopters of the navy --- currently Seaking choppers and later on MH-60R helicopters being bought from the United States.

India is buying 24 Lockheed Martin-Sikorsky MH-60R helicopters from the US to strengthen the navy's anti-submarine/anti-surface warfare and surveillance capabilities, in a deal worth Rs 17,500 crore.

“Rear Admiral George while complimenting the graduating officers highlighted the fact that it is a landmark occasion wherein for the first time women are going to be trained in helicopter operations which would ultimately pave way for the deployment of women in frontline warships,” the navy said in its statement.

Along with the navy, the IAF is also giving its women officers more opportunities and exposure with the Ambala-based Rafale squadron set to induct its first woman fighter pilot. Ten women have been commissioned as fighter pilots after the experimental scheme for their induction into the IAF’s combat stream was introduced in 2015, a watershed in the air force’s history.

IAF is operating its Rafale fighter jets in the Ladakh theatre where the military is on its highest state of alert, amid heightened border tensions with China. The IAF’s current fleet of five Rafale fighters is fully operational and ready to undertake any mission, officials said. India ordered 36 Rafale jets from France in a deal worth Rs 59,000 crore in September 2016.

The air force formally inducted the planes at the Ambala air base on September 10 though they landed at their home base on July 29. The Rafale jets are part of the IAF’s No. 17 Squadron, also known as the Golden Arrows.

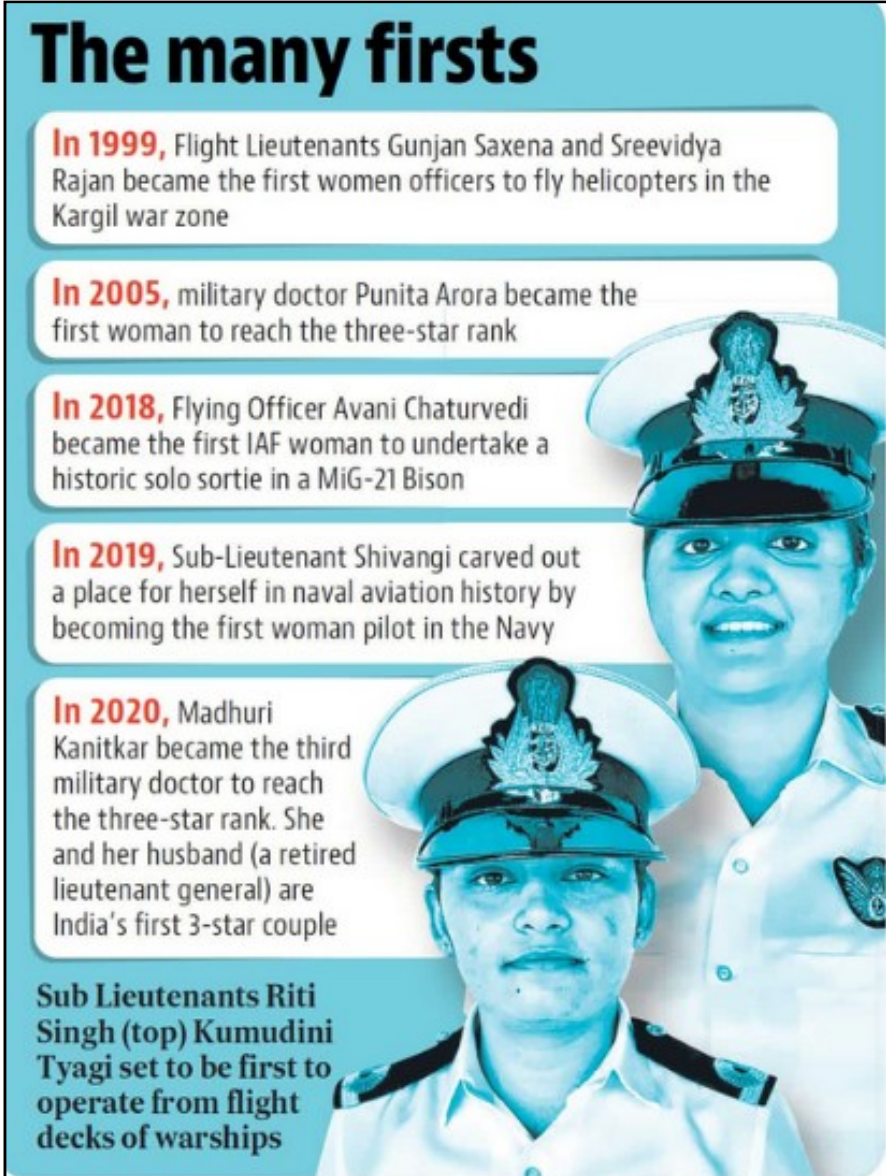
Rafale weaponry includes Meteor beyond visual range air-to-air missiles, Mica multi-mission air-to-air missiles and Scalp deep-strike cruise missiles --- weapons that allow fighter pilots to attack air and ground targets from standoff ranges.

The next batch of three to four Rafale jets is expected to reach Ambala from France in October followed by a third batch in December. All deliveries will be completed by the end of 2021.

The head count of women in the military adds up to more than 4,000, but combat roles were off limits to them until the IAF took the lead in crushing internal resistance to induct them into the fighter stream.

Tanks and combat positions in the infantry are still no-go zones for women, who were allowed to join the armed forces outside the medical stream for the first time in 1992.

<https://www.hindustantimes.com/india-news/women-leading-from-front-in-armed-forces/story-qt91JU0T9Xo6dwG7OnIGRK.html>



The many firsts

- In 1999**, Flight Lieutenants Gunjan Saxena and Sreevidya Rajan became the first women officers to fly helicopters in the Kargil war zone
- In 2005**, military doctor Punita Arora became the first woman to reach the three-star rank
- In 2018**, Flying Officer Avani Chaturvedi became the first IAF woman to undertake a historic solo sortie in a MiG-21 Bison
- In 2019**, Sub-Lieutenant Shivangi carved out a place for herself in naval aviation history by becoming the first woman pilot in the Navy
- In 2020**, Madhuri Kanitkar became the third military doctor to reach the three-star rank. She and her husband (a retired lieutenant general) are India's first 3-star couple

Sub Lieutenants Riti Singh (top) Kumudini Tyagi set to be first to operate from flight decks of warships

Goa Shipyard begins production of stealth frigates for Navy, delivery likely by 2026

Panaji: Goa Shipyard Ltd on Monday commenced production of the two guided missile frigates, which are being built in collaboration with Russia's Yantar Shipyard for the Indian Navy.

GSL expects to deliver the first ship to the Navy by 2026.

Though the frigates are based on a Russian design, they will have significant indigenous content, including an Indian-built radar, sonar systems and sensors, communication suites and anti-ship BrahMos missile systems.

Initiating the production process, vice chief of naval staff, vice admiral G Ashok Kumar said that the frigates would help the Navy meet maritime challenges.

India and Russia entered into a government to government agreement for four stealth frigates, with two being built in Russia and two at Goa Shipyard. The stealth frigate project is the largest contract in GSL's history and represents a quantum leap in the shipyard's capabilities.

"These two frigates will put GSL in a different league because this is the first time that frigates are being constructed at the yard," said Kumar.

Once completed, the two frigates will be advanced variants of the Talwar-class stealth frigates that are already in service with the Indian Navy.

"The project will provide a significant boost to the indigenous shipbuilding sector in Goa and across the nation creating employment opportunities. We are expanding our vendor base three-fold to over 1,000 entities to encourage MSME participation in the project," said chairman and managing director of GSL B B Nagpal.

<https://timesofindia.indiatimes.com/city/goa/goa-shipyard-begins-production-of-stealth-frigates-for-navy-delivery-likely-by-2026/articleshow/78243966.cms>

MEDIANAMA

Tue, 22 Sept 2020

DGCA approves third-party drone certification scheme

By Soumyarendra Barik

DGCA, India's civil aviation regulator, has approved third-parties to carry out certification of civilian drones. The Quality Council of India (QCI) will choose the third-party certification bodies soon, according to Amber Dubey, joint secretary at the Civil Aviation Ministry, and incharge of the drones division. The move is expected to increase exports of Indian made drones.

Who can be a certification body? Only a "legal entity" can be accredited as a certification body — so that it can be legally held responsible for its work irrespective of whether the entire organisation or a part of it performs the certification functions. QCI explained that certification bodies which are part of government, or are government departments, will be deemed as legal entities on the basis of their governmental status. It is not clear how a non-government body can be made a "legal entity" in this case.



Drones compliant with the “no permission no takeoff” (NPNT) protocol will also be certified by certification bodies, and the process will ensure that they meet applicable regulatory requirements and international acceptability. The scheme is applicable to both domestic drone manufacturers, as well as drone importers. The certification system will be based on international standards (ISO/IEC 17067:2013). Bodies chosen by the QCI will “eventually” be accredited as per the international standard ISO 17065, by the National Accreditation Board for Certification Bodies (NABCB), a constituent Board of the QCI.

India’s draft drone rules, which were published earlier this year mandate that drones have a “Certificate of Manufacture” to indicate whether they were manufactured in India or were imported. This certificate will be issued by testing laboratories or organisations approved by the DGCA. Manufacturers and importers will be allowed to



choose the labs at which they wish to get their drones tested. Testing laboratories will have to submit a test report and recommendations to the DGCA, based on which they may issue the certificates.

Certification criteria

Drones will be certified on the basis of their category, weight, type, dimensions, remaining life, and geo-fencing capability, among other things. For now, all but large category drones — which weigh more than 150 kilograms — can be certified under the scheme. Drone manufacturers or importers will also have to specify compatible payloads (things that a drone can carry), with details such as the weight, specifications, and purpose of usage of the payload. Other things that will be certified include:

- Drones will also be certified on the basis of “hardware tamper avoidance” — how well they can protect the onboard computer from being tampered. For a satisfactory result, the certification body would replace flight-critical components of a drone using an “unauthorised procedure”, and the drone’s propellers should not start. Every change of hardware should be recorded by the manufacturer and documents will have to be made available to the certification bodies or DGCA for inspection.
- A certification body will also check that there is no way to bypass a drone’s NPNT functionality. This has to be done by scrutinising the design, and comparing it with the final implementation. NPNT is a crucial part of ensuring that drones’ flights remains safe and secure. It also allows the government to have a log of the number of NPNT compliant drones, along with details on when and where they were flown.
- A manufacturer will also have to demonstrate that a drone has “detect and avoid capability”, which allows drones to avoid mid-air collisions.
- Endurance of drones will also be certified. For drones powered by batteries, the manufacturer will have to submit test reports from an accredited testing laboratory determining the rate of discharge of battery with a charge capacity of more than 85% at all times.

Governing structure of the scheme

A multi-stakeholder steering committee will be chaired by a “seasoned professional” who is “well respected by Government and Industry alike”. It will oversee the scheme along with a QCI secretariat. The steering committee will also be supported by a technical committee and a certification committee that will be constituted by QCI. It is unclear how the DGCA or QCI will appoint this “seasoned professional”. The steering committee will have to meet at least once a year.

Representatives from the Civil Aviation Ministry, DGCA, Airports Authority of India, DRDO, IITs, among others will be a part of the multi-stakeholder committee. All committees will be reconstituted every two years to provide representation to organisations like industry associations, certification bodies etc. by rotation. No “single interest” — various Ministries, defence establishments, and drone companies among others — should predominate the committees.

“The entire system has provisions for accepting complaints from any stakeholder against any component of the Scheme,” DGCA and QCI said. Manufacturing units certified under the scheme, certification and accreditation bodies are all required to have a complaints system in place. Complaints can also be made to the DGCA, who will then forward them to the QCI for further action. A statement on complaints, along with their status will have to be reported to the steering committee in each meeting.

<https://www.medianama.com/2020/09/223-drone-certification-india/>

Science & Technology News

THE TIMES OF INDIA

Tue, 22 Sept 2020

India-Japan moon mission: Isro forms study group

Bengaluru: The Indian Space Research Organisation (Isro), which is working on its second Moon landing mission — Chandrayaan-3 — for next year, has now formed a study group for another moon mission along with Japan.

The India-Japan mission, a joint initiative between Isro and Japanese space agency JAXA, was in the cold storage as Isro was focusing on its own moon and human missions. Senior scientists have now confirmed to TOI that it is back on the space agency’s agenda.

As part of the mission, Japan will be launching a joint lunar mission — Lunar Polar Exploration (LPE) — and as details shared by JAXA, the mission will be launched after 2023 and will involve a lander and a rover.

JAXA diagrams show that the Japanese would be building the overall landing module and the rover, while Isro would develop the lander system. The mission will be launched from Japan, and the designated launch vehicle is the H3 rocket, manufactured by Mitsubishi Heavy Industries.

“What we will design for the Indo-Japan mission will be subject to how the systems on Chandrayaan-3 will perform and whether or not we will be able to achieve a successful landing next year. Earlier this month, we got an internal communication about the study group, which means that the project is back on track,” an Isro scientist said.

The first thinking of this mission was made public in 2017, during a multi-space agencies’ meeting in Bengaluru and it was then also part of the inter-governmental discussions during PM Narendra Modi’s visit to Japan in 2018. The TOI had reported in September 2019, that the project had since moved forward and both agencies were keen on landing on Moon together.

According to JAXA, analysis of observational data suggests the existence of water in the polar regions of Moon. “...JAXA is working with Isro to plan an international collaborative mission to obtain data on the quantity and forms of water resources present, in order to determine the feasibility of utilizing such resources for sustainable space exploration activities in the future,” JAXA said.

The mission's aim is to obtain actual data regarding the quantity of water from in-situ observations of areas where water is anticipated to exist, based on the available past observational data. It also seeks to understand the distribution, conditions, form and other parameters of the lunar water resources in the Polar Regions.

The TOI had reported in June about how the project intends to improve the technology needed to explore the surface of lowgravity celestial bodies in order to support future lunar activities. "These advancements include technology for mobility, lunar night survival and mining excavation," JAXA added.

<https://timesofindia.indiatimes.com/india/india-japan-moon-mission-isro-forms-study-group/articleshow/78242002.cms>



Tue, 22 Sept 2020

Scientists invent faster, cheaper strategy for designing infrared-emitting materials

By Amanda Morris

Northwestern University researchers have developed a new low-cost, relatively simple strategy for designing materials used in live cell imaging, photodynamic therapy for cancer and night-vision technologies.

For these applications, scientists use specialized materials that absorb and emit near-infrared light. Compared to visible light, near-infrared light can penetrate materials deeper with lesser scattering and cause lower levels of photodamage.

To develop these materials, researchers currently use a chemical synthesis process that modifies the molecular structure.



Credit: Pixabay/CC0 Public Domain

The Northwestern approach only needs to co-crystallize two different molecules—a convenient and efficient method based on supramolecular chemistry.

"Our work simplifies the production process and lays a foundation for practical application," said Northwestern's Fraser Stoddart, senior author of the study. "This strategy will appeal to scientists working in a wide range of disciplines—from chemistry to crystal engineering to materials science."

The paper was published this week in the journal *Nature Communications*.

Stoddart is a Nobel Prize-winning chemist and the Board of Trustees Professor in Northwestern's Weinberg College of Arts and Sciences. Yu Wang, a postdoctoral fellow in Stoddart's laboratory, is the paper's first author.

Northwestern's method works by taking advantage of the charge transfers between two molecules, in which one molecule (a donor) donates electrons to another molecule (an acceptor). The two molecules can form two co-crystals with different donor-acceptor ratios.

"The two co-crystals assume distinct solid-state superstructures, crystal morphologies and optical properties, wherein one of them constitutes a unique material that exhibits two-photon absorption and near-infrared emission simultaneously," Wang said. "This work provides an ideal platform to uncover a superstructure-property relationship and gain a deeper understanding on the supramolecular material design."

The study, "Two-photon excited deep-red and near-infrared emissive organic co-crystals," was supported by the National Science Foundation and the Department of Energy.

More information: Yu Wang et al. Two-photon excited deep-red and near-infrared emissive organic co-crystals, *Nature Communications* (2020). DOI: [10.1038/s41467-020-18431-7](https://doi.org/10.1038/s41467-020-18431-7)

Journal information: [Nature Communications](https://www.nature.com/journal/534/nature)

<https://phys.org/news/2020-09-scientists-faster-cheaper-strategy-infrared-emitting.html>



Tue, 22 Sept 2020

Spin Hall effect in Weyl semimetal for energy-efficient information technology

The discovery of topological Weyl semimetals in 2017 has revealed opportunities to realize several extraordinary physical phenomena in condensed matter physics. Now, researchers at Chalmers University of Technology have demonstrated the direct electrical detection of a large spin Hall effect in this topological quantum material. Weyl semimetal takes advantage of its strong spin-orbit coupling and novel topological spin-polarized electronic states in its band structure. These experimental findings can pave the way for the utilization of spin-orbit induced phenomena in developing next-generation of faster and energy-efficient information technology and have been published in the scientific journal *Physical Review Research*.

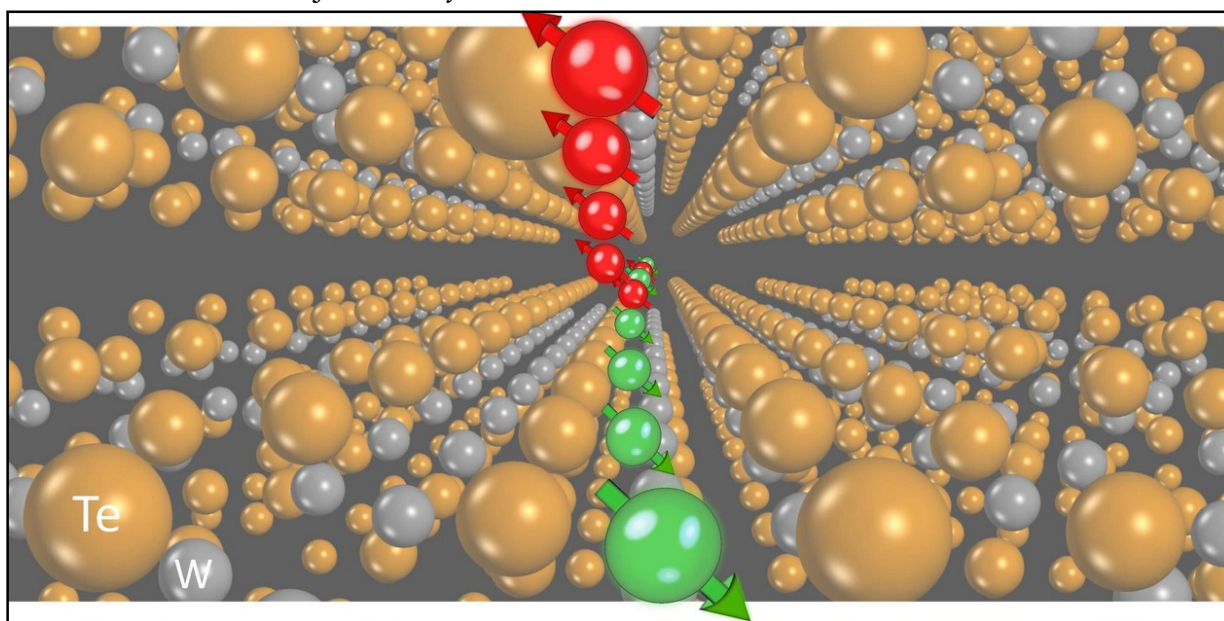


Fig 1. A schematic presentation of spin Hall effect in Weyl semimetal 1T' WTe₂, showing the separation of spin-polarized electrons (up and down spin) on the surfaces of a sample by just passing a charge current. Credit: Bing Zhao

As our society is becoming more integrated with artificial intelligence (AI) and Internet-of-Things (IoT), the demand for low-power, nanoscale, and high-performance electronic devices have been increasing. Spintronic devices are promising for the next generation of information technology in order to lower the power consumption while increasing the performance and non-volatile properties. Recently, the current induced magnetization switching by spin-orbit torque (SOT) using the basic spin Hall effect is identified as a vital ingredient for non-volatile spintronic memory and logic devices. The SOT mechanism is specifically useful, as a spin current can be generated by just passing a charge current in heavy metals due to the spin Hall effect, without the use of an external magnetic field. However, there are several challenges related to the limited switching speed and high-power consumption in these devices.

A group led by Saroj Dash, Associate Professor at the Quantum Device Physics Laboratory at Chalmers, used electronic devices made from novel topological quantum material, called Weyl semimetals, which is like a three-dimensional version of graphene but have a strong spin-orbit interaction and novel spin-polarized surface and bulk electronic states in their band structure.

"Weyl semimetals hold Weyl fermionic states, which are characterized by a linear dispersion of Weyl cones and Fermi arc surface states. Due to the monopole like Berry curvature in the momentum space and strong spin-orbit interaction, a unique spin texture in Weyl cones and Fermi arc surface states are predicted to exist in such novel materials," says Saroj Dash.

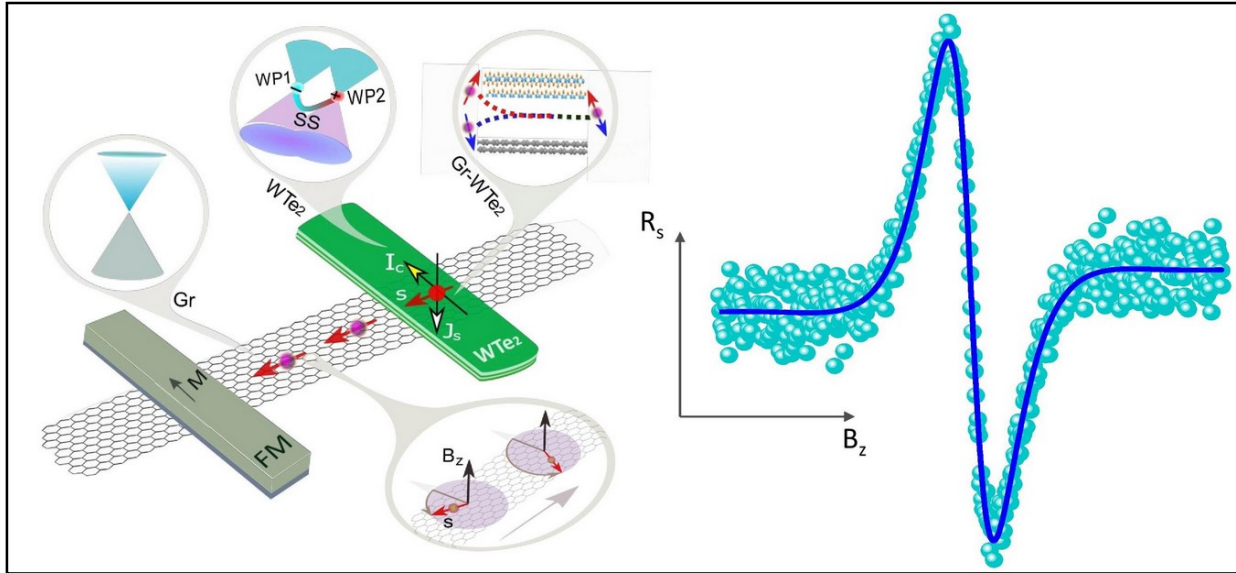


Fig 2, left part: Schematics of a measured device showing the heterostructure of WTe₂ with graphene (Gr) and a ferromagnetic contact (FM) for the measurement of spin Hall effect in WTe₂. The insets in the schematics show the band structures of the WTe₂, graphene and the structure at the interface. Fig 2, right part: The electrical resistance signal (R_s) is measured due to the spin Hall effect in WTe₂. The spin polarization can be created by passing a current in WTe₂ and precession is created by sweeping a perpendicular magnetic field, while the injected spins diffuse in the graphene channel. Credit: Bing Zhao

The researchers at Chalmers take advantage of such novel properties to electrically detect a large charge-to-spin conversion, i.e. the spin Hall effect, in such a Weyl semimetal candidate WTe₂ at room temperature.

"The detection of the spin current generated by spin Hall effect in WTe₂ was realized by making devices of van der Waals heterostructure with graphene, taking advantage of its layered structures and long spin coherence length in graphene and spin transmission at the heterostructure interface," explains Ph.D. student Bing Zhao who is supervised by Saroj Dash at MC2, Chalmers.

Saroj Dash continues, "Our detailed spin sensitive electronic measurements, both in spin transport and Hanle precession geometries, its angle and gate dependent studies, and theoretical calculations manifest the existence of the large and gate-tunable spin Hall phenomena in WTe₂ devices at room temperature. The demonstration of an efficient charge-to-spin conversion process in Weyl semimetal candidate WTe₂ at room temperature can pave the way for its utilization in spintronics and quantum technologies."

The advantages of topological semimetals 1T' WTe₂ is that it has a multitude of interesting properties, such as it is a van der Waals layered materials, a Weyl semimetal in bulk with a chiral anomalous (negative magnetoresistance) behavior, presence of quantum spin Hall states in monolayers, and novel spin-texture of surface and bulk electronic state providing a large current-induced spin polarization.

Saroj Dash group further aims to utilize such topological quantum materials for energy-efficient spintronic and quantum technologies by exploiting their electronic band structure through Berry curvature design and their novel spin topologies.

"Such developments have a great potential for realizing ultra-fast and low-power electronics for the next generation of memory, logic, communication, and quantum technologies," he says.

The research work is done in a multi-national collaboration between Chalmers University of Technology, Sweden; University of Science and Technology Beijing, China; Weizmann Institute of Science, Israel; and Max Planck Institute at Dresden, Germany.

More information: Bing Zhao et al. Observation of charge to spin conversion in Weyl semimetal WTe_2 at room temperature, *Physical Review Research* (2020). DOI: [10.1103/PhysRevResearch.2.013286](https://doi.org/10.1103/PhysRevResearch.2.013286)
<https://phys.org/news/2020-09-hall-effect-weyl-semimetal-energy-efficient.html>



Tue, 22 Sept 2020

Highly efficient perovskite solar cells with enhanced stability and minimised lead leakage

While the power conversion efficiency of perovskite solar cells (PVSCs)—a future of solar cells—has already greatly improved in the past decade, the problems of instability and potential environmental impact are yet to be overcome. Recently, scientists from City University of Hong Kong (CityU) have developed a novel method which can simultaneously tackle the leakage of lead from PVSCs and the stability issue without compromising efficiency, paving the way for real-life application of perovskite photovoltaic technology.

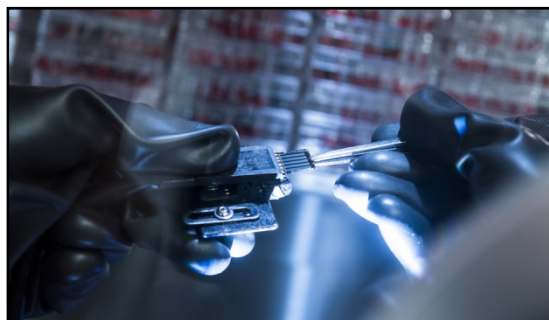
The research team is co-led by Professor Alex Jen Kwan-yue, CityU's Provost and Chair Professor of Chemistry and Materials Science, together with Professor Xu Zhengtao and Dr. Zhu Zonglong from the Department of Chemistry. Their research findings were recently published in the scientific journal *Nature Nanotechnology*, titled "2-D metal-organic framework for stable perovskite solar cells with minimized lead leakage."

Currently, the highest power conversion efficiency of PVSCs has been on par with the state-of-the-art silicon-based solar cells. However, the perovskites used contain lead component which raises a concern for potential environmental contamination. "As the solar cell ages, the lead species can leak through the devices, e.g. through rainwater into the soil, posing a toxicity threat to the environment," explained Professor Jen who is an expert in PVSCs. "To put PVSCs into large-scale commercial uses, it requires not only high power conversion efficiency but also long-term device stability and minimized environmental impact."

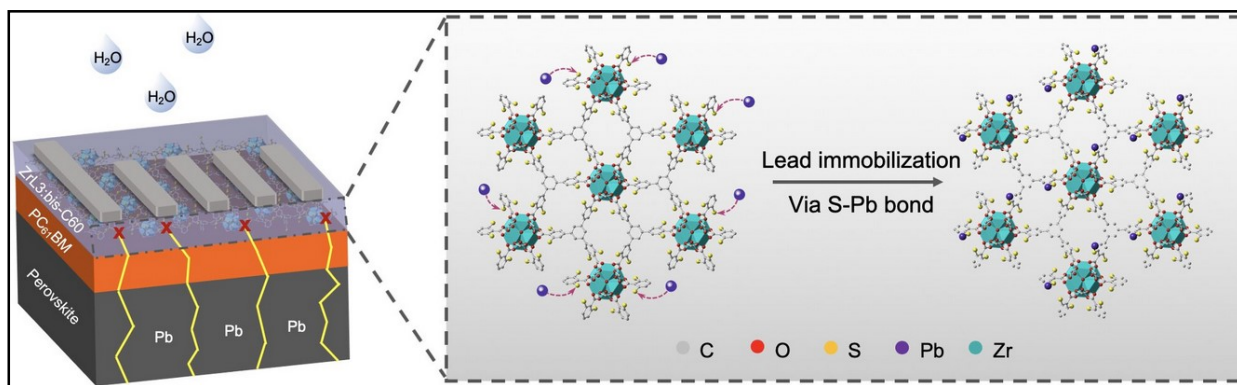
Collaborating with Professor Xu whose expertise is materials synthesis, Professor Jen and Dr. Zhu led the team to overcome the above challenges by applying two-dimensional (2-D) metal-organic frameworks (MOFs) to PVSCs. "We are the first team to fabricate PVSC devices with minimized lead leakage, good long-term stability and high power conversion efficiency simultaneously," Professor Jen summarized their research breakthrough.

Multi-functional MOF layer

Metal-organic framework (MOF) materials have been previously applied as scaffolds to template the growth of perovskites. Scientists have also used them as additives or surface modifiers to passivate (to reduce the reactivity of the material's surface) the defects of perovskites for enhancing the device performance and stability.



A researcher tests the function of the solar cells inside the glove box. Credit: City University of Hong Kong



Over 80% of the leaked lead ions are captured in the top MOF layer to mitigate the potential environmental impact. Credit: DOI: 10.1038/s41565-020-0765-7

However, most of the 3-D MOFs are quite electrical insulating with low charge-carrier mobility, hence unsuitable to be used as the charge-transporting materials.

But the MOFs prepared by Professor Xu is different. They are honeycomb-like, 2-D structure equipped with numerous thiol groups as a key functionality. They possess suitable energy levels, enabling them to be an electron-extraction layer (also called "electron-collection layer") where electrons are finally collected by the electrode of the PVSCs. "Our molecular engineered MOFs possess the property of a multi-functional semiconductor, and can be used to enhance the charge extraction efficiency," explained Professor Xu.

Trapping the lead ions to prevent contamination

More importantly, the dense arrays of thiol and disulfide groups in the MOFs can "capture" heavy metal ions at the perovskite-electrode interface to mitigate lead leakage.

"Our experiments showed that the MOF used as the outer layer of the PVSC device captured over 80% of the leaked lead ions from the degraded perovskite and formed water-insoluble complexes which would not contaminate the soil," Professor Jen explained. Unlike the physical encapsulation methods used in reducing lead leakage in other studies, this in-situ chemical sorption of lead by the integrated MOF component in the device was found to be more effective and sustainable for long-term practical applications.

Long-term operational stability achieved

Moreover, this MOF material could protect perovskites against moisture and oxygen while maintaining high efficiency.

The power conversion efficiency of their PVSC device modified with MOF could reach 22.02% with a fill factor of 81.28% and open-circuit voltage of 1.20 V. Both the conversion efficiency and the open-circuit voltage recorded are among the highest values reported for the planar inverted PVSCs. At the same time, the device exhibited superior stability in an ambient environment with the relative humidity of 75%, maintaining 90% of its initial efficiency after 1,100 hours. In contrast, the power conversion efficiency of the PVSC without MOF dropped significantly to less than 50% of its original value.

Also, their device retained 92% of its initial efficiency under continuous light irradiation for 1,000 hours at 85°C. "Such level of stability has already met the standard for commercialisation set by the International Electrotechnical Commission (IEC)," said Dr. Zhu.

"This is a very significant result which proved our MOF method is technically feasible and has the potential in commercializing the PVSC technology," added Professor Jen.

Highly efficient PVSCs for clean energy applications

It took the team almost two years to accomplish this promising research. Their next step will be to further enhance the power conversion efficiency and explore the ways to lower the production cost. "We hope in the future the manufacturing of this type of PVSCs would be like 'printing out' newspapers and easily scaled up in production, facilitating the large-scale deployment of highly efficient PVSCs for clean energy applications," concluded Professor Jen.

More information: 2-D metal-organic framework for stable perovskite solar cells with minimized lead leakage, *Nature Nanotechnology* (2020). DOI: [10.1038/s41565-020-0765-7](https://doi.org/10.1038/s41565-020-0765-7), www.nature.com/articles/s41565-020-0765-7

Journal information: *Nature Nanotechnology*
<https://phys.org/news/2020-09-highly-efficient-perovskite-solar-cells.html>



Tue, 22 Sept 2020

Strontium-iridium oxide used for customization as an electronic material

By Barbara Vonarburg

PSI scientists have gained a fundamental understanding of a highly promising material that could be suited to future data storage applications. Their experiments with strontium-iridium oxide, Sr_2IrO_4 , investigated both the magnetic and electronic properties of the material as a thin film. They also analyzed how these properties can be systematically controlled by manipulating the films. This study was made possible by sophisticated X-ray scattering, a technology where PSI researchers are amongst the world experts. The results are published today in the journal *Proceedings of the National Academy of Sciences*.

In their quest for the magnetic data storage of the future, researchers are looking for suitable materials with properties that can be customized as flexibly as possible. One promising candidate is strontium-iridium oxide, a metal oxide with the chemical notation Sr_2IrO_4 . PSI scientists have investigated this material, working alongside colleagues in Poland, the US and France.

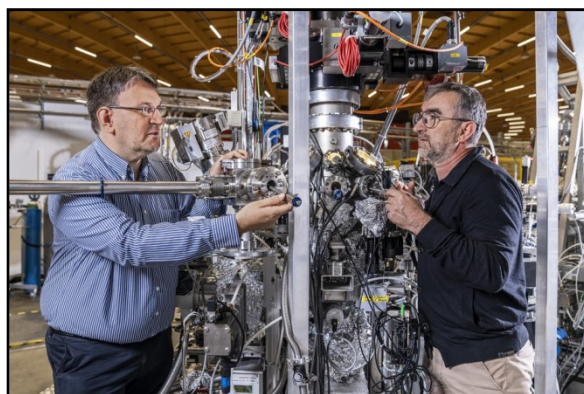
"The keyword of our research is spintronics,"

explains Thorsten Schmitt, Head of the PSI Research Group for Spectroscopy of Novel Materials. Spintronics utilizes both the electrical charge of the electron and its internal spin to develop advanced electronic components.

Spintronics is already being used in today's hard disks, but the properties of the materials used are based on "normal" magnetism: ferromagnets such as iron or nickel where the spins are arranged in parallel. Their drawback is the relatively wide spacing required between the ferromagnetic data storage points, i.e., the bits, to prevent cross-interference.

Experts believe antiferromagnetic materials could offer a promising alternative, as their spins are arranged in opposing directions. Viewed externally, antiferromagnetic materials are therefore magnetically neutral. Hence an antiferromagnetic bit would not interfere with its neighbor. "These bits can be packed more tightly together, so more data can be stored on the same space," Schmitt says. "On top of that, data read-write operations are much faster."

Strontium-iridium oxide is such an antiferromagnetic material. It is essentially a crystal within which the iridium and oxygen atoms form tiny octahedrons. "We call this a perovskite structure," explains Milan Radovic, a physicist at PSI and co-author of the new study. "It is an ideal material for systematically manipulating its functional properties," Radovic adds.



Thorsten Schmitt (left) and Milan Radovic at their experimental station at the Swiss Light Source SLS, where they performed their measurements on thin films of strontium-iridium oxide. Credit: Paul Scherrer Institute/Markus Fischer

Manipulating thin films

To perform such manipulation and discover more about the properties of this highly promising material, PSI scientists applied a thin, crystalline layer of Sr_2IrO_4 as the main film onto different crystalline substrates. The idea is that the substrate leads to the crystalline structure of the applied film being distorted. "It's as if we were pulling or compressing our material at the level of the atoms," Schmitt explains. This causes the perovskite octahedrons to twist and shift slightly against each other, ultimately changing the properties of the material as a whole.

This method makes it possible to systematically fine-tune the magnetic and electronic properties of the material. And since this type of material is already being used in electronic components in the form of thin films, developing applications in this area would be the next logical step.

Obtaining a global picture

For in-depth analysis of their samples, PSI scientists used a special X-ray technique that has been heavily developed by PSI known as Resonant Inelastic X-Ray-Scattering, or RIXS for short. At PSI the researchers used soft X-rays to perform their RIXS experiments. The research in Switzerland was supplemented by additional precision measurements with hard X-rays of higher energy conducted at the European Synchrotron Radiation Facility in Grenoble and the Advanced Photon Source in Argonne, U.S..

"Most methods focus separately on either the magnetism or the electronic properties," Schmitt explains. "With RIXS, on the other hand, we can investigate both properties with the same measurement and compare them directly with one another. In short: we have successfully obtained a global picture of our sample."

The researchers were able to discover how the electronic properties change when the crystalline lattice of the Sr_2IrO_4 film is distorted, and how this development is linked to the change in magnetism. Both go hand in hand—and provide important findings for potential applications.

Superconductors as a paradigm

Specifically, the group managed to modify the strontium-iridium oxide so that its magnetic properties mimic another class of fascinating materials: high-temperature superconductors composed of copper oxide layers, also known as cuprates. These also have a perovskite-like structure. In their experiment, PSI scientists pulled and twisted the Sr_2IrO_4 film so that the atomic distances in the crystal lattice expanded and additionally a rotation occurred. "This allowed us to make the material replicate the properties of a cuprate," says Schmitt. "However, we're still a long way from producing a new superconductor," he says, before anyone gets their hopes up. He also thinks it may take another 10 or 20 years before the current findings will possibly contribute to the development of new data storage applications. "Our task is to produce fundamental research. This is vitally important as a stepping-stone in the future development of new materials."

More information: Eugenio Paris et al., Strain engineering of the charge and spin-orbital interactions in Sr_2IrO_4 , *PNAS* (2020). www.pnas.org/cgi/doi/10.1073/pnas.2012043117

Journal information: *Proceedings of the National Academy of Sciences*
<https://phys.org/news/2020-09-strontium-iridium-oxide-customization-electronic-material.html>

Researchers identify new type of superconductor

By David Nutt

Until now, the history of superconducting materials has been a tale of two types: s-wave and d-wave.

Now, Cornell researchers—led by Brad Ramshaw, the Dick & Dale Reis Johnson Assistant Professor in the College of Arts and Sciences—have discovered a possible third type: g-wave.

Their paper, "Thermodynamic Evidence for a Two-Component Superconducting Order Parameter in Sr_2RuO_4 ," published Sept. 21 in *Nature Physics*. The lead author is doctoral student Sayak Ghosh, M.S. '19.

Electrons in superconductors move together in what are known as Cooper pairs. This "pairing" endows superconductors with their most famous property—no electrical resistance—because, in order to generate resistance, the Cooper pairs have to be broken apart, and this takes energy.

In s-wave superconductors—generally conventional materials, such as lead, tin and mercury—the Cooper pairs are made of one electron pointing up and one pointing down, both moving head-on toward each other, with no net angular momentum. In recent decades, a new class of exotic materials has exhibited what's called d-wave superconductivity, whereby the Cooper pairs have two quanta of angular momentum.

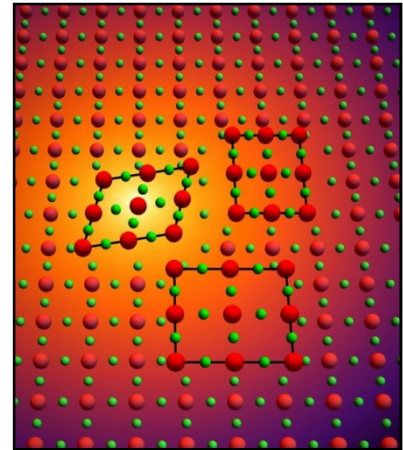
Physicists have theorized the existence of a third type of superconductor between these two so-called "singlet" states: a p-wave superconductor, with one quanta of angular momentum and the electrons pairing with parallel rather than antiparallel spins. This spin-triplet superconductor would be a major breakthrough for quantum computing because it can be used to create Majorana fermions, a unique particle which is its own antiparticle.

For more than 20 years, one of the leading candidates for a p-wave superconductor has been strontium ruthenate (Sr_2RuO_4), although recent research has started to poke holes in the idea.

Ramshaw and his team set out to determine once and for all whether strontium ruthenate is a highly desired p-wave superconductor. Using high-resolution resonant ultrasound spectroscopy, they discovered that the material is potentially an entirely new kind of superconductor altogether: g-wave.

"This experiment really shows the possibility of this new type of superconductor that we had never thought about before," Ramshaw said. "It really opens up the space of possibilities for what a superconductor can be and how it can manifest itself. If we're ever going to get a handle on controlling superconductors and using them in technology with the kind of fine-tuned control we have with semiconductors, we really want to know how they work and what varieties and flavors they come in."

As with previous projects, Ramshaw and Ghosh used resonant ultrasound spectroscopy to study the symmetry properties of the superconductivity in a crystal of strontium ruthenate that was grown and precision-cut by collaborators at the Max Planck Institute for Chemical Physics of Solids in Germany.



This illustration shows a crystal lattice of strontium ruthenate responding to various sound waves sent via resonant ultrasound spectroscopy as the material cools through its superconducting transition at 1.4 kelvin (minus 457 degrees Fahrenheit). The highlighted deformation suggests the material may be a new type of superconductor. Credit: Cornell University

However, unlike previous attempts, Ramshaw and Ghosh encountered a significant problem when trying to conduct the experiment.

"Cooling down resonant ultrasound to 1 kelvin (minus 457.87 degrees Fahrenheit) is difficult, and we had to build a completely new apparatus to achieve this," Ghosh said.

With their new setup, the Cornell team measured the response of the crystal's elastic constants—essentially the speed of sound in the material—to a variety of sound waves as the material cooled through its superconducting transition at 1.4 kelvin (minus 457 degrees Fahrenheit).

"This is by far the highest-precision resonant ultrasound spectroscopy data ever taken at these low temperatures," Ramshaw said.

Based on the data, they determined that strontium ruthenate is what's called a two-component superconductor, meaning the way electrons bind together is so complex, it can't be described by a single number; it needs a direction as well.

Previous studies had used nuclear magnetic resonance (NMR) spectroscopy to narrow the possibilities of what kind of wave material strontium ruthenate might be, effectively eliminating p-wave as an option.

By determining that the material was two-component, Ramshaw's team not only confirmed those findings, but also showed strontium ruthenate wasn't a conventional s- or d-wave superconductor, either.

"Resonant ultrasound really lets you go in and even if you can't identify all the microscopic details, you can make broad statements about which ones are ruled out," Ramshaw said. "So then the only things that the experiments are consistent with are these very, very weird things that nobody has ever seen before. One of which is g-wave, which means angular momentum 4. No one has ever even thought that there would be a g-wave superconductor."

Now the researchers can use the technique to examine other materials to find out if they are potential p-wave candidates.

However, the work on strontium ruthenate isn't finished.

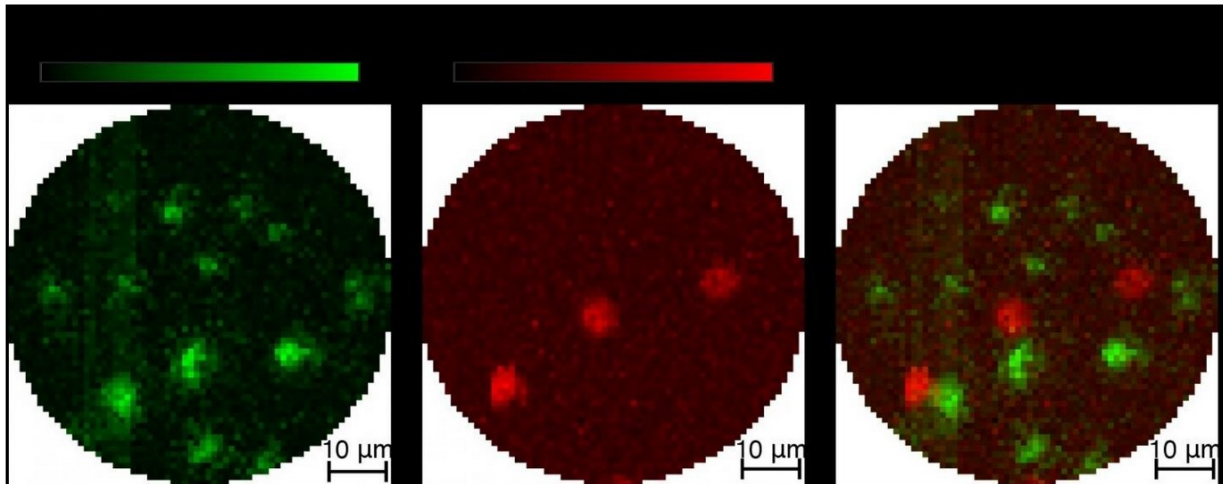
"This material is extremely well studied in a lot of different contexts, not just for its superconductivity," Ramshaw said. "We understand what kind of metal it is, why it's a metal, how it behaves when you change temperature, how it behaves when you change the magnetic field. So you should be able to construct a theory of why it becomes a superconductor better here than just about anywhere else."

More information: Thermodynamic evidence for a two-component superconducting order parameter in Sr₂RuO₄, DOI: [10.1038/s41567-020-1032-4](https://doi.org/10.1038/s41567-020-1032-4) , www.nature.com/articles/s41567-020-1032-4

Journal information: [Nature Physics](https://www.nature.com/journal/nature-physics)
<https://phys.org/news/2020-09-superconductor.html>

Researchers combine photoacoustic and fluorescence imaging in tiny package

Researchers have demonstrated a new endoscope that uniquely combines photoacoustic and fluorescent imaging in a device about the thickness of a human hair. The device could one day provide new insights into the brain by enabling blood dynamics to be measured at the same time as neuronal activity.



The researchers demonstrated their new device by using it to image fluorescent beads (green) and red blood cells (red). The field-of-view is the size of a hair. Credit: Emmanuel Bossy, CNRS/ Université Grenoble Alpes Laboratoire Interdisciplinaire de Physique

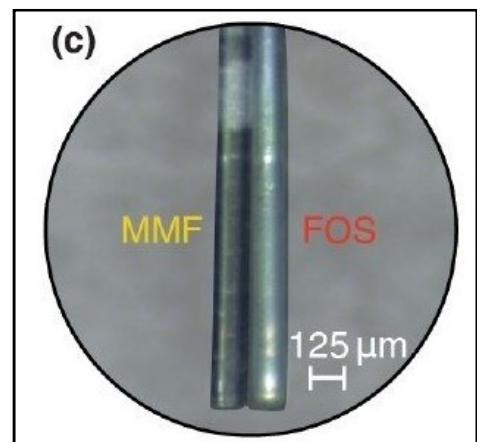
"Combining these imaging modalities could improve our understanding of the brain's structure and behavior in specific conditions such as after treatment with a targeted drug," said research team leader Emmanuel Bossy from the CNRS/ Université Grenoble Alpes Laboratoire Interdisciplinaire de Physique. "The endoscope's small size helps minimize damage to tissue when inserting it into the brains of small animals for imaging."

In The Optical Society (OSA) journal *Biomedical Optics Express*, Bossy's research team, in collaboration with Paul C. Beard's team from University College London, describe their new multi-modality endoscope and show that it can acquire photoacoustic and fluorescent images of red blood cells and fluorescent beads.

Two images are better than one

Acquiring fluorescence and photoacoustic images with the same device provides automatically co-registered images with complementary information. Fluorescent signals, which are created when a fluorescent marker absorbs light and re-emits it with a different wavelength, are most useful for labeling specific regions of tissue. On the other hand, photoacoustic images, which capture an acoustic wave generated after the absorption of light, do not require labels and thus can be used to image blood dynamics, for example.

The new endoscope uses a technique called optical wavefront shaping to create a focused spot of light at the imaging tip of a very small multi-mode optical fiber. "Light propagating into a multi-mode fiber is scrambled, making it impossible to see through the fiber," said Bossy. "However, this



A new endoscope about the thickness of a human hair uses a multimode fiber (MMF) for fluorescence imaging and fiber optic sensor (FOS) for photoacoustic imaging. Credit: Emmanuel Bossy, CNRS/ Université Grenoble Alpes Laboratoire Interdisciplinaire de Physique

type of fiber is advantageous for endoscopy because it is extremely small compared to the bundles of imaging fibers used for many medical endoscopic devices."

To see through the multi-mode optical fiber, the researchers used the spatial light modulator to send specific light patterns through the fiber and create a focus spot at the imaging end. When the focus spot hits the sample, it creates a signal that can be used to build up an image point by point by raster scanning the spot over the sample. Although other researchers have used multimode fibers for fluorescence endoscopy, the new work represents the first time that photoacoustic imaging has been incorporated into this type of endoscope design.

Adding sound sensitivity

The researchers added photoacoustic imaging by incorporating an additional, very thin optical fiber with a special sensor tip that is sensitive to sound. Because commercially available fiber optic acoustic sensors are not sensitive or small enough for this application, the researchers used a very sensitive fiber optic sensor recently developed by Beard's research team.

"The focused spot of light allows us to build the image pixel by pixel while also increasing the strength of fluorescence and photoacoustic signals because it concentrates the light at the focal spot," explained Bossy. "This concentrated light combined with a sensitive detector made it possible to obtain images using only one laser pulse per pixel, whereas commercial fiber optic acoustic sensors would have required many laser pulses."

The researchers fabricated a prototype microendoscope that measured just 250 by 125 microns squared and used it to image fluorescent beads and blood cells using both imaging modalities. They successfully detected multiple 1-micron fluorescent beads and individual 6-micron red blood cells.

Because fluorescence endoscopy in rodent's brain has been performed by other scientists, the researchers are confident that their dual modality device will work in similar conditions. They are now continuing work to increase the device's acquisition speed, with a goal of acquiring a few images per second.

More information: Sylvain Mezil et al, Single-shot hybrid photoacoustic-fluorescent microendoscopy through a multimode fiber with wavefront shaping, *Biomedical Optics Express* (2020). [DOI: 10.1364/BOE.400686](https://doi.org/10.1364/BOE.400686)

Journal information: [Biomedical Optics Express](https://phys.org/news/2020-09-combine-photoacoustic-fluorescence-imaging-tiny.html)
<https://phys.org/news/2020-09-combine-photoacoustic-fluorescence-imaging-tiny.html>

Long-term COVID-19 containment will be shaped by strength, duration of immunity

Summary:

New research suggests that the impact of natural and vaccine-induced immunity will be key factors in shaping the future trajectory of the global coronavirus pandemic, known as COVID-19. In particular, a vaccine capable of eliciting a strong immune response could substantially reduce the future burden of infection, according to a new study.

New research suggests that the impact of natural and vaccine-induced immunity will be key factors in shaping the future trajectory of the global coronavirus pandemic, known as COVID-19. In particular, a vaccine capable of eliciting a strong immune response could substantially reduce the future burden of infection, according to a study by Princeton researchers published in the journal *Science* Sept. 21.

"Much of the discussion so far related to the future trajectory of Covid-19 has rightly been focused on the effects of seasonality and non-pharmaceutical interventions [NPIs], such as mask-wearing and physical distancing,," said co-first author Chadi Saad-Roy, a Ph.D. candidate in Princeton's Lewis-Sigler Institute for Integrative Genomics. "In the short term, and during the pandemic phase, NPIs are the key determinant of case burdens. However, the role of immunity will become increasingly important as we look into the future."

"Ultimately, we don't know what the strength or duration of natural immunity to SARS-CoV-2 - or a potential vaccine -- will look like," explained co-first author Caroline Wagner, an assistant professor of bioengineering at McGill University who worked on the study as a postdoctoral research associate in the Princeton Environmental Institute (PEI).

"For instance, if reinfection is possible, what does a person's immune response to their previous infection do?" Wagner asked. "Is that immune response capable of stopping you from transmitting the infection to others? These will all impact the dynamics of future outbreaks."

The current study builds on Princeton research published in *Science* May 18 that reported that local variations in climate are not likely to dominate the first wave of the COVID-19 pandemic and included many of the same authors, who are all affiliated with PEI's Climate Change and Infectious Disease initiative.

In the most recent paper, the researchers used a simple model to project the future incidence of COVID-19 cases -- and the degree of immunity in the human population -- under a range of assumptions related to how likely individuals are to transmit the virus in different contexts. For example, the model allows for different durations of immunity after infection, as well as different extents of protection from reinfection. The researchers posted online an interactive version of model's predictions under these different sets of assumptions.

As expected, the model found that the initial pandemic peak is largely independent of immunity because most people are susceptible. However, a substantial range of epidemic patterns are possible as SARS-CoV-2 infection -- and thus immunity -- increases in the population.

"If immune responses are only weak, or transiently protective against reinfection, for example, then larger and more frequent outbreaks can be expected in the medium term," said co-author Andrea Graham, professor of ecology and evolutionary biology at Princeton.

The nature of the immune responses also can affect clinical outcomes and the burden of severe cases requiring hospitalization, the researchers found. The key question is the severity of subsequent infections in comparison to primary ones.

Importantly, the study found that in all scenarios a vaccine capable of eliciting a strong immune response could substantially reduce future caseloads. Even a vaccine that only offers partial protection against secondary transmission could generate major benefits if widely deployed, the researchers reported.

Factors such as age and superspreading events are known to influence the spread of SARS-CoV-2 by causing individuals within a population to experience different immune responses or transmit the virus at different rates. "Our models show that these factors do not affect our qualitative projections about future epidemic dynamics," said Bryan Grenfell, the Kathryn Briger and Sarah Fenton Professor of Ecology and Evolutionary Biology and Public Affairs and an associated faculty member in PEI. Grenfell is a co-senior author on the paper with C. Jessica Metcalf, associate professor of ecology and evolutionary biology and public affairs and also a PEI associated faculty member.

"As vaccine candidates emerge, and more detailed predictions of future caseloads with vaccination are needed, these additional details will need to be incorporated into more complex models," Grenfell said.

The study authors also explored the effect of "vaccine hesitancy" on future infection dynamics. Their model found that people who decline to partake in pharmaceutical and non-pharmaceutical measures to contain the coronavirus could nonetheless slow containment of the virus even if a vaccine is available.

"Our model indicates that if vaccine refusal is high and correlated with increased transmission and riskier behavior such as refusing to wear a mask, then the necessary vaccination rate needed to reach herd immunity could be much higher," said co-author Simon Levin, the James S. McDonnell Distinguished University Professor in Ecology and Evolutionary Biology and an associated faculty member in PEI. "In this case, the nature of the immune response after infection or vaccination would be very important factors in determining how effective a vaccine would be."

"When so much uncertainty in the underlying processes exists, it can be challenging to make accurate projections about the future," Grenfell said. "We argue in this study that ultimately, a family of both simple and more complex models is the best way to proceed under these circumstances. Comparing the predictions of these models carefully and then coming up with a carefully averaged picture of the future -- as with weather prediction -- can be very helpful."

One of the main takeaways of the study is that monitoring population-level immunity to SARS-CoV-2, in addition to active infections, will be critical for accurately predicting future incidence.

"This is not an easy thing to do accurately, particularly when the nature of this immune response is not well understood," said co-author Michael Mina, an assistant professor at the Harvard School of Public Health and Harvard Medical School. "Even if we can measure a clinical quantity like an antibody titer against this virus, we don't necessarily know what that means in terms of protection."

"Studying the effects of T-cell immunity and cross-protection from other coronaviruses are important avenues for future work," Metcalf said.

Additional authors on the paper include Rachel Baker, a PEI postdoctoral research associate; Sinead Morris, a postdoctoral research scientist at Columbia University who received her Ph.D. in ecology and evolutionary biology from Princeton; and Jeremy Farrar, director of the Wellcome Trust.

The paper, "Immune life-history, vaccination, and the dynamics of SARS-CoV-2 over the next five years," was published online by *Science* Sept. 21. This work was supported by funds from the Natural Sciences and Engineering Research Council of Canada, the Life Sciences Research Foundation, the Cooperative Institute for Modelling the Earth System (CIMES) at Princeton University, the James S. McDonnell Foundation, the C3.ai Digital Transformation Institute, the National Science Foundation, the US Centers for Disease Control and Prevention, and Flu Lab.

Story Source:

[Materials](#) provided by [Princeton University](#). Original written by Morgan Kelly, Princeton Environmental Institute. *Note: Content may be edited for style and length.*

Journal Reference:

1. Chadi M. Saad-Roy, Caroline E. Wagner, Rachel E. Baker, Sinead E. Morris, Jeremy Farrar, Andrea L. Graham, Simon A. Levin, Michael J. Mina, C. Jessica E. Metcalf, Bryan T. Grenfell. **Immune life history, vaccination, and the dynamics of SARS-CoV-2 over the next 5 years.** *Science*, Sept. 21, 2020; DOI: [10.1126/science.abd7343](https://doi.org/10.1126/science.abd7343)

<https://www.sciencedaily.com/releases/2020/09/200921141454.htm>

ScienceDaily

Tue, 22 Sept 2020

BCG vaccination in infancy does not protect against COVID-19, Swedish data indicate

Researchers uncover early results about an existing tuberculosis vaccine that has been hypothesized to help against the coronavirus

Summary:

Using information from the Swedish public health agency, researchers determined that BCG vaccination during infancy does not protect against COVID-19. Their results suggest that other, related factors likely underlie the disparities between countries.

While scientists race to develop and test a vaccine effective against SARS-CoV-2, the virus that causes COVID-19, recent studies have indicated that countries with widespread BCG vaccination appear to be weathering the pandemic better than their counterparts. This has led many researchers to suspect that BCG vaccine, which immunizes against tuberculosis, might offer protection against COVID-19.

Controlled trials with the vaccine are in progress, but in the meantime Clément de Chaisemartin, an assistant professor of economics at UC Santa Barbara, and his coauthor -- and cousin -- Luc de Chaisemartin, an immunologist at Paris-Saclay University, decided to see what they could learn from existing public health data.

Using information from the Swedish public health agency, the pair determined that BCG vaccination during infancy actually does not protect against the virus. Their results, which appear in the journal *Clinical Infectious Diseases*, suggest that other, related factors likely underlie the disparities between countries.

"Having a study like ours, which builds upon a natural experiment, is useful," Clément de Chaisemartin explained, "because even though it does not look at exactly the same research question as the controlled trials -- which will measure the effect of a recent BCG vaccination -- our results are available much more quickly."

The inspiration for the study was rather idiosyncratic. Clément de Chaisemartin is the oldest of five siblings. He received the BCG vaccine and its boosters as a child, but he recalled that his 18-year-old youngest brother had not. His native France did away with mandatory BCG vaccination in the early 2000s. In fact, many developed countries gradually went this way as tuberculosis became ever rarer.

The economist remembered this fact when studies began reporting that countries that had mandatory BCG vaccinations were faring better in the pandemic than those that didn't.

"So then I just went onto Wikipedia and tried to find a country where the BCG interruption was less recent, so that the people affected would be older and at higher risk of COVID-19," he recalled.

Sweden, he discovered, had discontinued the practice in April 1975. That fit his needs perfectly, so he reached out to the country's public health agency, which agreed to share data with him.

Usually, non-randomized studies can provide evidence only of correlations, not actual causation. But the type of analysis that the Chaisemartins applied is different. "The regression discontinuity method we used is considered almost as reliable as a randomized controlled trial in terms of teasing out correlation from causation," said Clément de Chaisemartin.

The researchers took advantage of the fact that the Swedish policy essentially created a randomized controlled trial. People born in March and April 1975 are extremely similar in terms of their susceptibility to COVID-19. Meanwhile, those born in March got the BCG vaccine, while those born in April did not. It's almost as if the individuals were randomly placed in the two different groups.

The researchers compared the COVID-19 outcomes between the two groups and found that cases per capita, hospitalizations per capita, and deaths per capita were very similar for people born just before and just after the April 1st cutoff.

The results were enlightening. The correlation between mandatory BCG vaccination and COVID-19 outcomes is very strong, and shows up even when controlling for a number of relevant factors, such as per-capita income. But the similar COVID-19 outcomes between those who received the vaccine in childhood and those who didn't indicate that immunization can't be the cause.

"Our study shows that this correlation is probably not due to the BCG vaccination, but rather to some omitted variable," explained Clément de Chaisemartin. "This raises the question as to what this omitted variable is, because if it is something that policymakers can act upon, then maybe we would have something actionable against COVID-19."

He hypothesized that mandatory child BCG vaccination may reflect the overall strength of a country's public health agency. "Countries that have many mandatory vaccinations may be countries where public health agencies are more powerful," he said. "So maybe those public health agencies are also able to implement effective policies against COVID-19."

Another hypothesis is that the mandatory vaccination relates to risk aversion. "Maybe countries where many mandatory vaccinations are in place are countries where people tend to be more risk averse," he continued. In that case, the public may adhere to more cautious guidelines during the pandemic.

Clément de Chaisemartin is quick to point out that these conjectures are preliminary, and would require more research to corroborate. Also, despite having found no connection between vaccination in infancy and protection from COVID-19, current experiments may still find that a recent BCG vaccination can provide some benefit.

One thing is abundantly clear, though, said Luc de Chaisemartin, "Without sound evidence that BCG protects against COVID-19, it is important to wait for the results of the ongoing trials, rather than deplete stocks of a vaccine already difficult to get for those who really need it, namely children in countries with a high prevalence of tuberculosis."

Story Source:

[Materials](#) provided by [University of California - Santa Barbara](#). Original written by Harrison Tasoff.
Note: Content may be edited for style and length.

Journal Reference:

1. Clément de Chaisemartin, Luc de Chaisemartin. **BCG vaccination in infancy does not protect against COVID-19. Evidence from a natural experiment in Sweden.** *Clinical Infectious Diseases*, 2020; DOI: [10.1093/cid/ciaa1223](https://doi.org/10.1093/cid/ciaa1223)
<https://www.sciencedaily.com/releases/2020/09/200921115550.htm>

Low-cost, frequent COVID-19 screening of asymptomatic people could decrease infections, deaths and be cost-effective

Summary:

When the COVID-19 pandemic is slowing, low-cost, recurring screening of asymptomatic people could decrease infections and deaths and be cost-effective.

New research suggests when the COVID-19 pandemic is slowing, low-cost, recurring screening of asymptomatic people -- at an expense of approximately \$3 or less per test every two weeks -- could decrease COVID-19 infections and deaths and be cost-effective. When the pandemic is surging, screening can be cost-effective when done more often, even if tests costs are higher. The report -- led by researchers at Massachusetts General Hospital (MGH) -- was recently published in *Clinical Infectious Diseases*.

COVID-19 testing refers generally to testing of people with symptoms of the illness, while screening refers to testing of individuals who do not have symptoms of the infection. In the United States, restricted testing capacity early in the pandemic led states such as Massachusetts to test only severely symptomatic people and those with a known exposure to someone with COVID-19. However, making COVID-19 testing available to all people with symptoms suggestive of the illness, as well as expanding to screening programs for the entire population -- including those who are without symptoms -- could reduce hospitalizations and deaths, allowing for safe resumption of economic and social activity.

"Massachusetts experienced a major COVID-19 outbreak beginning in March 2020, and while the outbreak is now under reasonably good control, questions remain about how to optimally deploy COVID testing, both in our current situation and in other settings -- and communities -- where new infections continue to rise," says Anne Neilan, MD, MPH, investigator in the MGH Divisions of General Pediatrics and Infectious Diseases and the Medical Practice Evaluation Center, who led the study. "While some have argued testing must be highly sensitive to be of value, others suggest that sensitivity can be sacrificed if tests are rapid, low-cost, frequent and widely available."

The study used a dynamic transmission model developed by members of the research team (the "CEACOV model") to analyze the outcomes anticipated from several different strategies for COVID-19 testing and screening for the entire population of Massachusetts, using laboratory-based polymerase chain reaction (PCR) tests. The PCR test uses a sample taken from the nose or mouth (usually a nasal swab or a saliva sample), which is then sent to a laboratory that tests for the virus causing COVID-19. The model-based analysis revealed that repeated screening of the entire population would lead to the most favorable clinical outcomes, preventing the greatest number of infections, hospitalizations, and, ultimately, deaths. This was true in a wide range of scenarios, ranging from decreasing to rapidly rising numbers of new cases per day. Such a screening strategy could also be cost-effective, depending on the cost of the test and the frequency of screening.

"Based on the prices that most laboratories are now charging for the PCR test, with our current levels of new COVID-19 cases in Massachusetts, the most cost-effective strategy remains testing only people with symptoms of COVID-19. Importantly, for Massachusetts as of now, this includes testing all people with symptoms, and not only people whose symptoms are severe," says study co-senior author Andrea Ciaranello, MD, MPH, investigator in the Division of Infectious Diseases at MGH. "However, in locations where cases are rising, regular screening of the entire population, while expensive, will actually be of very good value. This is true even at current testing costs around \$50 and will be truer if test costs can be brought down substantially. There are creative

ways to bring tests costs down; for example, using emerging techniques such as less expensive reagents, pooling of specimens in the lab, or carefully allocating unused testing capacity across cities or regions."

"When the pandemic is slowing, if testing costs can come down to \$5 or less, repeat screening of people without COVID symptoms would decrease infections and deaths, and be cost-effective," adds Neilan. "Our data suggest that even now, expanding testing and screening capacity must remain a focus of national efforts." Because the study modeled the use of the laboratory-based PCR tests, the investigators did not evaluate the possible use of even less sensitive and less expensive tests, such as rapid tests used on-site at healthcare facilities (like urgent care locations), schools, or places of employment. Several such tests have been brought to market but are not yet widely available for use in these settings.

Adds Ciaranello, "It is important to note that these strategies involve repeated screening. Screening a group of people just one time, while an interesting snapshot, is an approach that will miss many people who will become able to infect others in the future. Because of this, we also found that screening just once was a less efficient use of healthcare resources under most circumstance than strategies using repeat testing."

"There is also a price to not being able to rapidly deploy testing," says Nielan. "Early in the pandemic, we struggled to provide testing even for people with symptoms of COVID-19. If expanded PCR testing had been widely available in Massachusetts from April to May 2020, our model suggests that more than 100,000 infections and approximately 100 deaths would have been averted during that month alone."

"Expanding testing and screening capacity will require careful logistical planning, and also responsiveness to changes in the numbers of new infections that we are seeing. This needs to be a priority for policymakers seeking to utilize available resources in the most efficient way," says Ciaranello.

The study's co-authors are Elena Losina, PhD, Department of Orthopedic Surgery, Brigham and Women's Hospital; Audrey Bangs, Clare Flanagan, Christopher Panella, G. Ege Eskibozkurt, Justine Scott, Fatma Shebl, MD, PhD, Pooyan Kazemian, PhD, Medical Practice Evaluation Center, MGH; Amir M. Mohareb, MD, Emily Hyle, MD, Mark Siedner, MD, Kenneth Freedberg, MD, Division of Infectious Diseases, MGH; Milton Weinstein, PhD, Department of Health Policy and Management, Harvard T.H. Chan School of Public Health; Krishna Reddy, Division of Pulmonary and Critical Care Medicine, MGH; Guy Harling, ScD, Department of Epidemiology, Harvard T.H. Chan School of Public Health.

Story Source:

[Materials](#) provided by [Massachusetts General Hospital](#). *Note: Content may be edited for style and length.*

Journal Reference:

1. Anne M Neilan, Elena Losina, Audrey C Bangs, Clare Flanagan, Christopher Panella, G Ege Eskibozkurt, Amir Mohareb, Emily P Hyle, Justine A Scott, Milton C Weinstein, Mark J Siedner, Krishna P Reddy, Guy Harling, Kenneth A Freedberg, Fatma M Shebl, Pooyan Kazemian, Andrea L Ciaranello. **Clinical Impact, Costs, and Cost-Effectiveness of Expanded SARS-CoV-2 Testing in Massachusetts.** *Clinical Infectious Diseases*, 2020; DOI: [10.1093/cid/ciaa1418](https://doi.org/10.1093/cid/ciaa1418)
<https://www.sciencedaily.com/releases/2020/09/200921170454.htm>

Explained: What is the 'Feluda' test for Covid-19 approved by India?

Feluda Covid-19 Test: Feluda test uses indigenously developed CRISPR gene-editing technology to identify and target the genetic material of SARS-CoV2, the virus that causes Covid-19

By Abhishek De

An accurate and low-cost paper-based test strip to detect Covid-19 in less than 30 minutes has been approved for commercial launch by the Drugs Controller General of India. Developed by a research team led by Debojyoti Chakraborty and Souvik Maiti of the Council of Scientific and Industrial Research (CSIR) and Tata Group, the test has been named 'Feluda' — a fictional private detective from West Bengal created by renowned writer and filmmaker Satyajit Ray. The development comes at a time when India has been conducting an average of 10 lakh tests daily.

What is the new Feluda Covid-19 test?

Feluda, the acronym for FNCAS9 Editor Linked Uniform Detection Assay, uses indigenously developed CRISPR gene-editing technology to identify and target the genetic material of SARS-CoV2, the virus that causes Covid-19. According to CSIR, the test matches accuracy levels of RT-PCR tests, considered the gold standard in the diagnosis of Covid-19, has a quicker turnaround time and requires less expensive equipment.

“The Tata CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) test, powered by CSIR-IGIB (Institute of Genomics and Integrative Biology) FELUDA, has met high quality benchmarks, with 96 per cent sensitivity and 98 per cent specificity for detecting novel coronavirus,” a CSIR statement said. Moreover, 'Feluda' is also the world's first diagnostic test to deploy a specially adapted Cas9 protein to successfully detect the virus. Other CRISPR tests use CAS12 and CAS13 proteins to detect SARS-CoV2.

The CSIR research team came about creating the new test kit while working under the sickle cell mission for genome diagnostics and therapeutics. They soon realised that the technology could be harnessed to quickly develop a new diagnostic test for Covid-19.

What is CRISPR technology?

CRISPR, short form for Clustered Regularly Interspaced Short Palindromic Repeats, is a gene editing technology and finds its use in correcting genetic defects and treating and preventing the spread of diseases. The CRISPR technology can detect specific sequences of DNA within a gene and uses an enzyme functioning as molecular scissors to snip it. It also allows researchers to easily alter DNA sequences and modify gene function. Moreover, the technology can also be configured for detection of multiple other pathogens in the future.

The United States had granted emergency-use approval of the world's first CRISPR-based test for Covid-19, developed by Massachusetts Institute of Technology and Harvard University, way back in May.

How does Feluda Covid-19 test work?

Just like Feluda had the ability to solve crimes quickly, the test would detect the presence of the novel coronavirus in just minutes, the researchers said.

The Feluda test is similar to a pregnancy test strip that will just change colour upon detection of the virus and can be used in a simple pathological lab. According to Dr Debojyoti Chakraborty, the Cas9 protein is barcoded to interact with the SARS-CoV2 sequence in the patient's genetic material. The Cas9-SARS-CoV2 complex is then put on the paper strip, where using two lines (one control, one test) makes it possible to determine if the test sample was infected with Covid-19.

What is the cost of Feluda test? How does it compare with other tests?

The 'Feluda' test costs just about Rs 500 while the RT-PCR test now costs anywhere between Rs 1,600 to Rs 2,000. Antibody tests, which can give results in 20-30 minutes, costs between Rs 500 and Rs 600. Meanwhile, a rapid antigen test kit, which interprets a positive or negative test in 30 minutes, costs Rs 450. TruNat test provides results within 60 minutes and a kit comes for about Rs 1,300.

In March, only RT-PCR testing centres were available. Later, cartridge-based tests were approved by ICMR like TrueNat, CBNAAT, Abbott and Roche. In the month of June, rapid antigen kits were approved for testing.

<https://indianexpress.com/article/explained/feluda-coronavirus-covid-19-test-tata-sons-crispr-technology-6603573/>



Tue, 22 Sept 2020

Covid-19 vaccine with 50% effectiveness: Astrazeneca releases 111-page blueprint

Edited By Aparna Banerjee

- ***If the vaccine is found 50% effective, Astrazeneca may be able to stop the trial early and apply for authorization from the government to release it for emergency use***

Pharma major Astrazeneca released a 111-page trial blueprint of its Phase III Covid-19 vaccine trials, which are currently ongoing in various parts of the world.

The development comes under the backdrop of scrutiny and questions raised to the vaccine producer about its Covid-19 vaccine trials since two participants in the UK reported illness earlier this month.

AstraZeneca's 111-page trial blueprint, known as a protocol, states that its goal is a vaccine with 50 percent effectiveness — the same threshold that the US Food and Drug Administration has set in its guidance for coronavirus vaccines.

To determine with statistical confidence whether the company has met that target, there will have to be 150 people ill with confirmed coronavirus among participants who were vaccinated or received placebo shots.

A safety board will perform an early analysis after there have been just 75 cases.

If the vaccine is found 50% effective, it might be possible for the company to stop the trial early and apply for authorization from the government to release the vaccine for emergency use.

The British-Swedish company is not the only pharma giant to release its blueprint to public in midst of research to develop a potential Covid-19 vaccine candidate as the virus surges across the world.

US biotech firm Moderna, one of nine companies in the late stages of clinical trials for a Covid-19 vaccine, became the first to publish the complete blueprints of its study following calls for greater transparency.

Pfizer, the other American company currently carrying out Phase 3 trials in the US, followed suit a short time later and there is now added pressure for the remainder to do the same.

Oxford-Astrazeneca vaccine controversy:

On 8 September, AstraZeneca, which has co-developed a vaccine with the University of Oxford suspended its global trials briefly after two participants reported illness, but were later restarted in the UK, Brazil, and South Africa. However, the United States has not yet permitted the resumption of Oxford vaccine trial.

According to a New York Times report, the company has released few details about the two cases of serious illness in its trial. The first participant received one dose of the vaccine before developing inflammation of the spinal cord, known as transverse myelitis, according to a participant information sheet for AstraZeneca's vaccine from July. The condition can cause weakness in the arms and legs, paralysis, pain and bowel and bladder problems.

About 18,000 people worldwide have received AstraZeneca's vaccine so far.

Last phase of clinical trial of Oxford Covid-19 vaccine begins in India:

The phase-III or the last stage of clinical trial of the Covid-19 vaccine 'Covishield', being developed by Oxford University, and manufactured by the Serum Institute of India (SII), began today at the state-run Sassoon General Hospital in Pune, Maharashtra on Monday, a senior official said.

"We have started the phase-III trials of the vaccine candidate. We will administer dose to 150 to 200 volunteers," said Dr Muralidhar Tambe, Dean, Sassoon General Hospital, reported PTI.

With inputs from agencies

<https://www.livemint.com/news/world/covid-19-vaccine-with-50-effectiveness-astrazeneca-releases-111-page-blueprint-11600696827114.html>

