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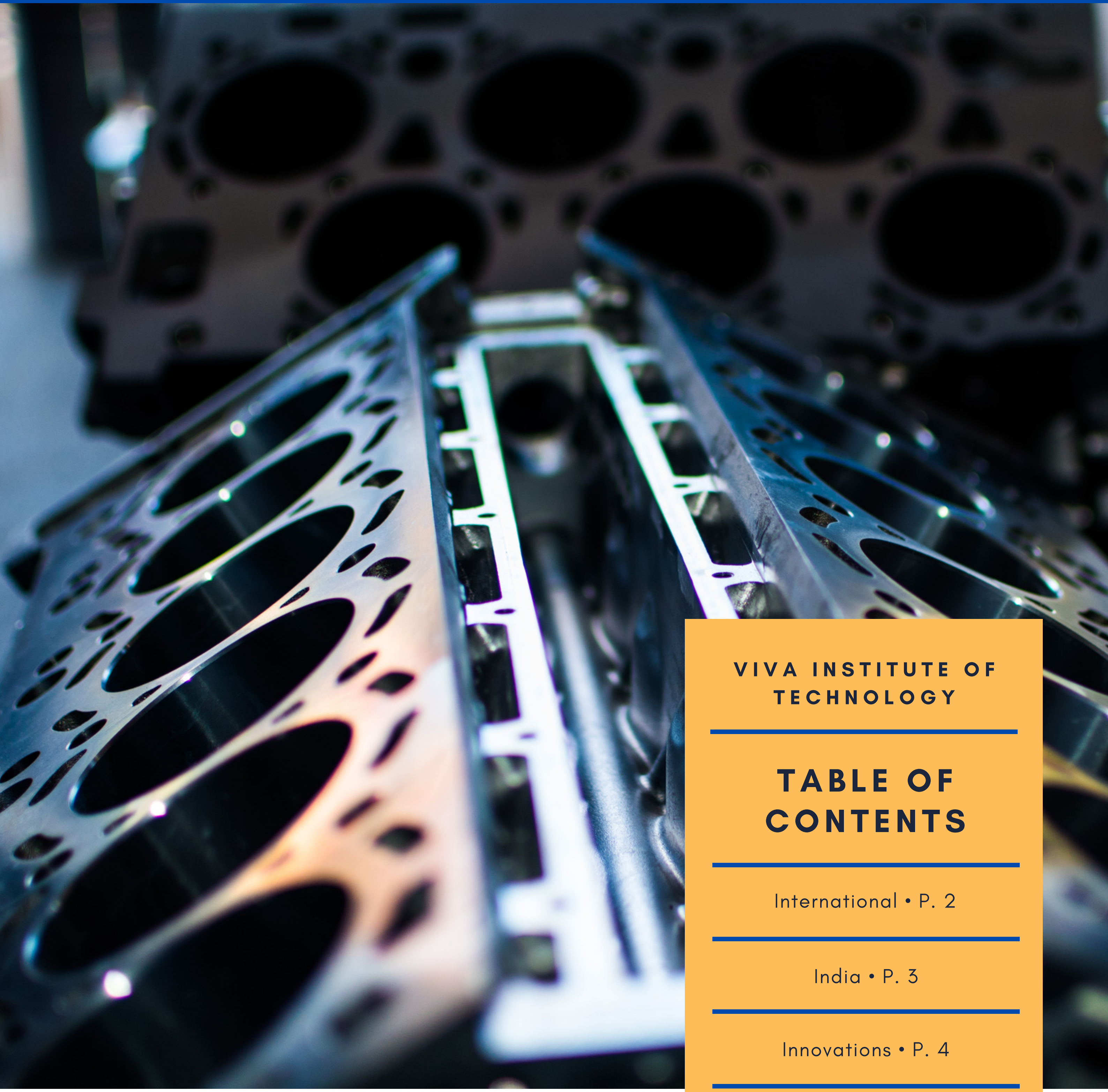

VIVA INSTITUTE OF TECHNOLOGY

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KNOWLEDGE ABOVE ALL

SUPERHYDROPHOBIC SPIDERS AND ANTS

BY SHREEYESH S.

In nature, plenty of creatures—like spiders and fire ants—can float or skim on the surface of water for long periods of time, which inspired the researchers. But just how do they do it?
The answer: They trap air bubbles. *Argyroneta aquatic* spiders, for instance, can create an underwater web, shaped like a dome, by filling it with air with their superhydrophobic legs and abdomens. Fire ants, for their part, create a sort of "raft" by trapping air with their superhydrophobic bodies. Here's where we need to go back to high school biology class for a moment. There's a good chance you sort of remember the terms "hydrophobic" and "hydrophilic" if your teacher broke down the Latin roots of each word: "phobic," meaning fear, and "philic," meaning to show love or fondness. That's how you were supposed to remember if a material got along with water, how the teacher explained why oil and water don't mix; hydrophobic surfaces have a barrier-like property that causes them to repel water.

Looking at the basic structures of a cell, one of the first things we're taught is that each and every one contains a lipid bilayer to help keep the contents of the cell inside like a perfect little bubble. Lipid bilayers made up of two sheets of fat cells, form the cell membrane. It's about five nanometers thick and insoluble in water, just like oil.
"Bilayer" indicates there are two layers, of course, as pictured above. Each layer contains fatty lipids with two significant regions: the hydrophobic tail, which resists water, and the hydrophilic head, which plays nice with water. Since the heads of the lipids point toward the outside of the cell on one layer and inside of the cell in the second, all of the tails are hidden inside the bilayer, making the whole structure impermeable to just about everything but water and gases without the help of other structures.
The material that Guo's lab produced is a superhydrophobic metal, which basically means it does an incredible job of repelling water, making it possible to float. That's why the researchers believe this metal has a future in shipbuilding.
In their paper, Guo and his
coauthors note that "multifaceted superhydrophobic (SH) surfaces can trap a large air volume, which points towards the possibility of using SH surfaces to create buoyant devices."

SURE, IMPOSSIBLE BURGERS ARE COOL. BUT HAVE YOU TRIED EDIBLE MUSCLES?

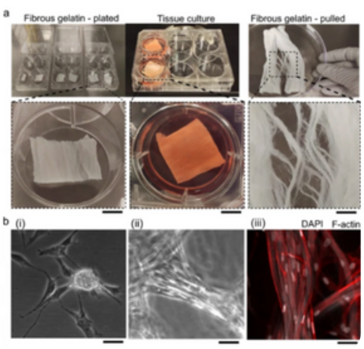
ANURAG PULIKOTIL
STUDENT

Bioengineered meat is fast becoming this era's "It" food, with the Impossible and Beyond burgers battling it out for lab-grown supremacy. And now another contender enters the ring: bioengineered, uh, edible muscles? If the thought of chewing some delicious sinewy muscles grosses you out, keep in mind most of the meat you already eat is, well, animal muscle. Researchers from Harvard University's John A. Paulson School of Engineering and Applied Sciences (SEAS) department describe their work on such meat analogues in a new paper published Monday in the scientific journal NPJ Science of Food. The team used smooth muscle cells from bovine aortas and skeletal muscle myoblasts from rabbits to create the lab-grown muscle. Myoblasts are the embryonic cells that eventually grow into myocytes or muscle cells. Scientists cultured both forms of muscle cells in "gelatin fibre scaffolds," according to the paper.

They used immunohistochemical straining, meaning the antigens in cells of the tissue are selectively identified. The scientists used this process to verify that both the rabbit and bovine cell types were attached to gelatin fibres. Through histology (the study of microscopic tissue), scanning electron microscopy, and mechanical testing, the researchers illustrated that cultured muscle did lack the "mature contractile architecture," seen in natural muscle tissue, but proved the engineered muscle had some of the same structural and mechanical features as regular meat products. In other words, the lab-produced meat had a similar texture and consistency to natural meat. Kit Parker, the lead author of the study and the Tarr Family Professor of Bioengineering and Applied Physics at SEAS, said he first became interested in food after judging a competition show called Runaway Chocolate on Food Network.

“The materials-science expertise of the chefs was impressive,” Parker said in a press statement. “After discussions with them, I began to wonder if we could apply all that we knew about regenerative medicine to the design of synthetic foods. After all, everything we have learned about building organs and tissues for regenerative medicine applies to food: healthy cells and healthy scaffolds are the building substrates, the design rules are the same, and the goals are the same: human health."

"This is our first effort to bring hardcore engineering design and scalable manufacturing to the creation of food," Parker continued.
One of the most difficult parts of mimicking real animal meat is achieving a look and texture that resembles the long, thin fibres you'd see in cutting with the grain on a piece of steak, for instance.



CHINA PLANS TO BUILD A PARTICLE COLLIDER FIVE TIMES MORE POWERFUL THAN THE LHC

MANDAR PITALE
STUDENT

For about a decade, the biggest machine on the planet has been the Large Hadron Collider, situated on the border between Switzerland and France. The main body of the collider is a giant ring over 5 miles in diameter and the entire facility employs thousands of people. But according to a new announcement from China's Institute of High Energy Physics, it might not be the world's largest machine for long.

The Chinese institute announced plans to build its own particle accelerator over the next decade, and it's designed to surpass the LHC in every way. According to the report authored by the institute, the upcoming collider will be over five times more powerful and over 20 miles in diameter.

The proposed collider is called the Circular Electron Positron Collider and was first proposed back in 2012. At the time, the specs for the collider were vague. Proposals ranged significantly in terms of size and power, so it wasn't clear exactly how big or how much science would be done with it. That all changes with this latest announcement, which is accompanied by a 500-page detailed proposal for every last inch of the collider. Here's how the plan is going to unfold: First, the CEPC will be built with its 20-mile diameter ring. If construction goes according to plan—which it very well may not, considering the scale of the endeavor—the collider should be finished by 2030. The CEPC will then go into full operation, where it will begin producing exotic particles like the Higgs boson. According to the plan, the CEPC should be able to make a million Higgs particles over a decade, along with millions of other rare particles like W and Z bosons.

Currently, only handfuls of these particles are produced in the Large Hadron Collider, and their rarity makes them difficult study subjects. If scientists could drown themselves in these particles—metaphorically speaking, of course—they could learn so much more about them. These particles might also be key to unlocking new physics, such as discovering the identity of dark matter.

After ten years of making bosons, the CEPC will be retired. But in its place, scientists will build another collider, called the Super Proton Proton Collider, that will work exactly like a bigger, more powerful version of the LHC. This new collider will take advantage of the infrastructure already built for the CEPC and the advanced technologies that will likely exist by 2040.

BIG OIL ON CLIMATE CHANGE

ROHAN THAKUR
STUDENT

Burning fossil fuels is by far the leading cause of climate change, and investigations have shown that most fossil fuel companies were aware of and deliberately misled the public on the dangers of fossil fuels. And according to a study from U.K. think tank CDP, virtually none of the world's major oil companies are dedicating any of their profits toward solving the problem. Overall, the study found that the world's large oil companies spent only about 1.3 per cent of their 2018 budgets on renewable energy investments.

CDP, formerly known as the Carbon Disclosure Project, has spent decades tracking how much various companies contribute to climate change and how much they spend trying to fix it. For this study, CDP examined two dozen oil companies from Europe, China, and the U.S., along with two companies from Brazil and Australia. According to the data, European companies are the best at actually spending money to address climate change.

The top five oil companies in the CDP analysis are all from various countries in Europe, and European companies have bought about 70 per cent of the entire global oil industry's renewable capacity. Among these European pack leaders are Norway's Equinor, France's Total, and Shell. All of these companies have plans to spend billions of dollars on clean energy over the next decade. While this action is far from enough to really halt or reverse the effects of climate change, it's a step in the right direction.

The other end of the list, however, is made almost entirely of companies from China and the United States. These companies—such as ExxonMobil and China's Petrochina and Sinopec—have contributed more than almost anyone else to climate change, and are doing less than almost any other fossil fuel corporation to fight it.
"With less domestic pressure to diversify, US companies have not embraced renewables in the same way as their European peers," reads the CDP report. Meanwhile, time is running out to invest in solutions.