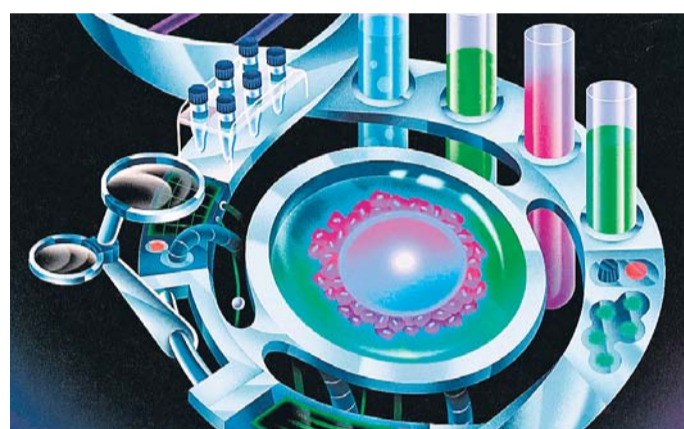


#INNOVATION

Lab-Made Ovaries

This new data allows us to start building our understanding of what makes a good egg, what determines which follicle is going to grow, ovulate, be fertilized, and become a baby.



A new 'atlas' of the *human ovary* provides insights that could lead to treatments restoring ovarian hormone production and the ability to have biologically related children, engineers report.

This deeper understanding of the ovary means researchers could potentially create 'artificial ovaries' in the lab, using tissues that were stored and frozen before exposure to toxic medical treatments such as chemotherapy and radiation. "Currently, surgeons can implant previously frozen ovarian tissue to temporarily restore hormone and egg production. However, this does not work for long because few follicles, the structures that produce hormones and carry eggs, survive through the treatments," the researchers say.

The new atlas reveals the factors that enable a follicle to mature, as most follicles wither away without releasing hormones or an egg. Using new tools that can identify what genes are being expressed at a single-cell level within a tissue, the team was able to home in on ovarian follicles that carry the immature precursors of eggs, known as 'oocytes'.

"Now that we know which genes are expressed in the oocytes, we can test whether affecting these genes could result in creating a functional follicle. This can be used to create an artificial ovary that could eventually be transplanted back into the body," says Ariella Shikanov, associate professor of Biomedical Engineering at the University of Michigan and corresponding author of the new study in *Science Advances*.

The majority of the follicles, called *primordial follicles*, remain dormant and are located in the outer layer of the ovary, called the cortex. A small portion of these follicles activate periodically and migrate into the ovary, a region known as the growing

pool. Only a few of those growing follicles go on to produce mature eggs that get released into the fallopian tube.

With the ability to guide follicle development and tune ovarian environment, the team believes that engineered ovarian tissue could function for much longer than unmodified implanted tissue. This means that patients would have a longer fertility window as well as a longer period, in which their bodies produce hormones, that help regulate the menstrual cycle and support muscular, skeletal, sexual, and cardiovascular health.

"We're not talking about utilizing a surrogate mother, or artificial insemination," says Jun Z. Li, associate chair of the Computational Medicine and Bioinformatics and co-corresponding author of the study. "The magic that we're working towards, is being able to trigger an immature cell into maturity, but without knowing which molecules drive that process, we're blind."

The researchers used a relatively new technology, called *spatial transcriptomics*, to track all of the gene activity, and where it occurs in tissue samples. They do this by reading strands of RNA, which are like notes taken from the DNA strand, revealing which genes are being read. Working with an organ procurement organization, the researchers performed RNA sequencing of ovaries from five human donors.

"This was the first time where we could target ovarian follicles and oocytes and perform a transcription analysis, which enables us to see which genes are active," Shikanov says. "The majority of ovarian follicles, already present at birth, never enter the growing pool and eventually self-destruct. This new data allows us to start building our understanding of what makes a good egg, what determines which follicle is going to grow, ovulate, be fertilized, and become a baby."



Do We Care for the Elderly?



There are two occasions where the behaviour of untrained caregivers have left an indelible scar on me. My father, in his later years, became a hollow shadow of the great person he was. He could barely mumble a few words and was totally unable to care for himself. So, a caregiver was employed.

The man was basically a person looking for a job, and finding none, accepted this task. He looked supportive and was aiding my father well. One day, I noticed that there were red spots on the arm. They looked like insect bites. I got the room fumigated and applied anti-mosquito cream. Even then, the spots kept coming up. It was later that an observant aunt told me that the help was pinching my father in his idle moments. I confronted him and dismissed him. So much for empathy!



Dr. Goutam Sen
CTVS Surgeon
Traveller
Storyteller

As old age creeps up, finding companionship and conversation become limited for most senior citizens. There are rare people who still retain their mental abilities but find themselves limited due to physical impediments.

Gathering of such people are usually a venue, where the discussion of day-to-day issues take a priority. It is a doleful litany of the shortcomings in life, along with the glorious days of the past. It commonly begins with a complaint of lack of attention by family and also in the same measure or even more, with caretakers employed for their physical needs.

The number of senior citizens will rise from a 100 million in 2011 to double the number by 2036. It is projected to rise, to be of one-fifth of our total population by 2050. On the other hand, the families are getting smaller from an average of 6 members to 4.5 members. The whole generation is getting older. The family is suddenly 'burdened' with the responsibility of care of an older generation, both physically and socially at home, and often, the distinction between the two is difficult to detect. The need for external care is rising rapidly. The 'care at home' is no more just

making sure that the older generation is basically comfortable. It is gradually reshaping itself into specialised nursing/ medical care as well. It is interesting that adequate home care, according to Niti Aayog, can lower the number of hospital visits by twenty percent and reduce the cost of care by half.

The kind of care, given to the senior citizens, depends wholly on caregivers available in India. Most of them are basically domestic help, who have no experience or training in nursing care. They have learnt by observing and often do not have the desire or empathy for the task. It is forced upon them for economic reasons without any other option while nursing care still remains a mission to a degree!

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Caregivers, who are well-trained and possess a proper loving outlook, are in short supply. They are either not exposed to the possibilities of this career or find it stressful, both for physical and mental reasons, since caring can mean a 24x7 job. It is rare where shift jobs are available. Most senior citizens and their families find it a costly proposition. Further, the caregivers often complain of being mistreated by families. While they should be limited to the care of the senior, they are tasked to perform domestic chores, which are outside the scope. This is because for the family, it seems that there are many idle moments, when the senior citizen is resting. They are treated as menials. There is, at present, no system of redressal for this shortcoming. Currently, it is the private for-profit sector that offers the bulk of these services. Market estimates project the home-based care industry to grow at a rate of 15-19 per cent annually, provided that the scope of work becomes clearly defined. There is a need for a degree of respect to be given to these personnel. The ability for understanding and dealing with the growing demand for trained caregivers is essential. This constitutes a desirable move towards streamlining their vocational training, nomenclature, roles, and career progression. Finally, all this ought to be brought together under a comprehensive policy on 'home-based care'. An administrative body like *Caregivers Council* (Similar to Medical and Nursing



#MIS-CARED

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My mother, too, was an invalid and bedridden due to advanced Rheumatoid Arthritis. She could barely move in her last days. She had to be attended day and night for simple tasks like being given a drink of water or a urinal and even turning sides in bed. It was the nights which were difficult. My wife and I would get up and do the needful when called. This was, however, taking a toll on our sleep and well-being. Finally, a lady was employed for the night shift. She would come punctually and change into a comfortable housecoat. She had a mattress bed next to my mother's cot. She settled quickly, read the newspaper and soon went off to sleep. After that nothing would wake her up! We were getting up the same number of times as before. When I remonstrated and asked the caregiver to be a bit wakeful, she said, "What can I do if she calls so feebly?" (We could hear mother in the next

The government has, under its consideration, *The Maintenance and Welfare of Parents and Senior Citizens (Amendment) Bill, 2019*, which seeks to regulate home-based care for older people. This humanitarian bill, unfortunately, has a low priority and remains stalled at the committee level.

The terms of engagement and treatment protocols must be tailored to the home environment. Unfortunately, the bill has to go through many other ministries, before it can become effective. The Ministry of Health and Family Welfare (MOHFW), Ministry of Social Justice and Empowerment (MSJE) and Ministry of Skill Development and Entrepreneurship (MSDE) also have a pivotal role to play in the matter.

The insurance Regulatory and Development Authority of India (IRDAI) already recognises 'hospitalisation at home' in certain conditions. In its present shape, it is a sham! This has given the insurance companies a chance to change their offers and fill their own coffers. Except for the fact that the elderly have now got an opportunity to have an insurance, nothing has been gained. The policies are so designed that the initial Rs. 50,000/- has to be shelved out before any payout begins. Further, there is a minimum payment block of 2-3 years for previous diseases like cancer and heart conditions. Even rooms are decided on the value of

the insured amount. Many investigations like MRI are out of the list. In fact, except for major surgery, there is little to be gained by such insurance. The premium saved may help in the long run.

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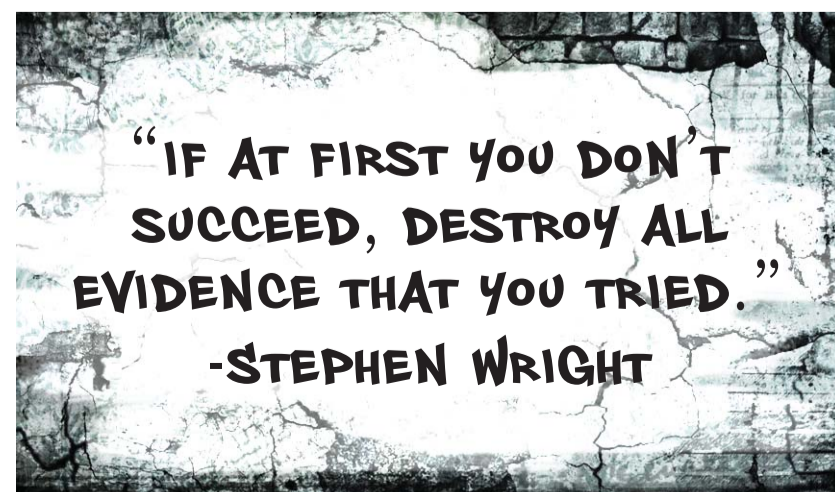


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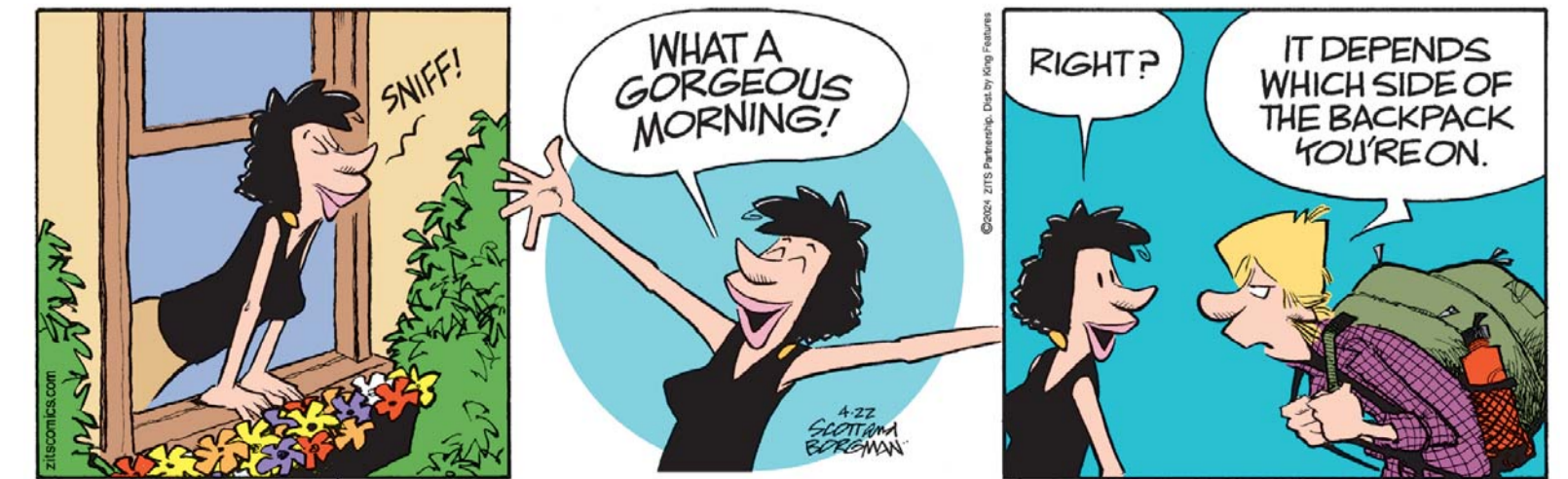
By Rick Kirkman & Jerry Scott

BABY BLUES

THE WALL



ZITS



By Jerry Scott & Jim Borgman

#SPACE

How The Moon Got A Makeover

The Moon's former surface sank to the depths, until volcanism brought it back.

Our Moon may appear to shine peacefully in the night sky, but billions of years ago, it was given a facial by volcanic turmoil. One question that has gone unanswered for decades is why there are more titanium-rich volcanic rocks, such as ilmenite, on the near side as opposed to the far side. Now, a team of researchers at Arizona Lunar and Planetary Laboratory are proposing a possible explanation for that.

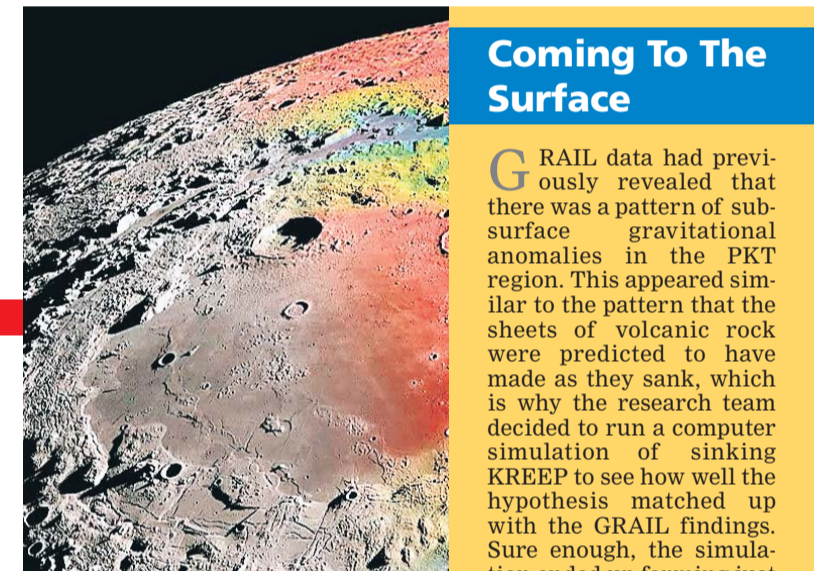
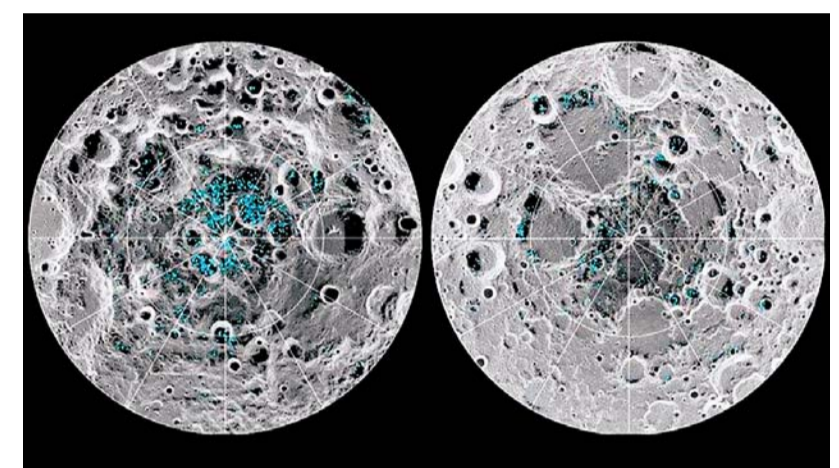
The lunar surface was once flooded by a bubbling magma ocean, and after the magma ocean had hardened, there was an enormous impact on the far side. Heat from this impact spread to the near side and made the crust unstable, causing sheets of heavier and denser minerals on the surface to gradually sink deep into the mantle. These melted again and were belched out by volcanoes. Lava from these eruptions (more of which happened on the near side) ended up in what are now titanium-rich flows of volcanic rock. In other words, the Moon's old face vanished, only to resurface.

What Lies Beneath

The region of the Moon, in question, is known as the *Procellarum KREEP Terrane* (PKT). KREEP signifies high concentrations of potassium (K), rare earth elements (REE), and phosphorus (P). This is also where ilmenite-rich basalts are found. Both KREEP and the basalts are thought to have first formed when the Moon was cooling from its magma ocean phase. But the region stayed hot, as KREEP also contains high levels of radioactive uranium and thorium.

"The PKT region represents the most volcanically active region on the Moon as a natural result of the high abundances of heat-producing elements," the researchers said in a study.

Why is this region located on the near side, while the far side is lacking in KREEP and ilmenite-rich basalts? There was one existing hypothesis that caught the researchers' attention. It proposed that after the magma ocean hardened on the near side, sheets of these KREEP minerals were too heavy to stay on the surface. They began to sink into the mantle and down to the border between the



Coming To The Surface

GRAIL data had previously revealed that there was a pattern of subsurface gravitational anomalies in the PKT region. This appeared similar to the pattern that the sheets of volcanic rock were predicted to have made as they sank, which is why the research team decided to run a computer simulation of sinking KREEP to see how well the hypothesis matched up with the GRAIL findings. Sure enough, the simulation ended up forming just about the same pattern as the anomalies that GRAIL found. The polygonal pattern, seen in both the simulations and GRAIL data, most likely means that traces of heavier KREEP and ilmenite-rich basalts were left behind beneath the surface as those layers sank due to their density, and GRAIL detected their residue due to their greater gravitational pull. GRAIL also suggested there were many lesser anomalies in the PKT region, which makes sense considering that a large part of the crust is made of volcanic rocks, thought to have sunk and left behind residue, before they melted and surfaced again through eruptions.

We, now, also have an idea of when this phenomenon occurred. Because there are impact basins that dated to around 4.25 billion years ago (not to be confused with the earlier far-side impact), but the magma ocean is thought to have hardened before that, the researchers think that the crust also began to sink before that time. This is just one more bit of information regarding how the Moon evolved and why it is so uneven.

