Param

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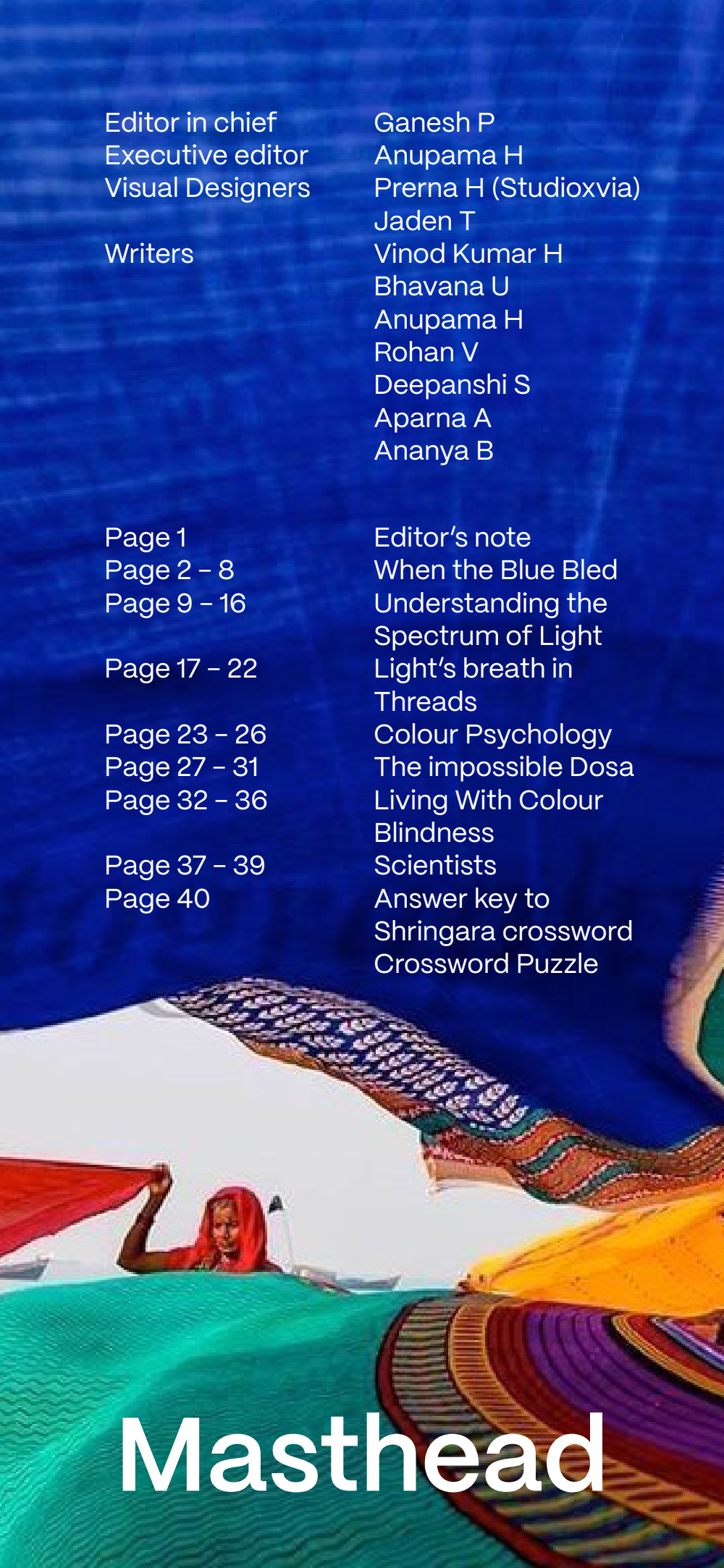
Science Magazine

Founded 1909 The Mythic Society

Param Foundation



Masthead

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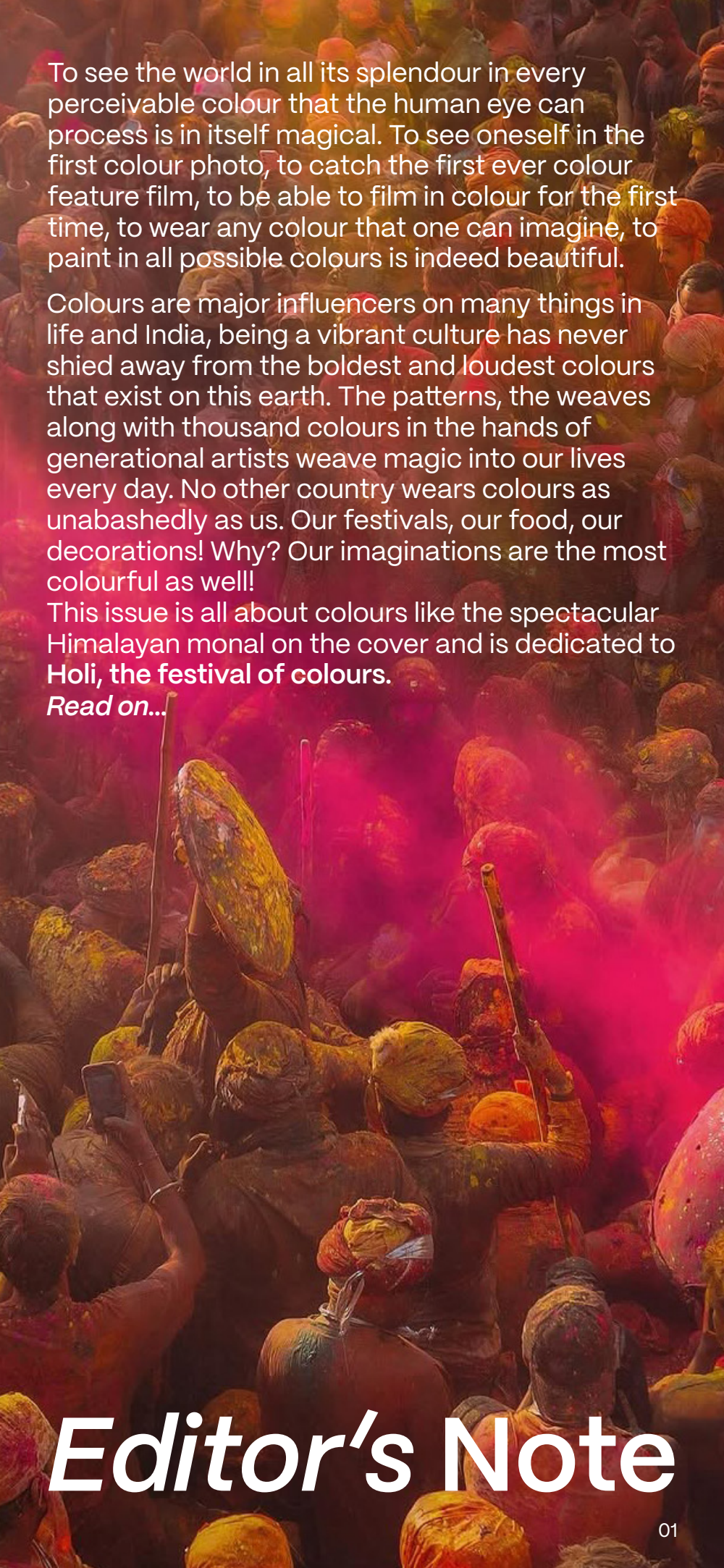


To see the world in all its splendour in every perceivable colour that the human eye can process is in itself magical. To see oneself in the first colour photo, to catch the first ever colour feature film, to be able to film in colour for the first time, to wear any colour that one can imagine, to paint in all possible colours is indeed beautiful.

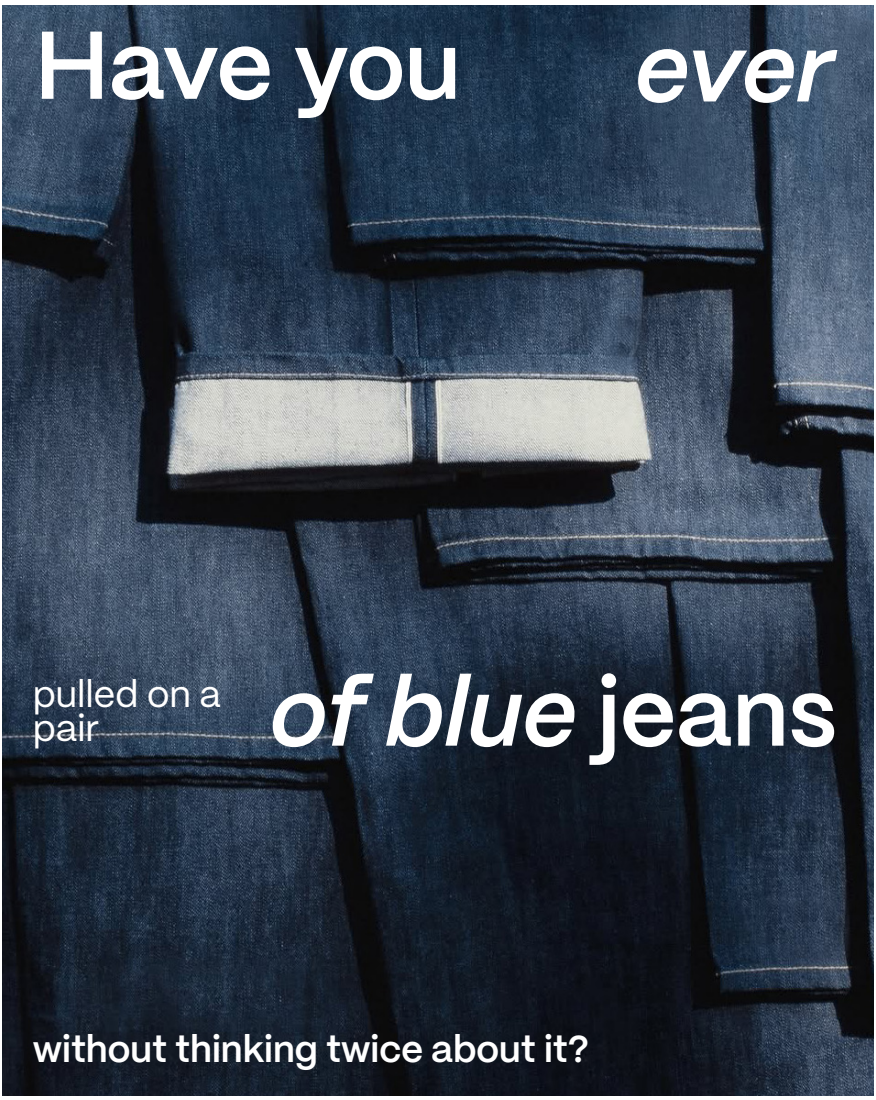
Colours are major influencers on many things in life and India, being a vibrant culture has never shied away from the boldest and loudest colours that exist on this earth. The patterns, the weaves along with thousand colours in the hands of generational artists weave magic into our lives every day. No other country wears colours as unabashedly as us. Our festivals, our food, our decorations! Why? Our imaginations are the most colourful as well!
This issue is all about colours like the spectacular Himalayan monal on the cover and is dedicated to **Holi, the festival of colours.**
Read on...

Editor's Note

When the blue *bled.*

By Deepanshi Sharma

Two hundred years ago, that same shade of blue was greatly admired across Europe. It coloured dresses, coats and uniforms. The deeper the blue, the more valuable the cloth. But this beautiful colour was not manufactured in machines. It came from a plant called **indigo**.



Indigo leaves were crushed and processed to produce a rich, long-lasting dye. It was so precious, people called it "Blue Gold". Under the East India Company and later British rule, indigo became one of the most profitable trade commodities. Ship after ship carried the dye to England, where it was turned into fashionable fabric. To the buyers in Europe, ***it was just colour.***

To the Indian farmers, it was something else.

Picture a farmer standing in his field, looking at the soil that once grew rice for his family, now draining only **blue.**

In Bengal, the land was fertile and the climate warm which was perfect for indigo. British planters saw only profit in every inch of land. They pressured Indian farmers to grow indigo instead of food crops. Loans were offered, contracts were drawn, and once signed, it was impossible to refuse.

Indigo crops killed the soil. After just one harvest, the land lost its fertility. Yet the farmers were paid very little. The money barely covered their debts. Many families slipped deeper into poverty.

The blue dye that travelled to England carried with it something *darker*.

As one British official later admitted:

Not a chest of indigo reached England without being stained with

human blood.

This blue bled blood, sweat and tears.

The day the farmers *said no.*

But how long could the farmers take it?

In 1859, something changed. Farmers across Bengal began to refuse. They refused to sow indigo seeds. They refused to accept advances. They refused to let their fields be turned blue again. This resistance came to be known as **the Indigo Rebellion.**

It did not begin with weapons. It began with courage. Villagers stood together. If one farmer refused, others supported him. News spread from village to village. Newspapers reported the injustice. People in towns began to listen.

A writer, Dinabanhu Mitra wrote a play called Nil Darpan, meaning "The Indigo Mirror". It shed light on the grave suffering of the farmers and forced society to face the truth.

The protests grew so strong that the British government could no longer ignore them. In 1860, they set up the Indigo Commission to investigate and the Commission admitted that farmers had been treated unfairly.

Slowly, the forced cultivation of Indigo declined. Later, when synthetic dyes were invented in Europe, natural indigo lost its allure.
But the story did not fade.

And blue became a symbol.

The Indigo Rebellion became one of the earliest organised protests against British rule. It proved that even poor farmers, when united, could *challenge injustice*.

Today, blue makes us think of the sky, the sea, calm and peace. Yet in nineteenth-century India, blue also meant struggle and bravery.

Sometimes, a colour is not just a colour.

It could be a testament of courage and hope.

Understanding the *light spectrum*.

Through postage stamps.

The visible light spectrum is one of the most familiar yet fascinating aspects of physics—it surrounds us in the form of colors we see every day. From rainbows in the sky to the glow of a lamp, visible light shapes our perception of the world.

Interestingly, this scientific phenomenon has also been celebrated culturally and historically through postage stamps.

By exploring postage stamps from different countries, we can trace the scientific understanding, historical evolution, and everyday manifestations of visible light in a visually engaging way.

Germany
(Deutsche Bundespost):
Visible light spectrum

Germany
(Deutschland):
Fraunhofer Patterns

Finland:
Astronomy & Optics

Postage stamps are more than tools for communication; they are historical records, artistic expressions, and silent educators. Through stamps depicting prisms, spectra, scientists, and natural phenomena,

the story of visible light unfolds across cultures and generations.

By combining physics with philately, the visible light spectrum becomes not just a scientific topic, but a narrative—one that connects discovery, history, nature, and art. These small pieces of paper carry big ideas, making science accessible, memorable, and visually compelling. Visible light is a small but crucial portion of the electromagnetic spectrum—the only range of wavelengths that the human eye can detect. While electromagnetic radiation includes radio waves, microwaves, infrared radiation, ultraviolet rays, X-rays, and gamma rays, visible light occupies a narrow window between infrared and ultraviolet radiation.

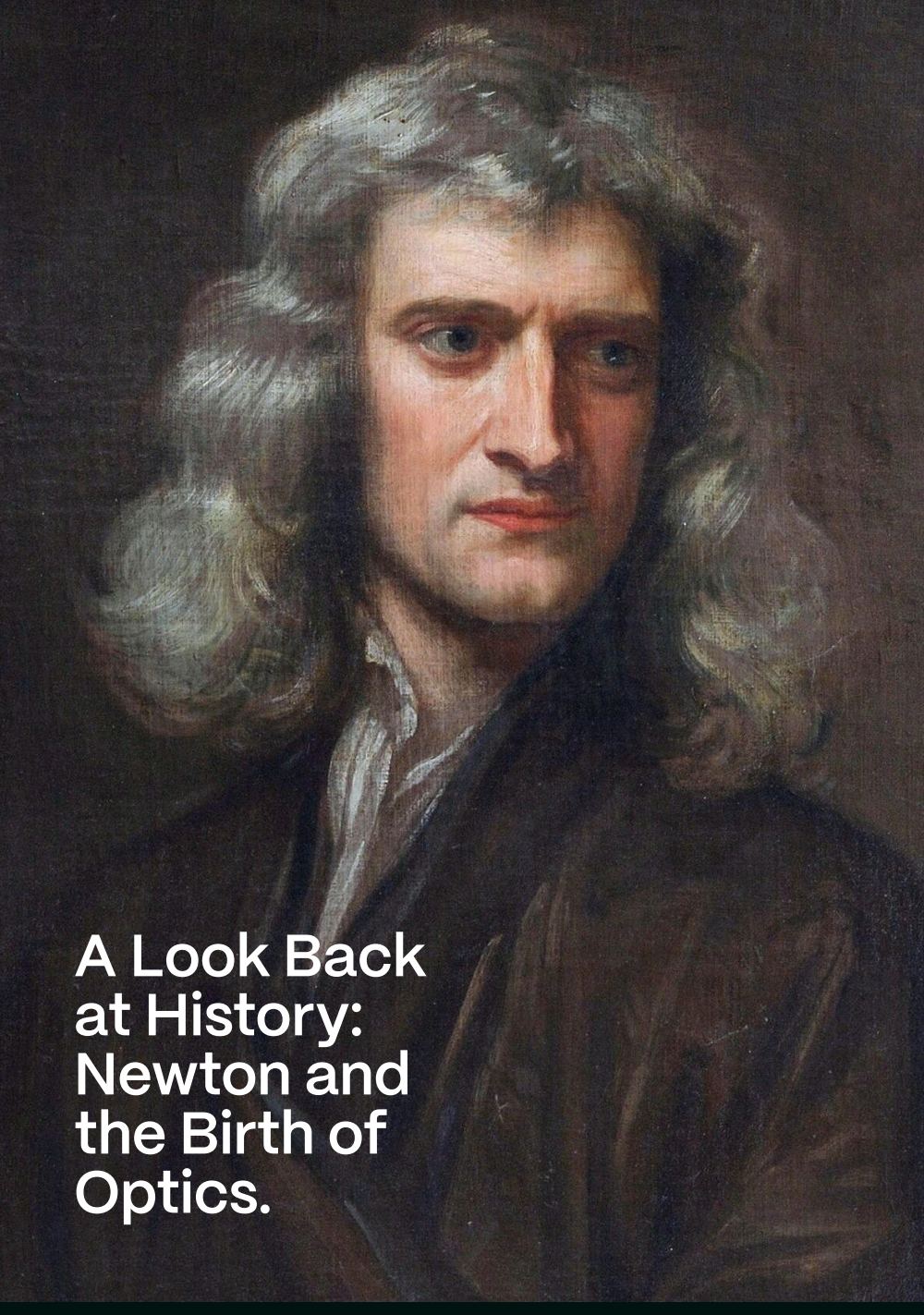
When white light passes through a prism, it disperses into a sequence of colors due to wavelength-dependent refraction. This ordered set of colors is known as the visible light spectrum and is commonly remembered using the acronym VIBGYOR:

violet
indigo
blue
green
yellow
orange
red

Taiwan:
Rainbow

Netherland:
Prism dispersion

Each color corresponds to a specific wavelength, with violet having the shortest wavelength and red the longest. Postage stamps depicting prisms, rainbows, and spectral diagrams visually reinforce this fundamental concept of optics.



A Look Back at History: Newton and the Birth of Optics.

The scientific understanding of the visible spectrum was profoundly shaped by Sir Isaac Newton. In his seminal work Opticks, Newton documented experiments in which he passed sunlight through a glass prism, demonstrating that white light is not pure but composed of multiple colors.

Newton's identification of the seven constituent colors of visible light laid the foundation for modern optics. This historic achievement has been commemorated on postage stamps across the world, featuring Newton, prisms, spectral diagrams, and optical instruments. These stamps not only honor a great scientist but also serve as miniature educational tools that preserve the legacy of scientific discovery.

Uganda:
Early Optics Experiment

Great Britain:
Discovery of Refractive Optics

The Royal Society featuring Optics

Germany:
Optics & Spectrum

Israel
Child & Rainbow

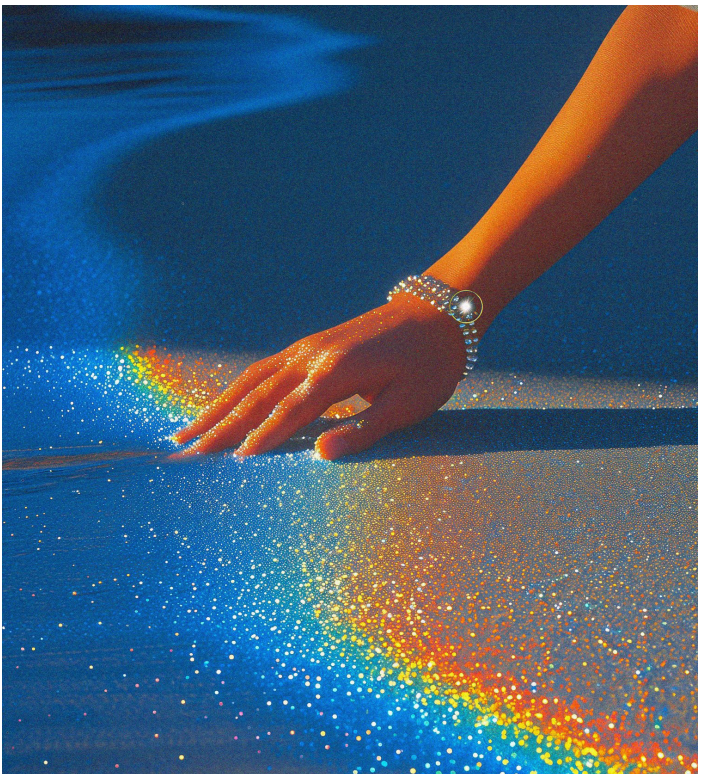
USA:
Forever stamp featuring rainbow landscape

United Nations:
Rainbow & peace

The spectrum we see in *everyday life*

Among all electromagnetic waves, visible light holds a unique place – it is the spectrum we experience directly.

One of the most striking natural demonstrations of visible light is the rainbow. Formed by the reflection, refraction, and dispersion of sunlight within water droplets, a rainbow displays the full visible spectrum across the sky. Many postage stamps capture this universal symbol of beauty and science, showing rainbows in natural landscapes, cultural motifs, and messages of peace and unity. Such representations bridge scientific explanation with human emotion, reminding us that physics is deeply intertwined with everyday experience.



The visible light spectrum is a cornerstone of our understanding of the physical world,

and postage stamps offer a unique lens through which to explore it. From Newton's groundbreaking experiments to the simple wonder of a rainbow, stamps capture the essence of light in both scientific and human terms. In doing so, they remind us that science is not confined to laboratories and textbooks – it is embedded in culture, history, and the colors we see every day.

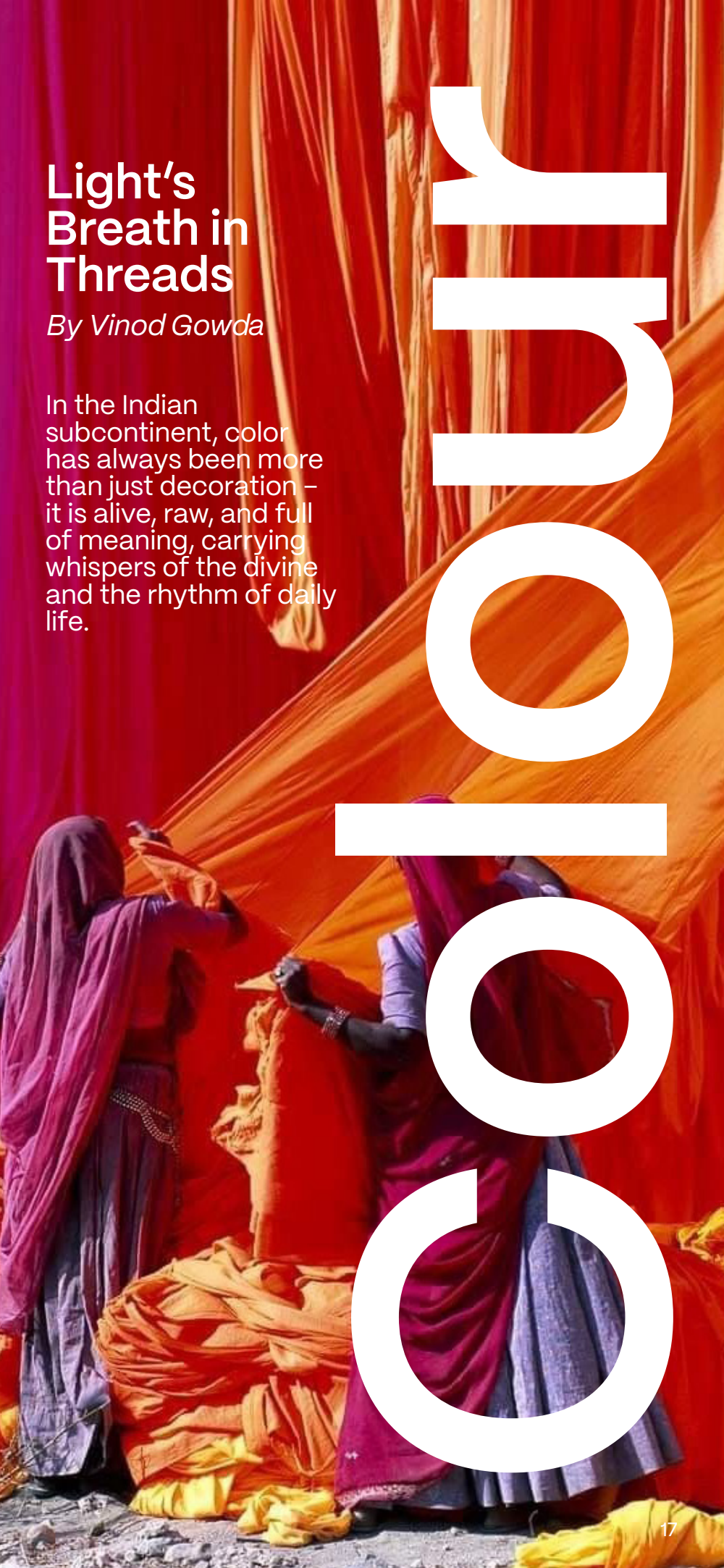
By Miss. Ananya Bhattacharjee,
Faculty, Department of ECE, Kumaraguru College of Technology.

Color

Light's Breath in Threads

By Vinod Gowda

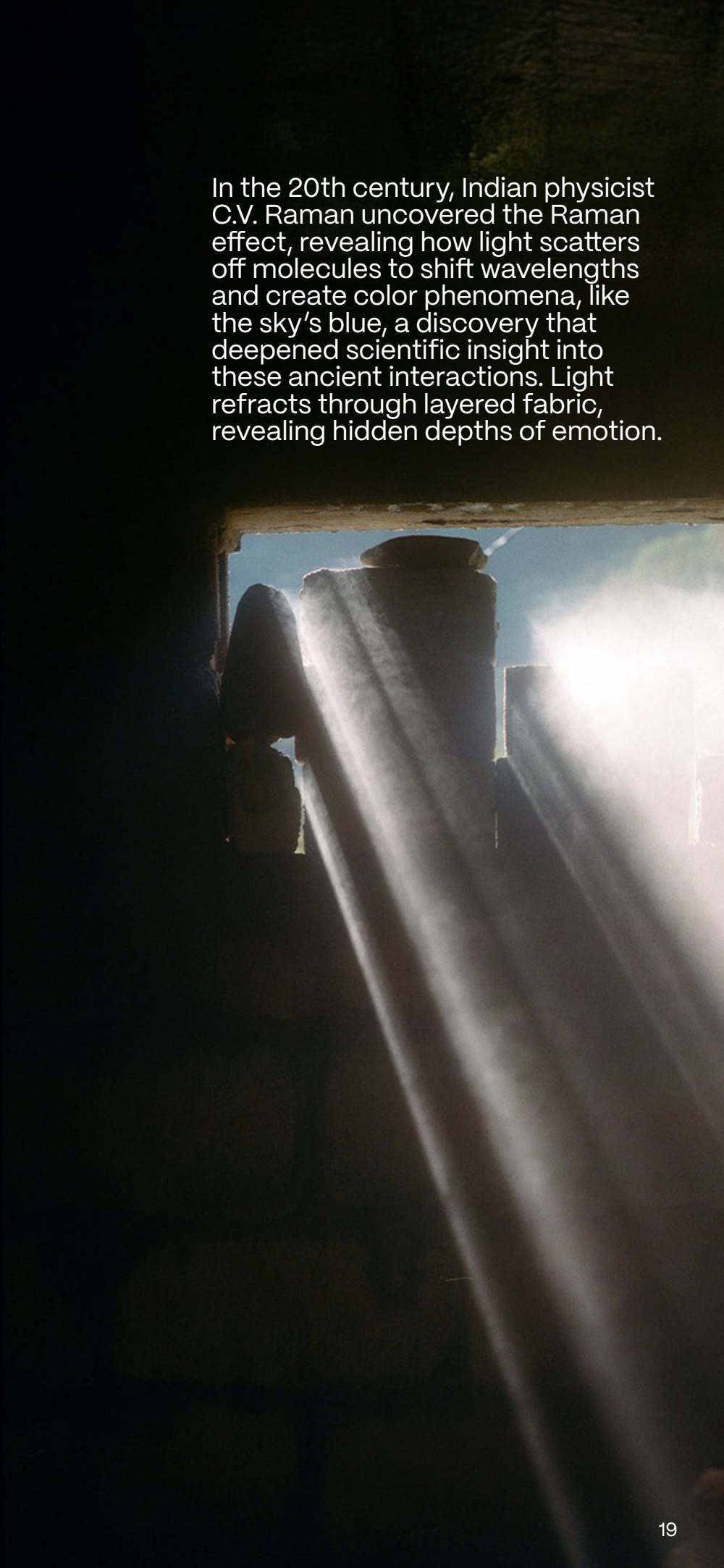
In the Indian subcontinent, color has always been more than just decoration – it is alive, raw, and full of meaning, carrying whispers of the divine and the rhythm of daily life.



Step back in time to the banks of the Indus River, 4,000 years ago. An ancient weaver dips cloth into vats of indigo harvested from wild plants. The fabric first turns greenish, then oxidizes in the air to a deep blue like the night sky — a transformation born of patience. Yet this blue is not eternal. Sun and rain will soften it, turning the bold victory into gentle memory.

Colors are born here from earth's chemistry, reacting to light, touch, and time. The Turmeric's yellow shifts with heat; Madder's red pulses with life's fire, drawn from the root of the Rubia cordifolia plant known as manjistha in Sanskrit, an ancient natural dye source that yields vibrant hues through earth's patient chemistry, extracted by crushing and mordanting with alum where heat and time awaken its intensity.

In the 20th century, Indian physicist C.V. Raman uncovered the Raman effect, revealing how light scatters off molecules to shift wavelengths and create color phenomena, like the sky's blue, a discovery that deepened scientific insight into these ancient interactions. Light refracts through layered fabric, revealing hidden depths of emotion.



These hues carry the soul. In the Mahabharata, Draupadi is described as dark-skinned, yet the most beautiful woman — her complexion a symbol of strength and allure.

Krishna's blue skin holds the infinite cosmos, teaching wisdom, and vastness. In stories of his rasleela with Radha, colors swirl in joyous abandon, blurring boundaries between ***mortal and eternal.***

Colour became a symbol of quiet *resistance.*

In 1917, Mahatma Gandhi arrived in Champaran, Bihar, where indigo farmers were forced to grow the dye for British profit while their own lands starved.

The deep indigo, extracted through laborious fermentation and oxidation, turned blue-stained hands into a symbol of defiance.

Fading cloth became a metaphor for *fleeting colonial power;*

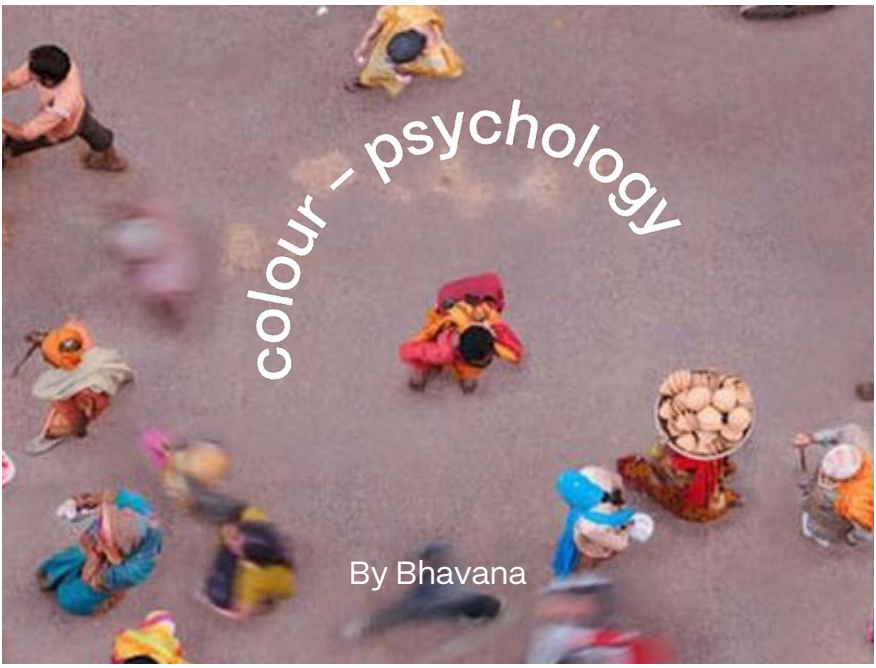
Gandhi's satyagraha transformed it into a movement for freedom.

In the villages of West Bengal, Santhal tribes paint their mud huts during Sohrai festivals with natural earth pigments. Women harvesting rice in earthy browns and greens, dancers swirling in yellows and reds around a sacred stone — these walls become living biographies of

devotion, community, and joy.

This understanding of color – rooted in impermanence and profound symbolism flowed like monsoon winds across Asia, carried by ancient trade routes and wandering monks since 290 BCE. The Ramayana's epics reached Indonesia, inspiring batik's layered dyes to narrate cosmic tales, reds igniting passion amid Javanese lore. ***Vietnamese dragon dances echoed Holi's red vitality through Champa echoes; Burmese pagodas drew Krishna's serene blue into Buddhist murals.*** Across this Indosphere, colors adapted, yet endured as shared whispers of resilience and emotional depth.

Today, this timeless view offers a quiet philosophy: embrace impermanence as beauty, choose materials that tell their own truth without disguise, leave space for personal meaning, and remain consistent across time. In a world of noise and uniformity, color reminds us that true peace blooms in the fleeting; ***a simple, sublime story woven into life itself.***



This is a colourful account of the colours that filled Maya's day. Maya, like all of us, thinks that she drives everything in her life! She believes her choices are driven by logic, desire, or sheer willpower. Little does she know that there is something called the psychology of colours that influences many things.

6:30

The morning calm

Maya opens one eye. Her bedroom walls are a soft, ***pale blue***. Without her realising it, this specific shade has been lowering her heart rate and cortisol levels as she wakes up. She feels refreshed rather than frantic. But if those walls were bright red, she'd have woken up ready to fight a gladiator.

9:15

The wardrobe dilemma

Standing before her cupboard, she ignores her grey leggings. "Not on a Sunday," she mumbles. She pulls out a vibrant ***yellow Kurti.*** Yellow is the color of sunshine and dopamine. By the time she is dressed, her brain has already decided that today is going to be "A Good Day." She isn't just wearing a color; she's wearing a mood booster.

10:30

The breakfast illusion

At the local South Indian eatery, Maya's eyes settle on the bright ***red and orange walls*** and logo. These specific colors are known to increase the heart rate and gently trigger the appetite. Suddenly, she doesn't want to order idli which was on her mind all along; instead, she orders the "Masala Roast."

13:00

The sale trap

Walking through the mall, she sees a giant ***Red sign*** screaming SALE and her brain skips the "do I need this?" logic and goes straight to "Fear of missing out!" Red creates a sense of urgency. It speeds up her pulse. Ten minutes later, she's walking out with a frying pan she didn't need at all, simply because the red tag created a fake sense of urgency that her brain mistook for a genuine need.

20:00

The whitewashed dinner

Back home, she settles in for dinner. She eats off from a large white plate. Because the ***plate is white*** and provides little contrast to her rice, her brain fails to register exactly how much she's piling on it. If she had used the dark blue plate, the visual "pop" of the food would have made her serve herself 20% less maybe? She finishes the meal feeling a little too full, blaming the delicious curry, while the white plate sat in the sink, looking perfectly innocent.

22:30

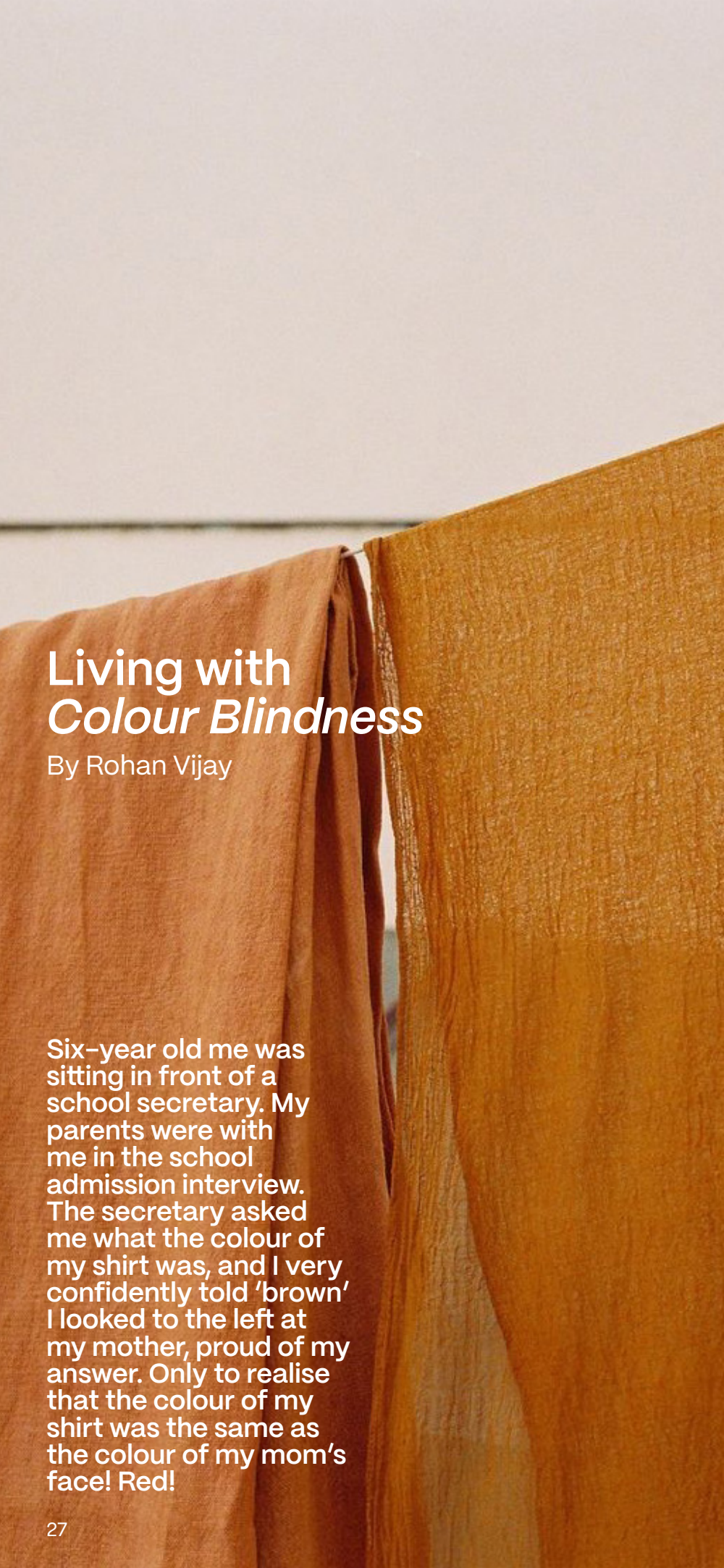
The blue light betrayal

Maya decides to sleep early, reaching for her phone for a "quick" scroll on her phone before sleeping. The short-wavelength ***blue light*** from the screen mimics daylight, tricking her brain into thinking it's not night yet making her brain stop producing melatonin(the sleep hormone). What should have been a five-minute activity becomes an hour-long rabbit hole of doom scrolling cat videos.

13:00

Lights out

Realising that it's Monday tomorrow, she turns her phone off and switches on the warm, ***amber bedside lamp.*** The dim golden hue signals her body that the fire is dying down and it's safe to rest. As she drifts off, Maya thinks she had a productive, self-directed Sunday. She had no idea that from the yellow kurta to the blue screen, colors were calling the shots all day.



Living with *Colour Blindness*

By Rohan Vijay

Six-year old me was sitting in front of a school secretary. My parents were with me in the school admission interview. The secretary asked me what the colour of my shirt was, and I very confidently told 'brown' I looked to the left at my mother, proud of my answer. Only to realise that the colour of my shirt was the same as the colour of my mom's face! Red!

A favourite activity of non-colourblind folks when they meet someone colourblind is to ask this question ‘So what colour is this?’

while pointing at the closest colourful object. it might seem like fun to point at objects and know how different the perception of colour-blind folks are, it shines an anxiety inducing spotlight on us colour-blind folks. The anxiety is induced mainly because we grew up not being able to tag a colour with confidence as it often invited reactions from people around us who saw colour differently. Imagine choosing a light pink colour pencil in art class only to be told by someone next to you the sky needs to be coloured blue, not pink.

Being colourblind all my life, I have seen a very different world from the rest of you non-colourbind folks. In my world green appears yellow, red appears brown and blue and purple can never be distinguished. Colour-blindness isn’t a disease, it is genetic variation activating fewer of the cone cells, affecting roughly 8% of people, mostly men.




To explain this in simple terms, our retina is composed of cone cells. These cells are responsible for the interpretation of colours. Cones come in 3 shades red, green and blue. A proportionate mix of these in the retina allows us to see the full spectrum. Colourblindness is the phenomenon when the mix is not proportionate. There are 3 alternate proportions to the normal. Reduced sensitivity of red cones (classified as protan), reduced sensitivity of green cones (classified as deutan) and a much rarer reduced sensitivity of blue cones (classified as tritan). The proportion to which the cones lack sensitivity determines the degree of 'blindness' ; it is classified as an anomaly if mild and –opia if moderate or severe. So a person with a moderately reduced sensitivity of red cones (eg. myself) is considered to have protanopia. You can mix and match to make the other combinations to know the other terms.

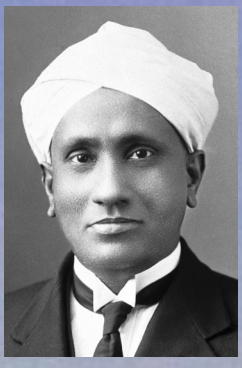
Despite being seen as a disadvantage, colour-blind people have played a crucial role in the evolution of humanity.

Back in the day when humans lived in dense forests and relied on hunting and gathering for survival, it were those few tribe members gifted with colour-blindness who could see through camouflage and spot prey. This might be one of the reasons why evolution has not eliminated this genetic trend.

In the modern world, there aren't a lot of opportunities for the unique talent of camouflage cracking to shine and this is what impacts people with colour-blindness to feel less confident about how they perceive colours. So to state in one line, what my experience is like being colour-blind,

the colours have always been there, the confidence about them wasn't.

The Raman *Effect.*



Sir C.V. Raman was awarded the Nobel Prize in Physics in 1930 for his groundbreaking work on the scattering of light and the discovery of the Raman Effect. He was the first Asian and coloured person to receive a Nobel Prize in any branch of science.

Discovered in 1928, The Raman Effect is fundamentally a phenomenon of inelastic light scattering, where a small portion of light passing through a material changes color (wavelength). It provides a molecular "fingerprint" by revealing how atoms within materials vibrate, effectively producing a "mini-rainbow" based on the material's chemical structure.

Raman's curiosity was sparked by the deep blue color of the Mediterranean Sea, which he proved resulted from the scattering of sunlight by water molecules, contradicting the belief that it was simply a reflection of the sky. Color Shift (Inelastic Scattering): When monochromatic light (e.g., violet) passes through a substance, most light retains its original color (Rayleigh scattering), but a tiny fraction is scattered at a different color (Raman scattering), which Raman identified using filters. This won him a nobel prize.

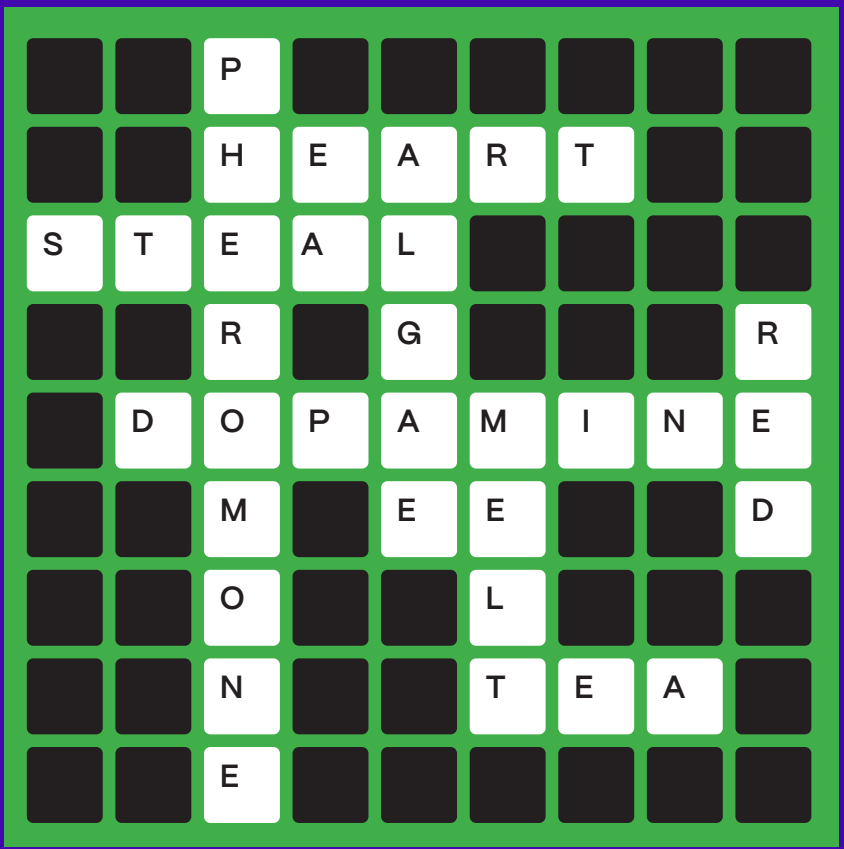
Bengaluru based researchers, Prof. Rajesh Ganapathy, Chandan Mishra and Prof. Ajay Sood have designed crystalline materials that selectively scatter specific colours of light. Structural colour is produced when light is scattered by particles which are arranged in an ordered and periodic pattern. This approach mimics nature and is also the science behind the spectacular sheen and colour on the wings of butterflies..

In nature, nanosized particles and colloids are responsible for producing structural colours. Compared to atoms, colloidal particles are 10,000 times bigger, hence conventional lab techniques to move the particles over long distances to form an ordered, periodic pattern have faced a number of problems in the past.

The novel approach adopted by the combined efforts of the researchers at the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) and Indian Institute of Science (IISc) Bangalore has overcome the challenge of transporting the particles to target sites; the size and symmetry of the growing crystallites are also controlled.

The results were published in the journal Proceedings of the National Academy of Sciences.

Shringara answer key *February:*



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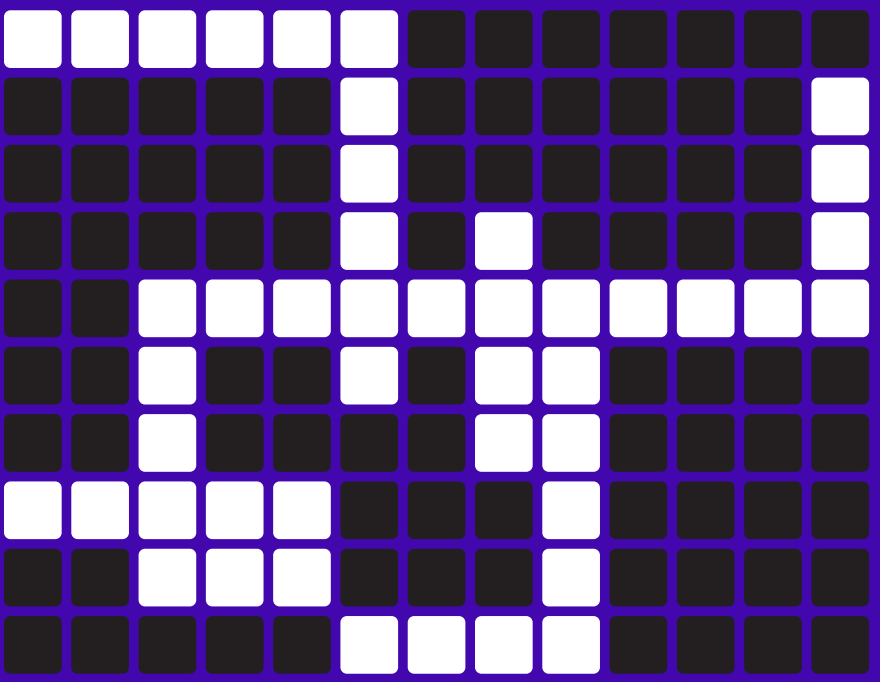
Are you ready for an immersive science experience in Jayanagar?

Colours Crossword March:



[1A] Particle we use to perceive colours (6)
[2A] Method of measuring colour using light absorption (11)
[3A] Foliage is .... (5)
[4A] Eyes give us this ability (3)
[5A] Eyes are the colour of (4)
[1D] Scientist who split the colour spectrum (6)
[2D] The world looks like this without colour (4)
[3D] When I mix a colour with white (4)
[4D] Eye cells responsible for colour vision (5)
[5D] Colourful Shrimps (6)