

In this issue

Quantum Efficiency and Yield

Absorption and conversion

Photovoltaic cells, photodetectors, photoelectrocatalysts and luminescent materials share a common process: they absorb photons and convert the energy to some other form. So the ratio of quantum efficiency to quantum yield defines the significant properties of the materials used.

Researchers from the Materials Research Centre, IISc Bengaluru point out that, depending on the use to which the device is put, either the internal quantum efficiency or the external quantum efficiency becomes important, relevant. They demonstrate the use of the concepts to understand photovoltaic cells, photodetectors, photoelectrocatalysts, and luminescent materials.

The General Article on **page 894** in this issue is a must-read for researchers attempting to improve such devices and scholars interested in these materials.

Scrub Typhus

In the Himalayan states?

Though scrub typhus was described more than two hundred years ago in Japan, and the involvement of mites in transmitting the disease was well recognised, it was only a hundred years ago that the causative organism could be identified. The name, *Orientia tsutsugamushi*, seemed appropriate: the disease was found to be endemic in South East and East Asia; *tsutsuga* means illness and *mushi* means insect in Japanese. Later, of course, the oriental illness was reported occasionally from other parts of the world. And now, it seems that the disease is endemic to Himalayan regions also.

There are at least 23 genera of mites that harbour widely varying strains of the Gram negative bacteria, *Orientia tsutsugamushi*. The bacteria can pass on from generation to generation, through eggs to larvae called chiggers and to adult mites. These mites, mostly found in scrub forests, bite rodents, cattle and humans and act as vectors. The symptoms after infection are not easily distinguished from ordinary fevers, but the consequences of not diagnosing the infection correctly can even be fatal.

For the benefit of health care providers and people living in the Himalayan states of India, Sidharath Dev Thakur provides a very useful Review Article on scrub typhus and strategies for tackling the problem. Turn to **page 899** in this issue.

Changes in Glaciers

Himalaya-Karakoram region

Changes in the glaciers of the Himalayas are difficult to assess through field studies since most are inaccessible. Yet as the source of many rivers that provide plentiful water in the scorching summers of the northern parts of the subcontinent, there is a need to keep track of the glaciers. Remote sensing steps in to solve the problem.

A Research Article in this issue provides an account of using data from ISRO's Linear Imaging Self-Scanning Sensor 3 which covers a swath of about 140 kilometres at a resolution of about 24 metres every 24 days. The multispectral data gets affected by cloud cover and other atmospheric conditions. So the researchers complemented the data with data from Landsat to create a picture from 2001 to 2011. They extended the study using data from more sources till 2017. They thus covered 5234 glaciers from Kashmir in the west to Sikkim in the east, including some from Nepal and parts of Tibetan regions. Out of these, 2143 showed a mild gain in area but the remaining showed loss at higher rates than the gain.

The authors provide insights into differences in the behaviour of glaciers. Latitudinal variation in the locations of glaciers is an obvious factor that influences the behaviour of glaciers. The role of debris on glaciers is ambivalent and varies based on the situation. And meteorological and climatic factors also contribute to the changes observed. For details, turn to **page 929**.

Pyrrhae Fossae in Mars

Age estimation

In the southern highlands of Mars, there are signatures of compressional and tensional tectonics, quite similar to those between plates on the earth. The land morphology there shows elongated depressions, or grabbens. Researchers from India

and Japan found the morphology of grabbens in the vicinity of Pyrrhae Fossae unique: their orientations had varied directions. The curiosity turned into a solution for the problem of estimating the age of these formations.

In a Research Article, they provide a fascinating account of the buffered crater counting technique, which, in this case, offered advantages over the traditional technique using crater size-frequency distributions. The assumption is: the more the land is pock-marked with craters, the older it is.

The results show that the Pyrrhae Fossae was formed in the late Noachian time, some 3.7 to 3.8 billion years or so ago. The discovery pushes the age of the basement on which the Pyrrhae Fossae was formed to earlier times than the present estimate. Turn to the Research Article on **page 906** for more.

Move over, Google Earth

Virtual reality is here

When we navigate on Google Earth, we see what ordinary maps do not show. But we are still observers looking from the outside. Now imagine if it were like a virtual reality gaming experience, where you are immersed in the location... And what if you can teleport to another location in the blink of an eye?

That is what ISRO's Space Applications Centre is now delivering: a virtual reality tool that takes remote sensing satellite data and digital elevation models and merges them in a geographic information system environment to provide two 2-D images that converge, creating a 3-D visual experience in a virtual reality headset, fitted with head movement and motion trackers to adjust your experience when you move around. So – where in the world do you want to go?

But first go to **page 958** in this issue and read the Research Communication to understand the principles and processes involved in constructing this virtual reality world.

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