In this issue

Stimulating Innovation
Nation and enterprises

Innovation cannot be stimulated by national policies alone as demonstrated by the Indian experience of the decade after the first Science, Technology and Innovation Policy of 2003 and the two years after the new policy of 2020 in India. A culture of innovation is perhaps more easily established at micro-levels, within enterprises. But what are the factors that help stimulate innovations within firms?

A General Article in this issue examines the path from research to development and suggests that it is perhaps not a straight line, but a complex network with nodes and linkages that connect the actors internally within the firm as well as entities outside, to create an innovation circle. The dynamics of the innovation circle to acquire and process knowledge to enable the creation of new knowledge and artefacts is powered from within the firm. Innovative firms shift their strategy to compete in the market: instead of competing with other firms based on price, market leadership is based on competing with new technologies, say the authors.

Turn to **page 15** to read about the characteristics of innovative firms and the drivers of innovation within firms.

Mining for Natural Products
Databases and AI tools

Recent advances in genomics, transcriptomics, proteomics and metabolomics have led to the creation of a large number of databases. Simultaneously, artificial intelligence and machine learning algorithms have evolved to meet the challenge of mining the data and to extract information that is useful to solve scientific problems and to come up with products useful for agriculture and medicine.

A Review Article in this issue examines available artificial intelligence tools and machine learning algorithms as well as the databases that researchers can use to propel and accelerate translational research. Besides reviewing the success stories so far, the review article points out the possible future courses of action and the potential pitfalls in using the new research tools and resources.

Turn to **page 19** to update yourself.

Excavated Pottery Sherds
Salt fog on surface

In 2020, archeologists from Cairo University discovered several pot sherds at Saqqara – the remains of pottery from the time of the New Kingdom, more than 3000 years ago. The pottery which they carefully excavated using chisels and brushes were well made, suggesting the prosperity of those times. But within a few hours of excavation, they found the surface of the pottery sherds fogged over by crystalline salt.

Why and how does this happen?

Researchers from the Cairo University examined the phenomenon using a light microscope, a scanning tunneling microscope, X-ray diffraction and Fourier transform infrared spectroscopy to provide an explanation.

Water containing dissolved salts from surrounding soils creeps into pores in the pottery. When the pottery is excavated, the water evaporates at a rate dependent on the ambient temperature. The salts start crystallizing. The pressure of crystallization, which is greater in smaller pores, pushes the salt solution into the surface. So after excavation, the pot sherds showed water droplets on the surface of the potsherds. When these water droplets evaporate, small cubic crystals of salt start forming leaving behind spots of salt efflorescence on the surface. The roughness of the pottery surface, the materials and the process used for making the pottery, the location from which the pottery was excavated, etc. play a role in the extent of the fogging, points out the Research Article on **page 85** in this issue.

Such crystallization of salts can often create cracks in pottery. Given the insights from the research article, archeologists can now devise ways to extract salts from the pores of pottery after excavations.

Collaboration Among G-20
Boosting research

The Group of 20, G-20, was established in 1999 as an inter-governmental organization as a response to global economic crises. The members, nineteen countries and the European Union, between them, contain two-thirds of the world population, provide more than 90% of the global budget for research and produce more than 90% of the world's scientific publications.

In the 20 years after the formation of G-20, how has the research output of each country changed? How is the data on research output related to the gross expenditure on research made by each of these countries from 2000 to 2020? How has the relative intensity of collaboration between the member countries changed during this time? Since international collaborations lead to a boost in research productivity and citations, how much have the G-20 countries gained?

A Research Article in this issue presents data to answer such questions. Researchers and policy makers need to read the article on **page 36** for insights that can lead to strategic action.

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