Editorial*

B. Sury, Chief Editor

This issue honors Jacques Tits, a colossus whose ideas decisively impacted the mathematical landscape for almost six decades. To describe his viewpoint in very simple terms, one might say that he made fundamental contributions to the abstract algebraic theory of groups via geometric methods. His viewpoint has enriched areas seemingly remote from those that constituted his original motivation.

One of the mathematical objects named after him goes under the ‘real estate’ name of ‘Buildings’. These (abstract mathematical) buildings were introduced by Jacques Tits in order to provide a unified geometric framework for understanding semisimple algebraic groups over arbitrary fields; especially the elusive exceptional groups of Lie type. The germ of this approach emerged in the 1950’s and they evolved further by the mid 1960’s. Tits described the outlines of this theory in a 1965 Séminaire Bourbaki exposé. Later, in 1974, he gave a definitive report on the developments. One of Tits’s greatest achievements is the classification of the so-called thick, spherical buildings of rank at least 3, proved in this 311-page volume. Roughly speaking, the result is that such buildings correspond to algebraic groups (of relative rank at least 3) defined over an arbitrary field. Under a certain symmetry relation imposed on the buildings (the so-called Moufang condition), the classification extends to rank 2 as well. These developments are due to Tits and Weiss. Tits proved that spherical buildings of rank at least 3 have the Moufang property. The connection between buildings and groups is provided by Tits’s theory of BN-pairs (also called Tits systems). Given a group $G$ with a pair of subgroups $B, N$ satisfying certain axioms, one constructs a building on which $G$ operates as a group of automorphisms.

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Conversely, if a building admits a group action with sufficiently strong properties, it yields a BN-pair.

Tits’s unpublished 1961 paper ‘Groupes et Géométries de Coxeter’ whose contents appeared as chapters IV to VI in Bourbaki’s famous volumes on *Groupes et Algèbres de Lie*, contains some of the most influential pieces of mathematical work. His work on (the Tits) classification of algebraic groups, his work with Borel on (Borel–Tits) structure theory of isotropic reductive groups over arbitrary fields, and the theory of $p$-adic groups developed with Bruhat (the Bruhat–Tits theory) have all immutably metamorphosed the mathematical landscape. We had alluded above to his 311-page treatise on ‘Buildings of spherical type and finite BN-pairs’, *Lecture Notes in Mathematics*, Vol.386, Springer-Verlag, Berlin, 1974. The theory of buildings has been deeply intertwined with the theory of algebraic groups since the burgeoning of this subject. Much later, after the appearance of the above work, the connection between twin buildings and the Kac–Moody groups was discovered. One can say that there has been a mushrooming of applications that have gone far beyond what was envisaged in the early days of the theory of buildings. Whether these are fortuitous or whether they advertise the depth and foresight of the original ideas is for future generations to judge. We could perhaps refer to it as ‘Rem acu tetigit’. Considering our readership, we have reproduced as a ‘classic paper’, a survey talk by Tits in the International Congress of Mathematicians, which was held in 1974 in Vancouver, Canada. Jacques Tits was born a Belgian and took up French citizenship in order to be able to teach in France. More on his background can be gleaned from a general article describing his work that appears in this issue. Tits was truly a theory builder—pun intended.

In addition to featuring Jacques Tits, the issue has diverse, interesting morsels on different topics in science. In the important subject of quantum information processing, it is of interest to look at the conversion of quantum signals from one form of energy to another. An article by Mrittunjoy Guha Majumdar discusses certain principles of quantum transduction. In an extremely captivating
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write-up accessible to undergraduate students, Anantha Hegde, Adarsh Kumar, Adhip Agarwala, and Bhaskaran Muralidharan convinces us that a program of simulating quantum electronics with topological toy models is the storehouse for discovering fantastic physics ideas. This is done through hands-on experiments whose codes are shared. This article has so much substance of interest to a diverse readership that we have split it into five parts, and the first part appears here. So, there is a lot to look forward to in the next few issues!

We have an inspiring narrative by Varsha D. Shiragannavar, Nirmala G. Sannappa Gowda, and Prasanna K. Santhebakadur about a shero Henrietta Lacks, after whom the co-called HeLa cells are named. Usually, Resonance does not carry purely biographical articles and the one above is also not an exception because it has some interesting, informative science content as well. Arnab Chatterjee and Rajarshi Ghosh describes the scientific reasoning behind why the molecule 2-deoxy-D-glucose derived from glucose has been considered for its medicinal uses—especially in the treatment of cancer cells.

The precise measurement of viscosity is an important aspect to consider in industrial applications. To understand the role of inter-molecular interactions on the liquid flow, three types of intermolecular interactions are considered in a study made by Priyanka Thakral, Jay Bharat Ingle, Ridhima Raina, and Deepika Nehra. This procedure is deemed suitable for undergraduate laboratory demonstrations. In another captivating narrative, Komal Kadam and Ram Kulkarni discusses the bridge between biology and biotechnology using as a tool, the ‘adaptive laboratory evolution’ (ALE) experiments which have gained momentum in recent times as a method to enhance microbial phenotypes and study various biological processes.

The issue features the last of a four-part article by Jyotirmoy Sarkar and Mamunur Rashid on the anatomy of the novel coronavirus viewed in an idealistic world removed from reality. They have imposed some quasi-symmetry conditions for their mathematical musings and invite the readers to conduct their own mus-
ings by assuming other symmetry properties. In Part 1, they described the external shape of the n-Cov as a sphere with three kinds of proteins protruding out of it. In Part 2, they modeled the locations of the S-proteins as the vertices of icosahedron and dodecahedron inscribed within a sphere and at the midpoints of edges of the icosahedron (or the dodecahedron). In Part 3, they studied the properties of spherical triangles, which help in locating M- and E-proteins. In this last part, they answer the challenge posed in Part 1 and offer additional variations to their model. Finally, in the third and final part of their survey on dynamic graph problems, Manas Jyoti Kashyop and N S Narayanaswamy discusses techniques to prove lower bounds; upper bounds were discussed in the second part.

I believe every reader would find something in this issue to interest and excite her.