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Tissue imaging: a light and sound show

Photoacoustic tomography is a non-invasive biomedical tool equipped to image live cells deep beneath the skin. A pulsed laser heats the cells, increasing their temperature by the thousandths of a degree, causing them to expand and contract rapidly. These rapid oscillations generate ultrasonic waves whose signal is transduced to an image. Gold nanoparticles, owing to their lack of toxicity and high specificity, are often 'fed' to the target cells to generate high contrast images.

In a Research Communication on **page 1556**, researchers from the Saha Institute of Nuclear Physics, Kolkata, simulate the photoacoustic profile of cells that have engulfed gold nanoparticles of varying radii. Contrary to other earlier studies, which assume photoacoustic pressure is generated at a molecular level, their theoretical model assumes that the pressure is generated at the cellular level. Although the study oversimplifies the distribution of nanoparticles in the cells, the results of the simulation are congruent with experimental result, thus validating their theoretical model.

A hundred and thirty years ago, Alexander Graham Bell stumbled upon the photoacoustic effect while engineering the photophone, a device which used sunlight to transfer sound. Although his photophone was not practicable, he still called it his greatest invention. Today, the photoacoustic phenomenon has revolutionized biomedical imaging methods, and its most promising application could be in the detection and ablation of tumour cells with unprecedented efficacy.

Macroperspectives on nanotechnology

Both biotechnology and nanotechnology have potential for being disruptive technologies. And both have become buzzwords for researchers. So it is not surprising that the intersection of these two – nanobiotechnology – has extensive publications: 115,000 publications in the 10 years between 2003 and 2012! An impossible number of papers for any individual scientist to keep up.

A General Article on **page 1490**, examines the progress in nanobiotechnology research, using scientometrics. Which are the countries that publish most research? Which labs? What are the research trends? Which individuals have made impactful contributions? Which are the journals that focus on nanobiotechnology? The study provides a bird's eye view of this effervescent research field.

This timely article from Anna University employs scientometrics techniques to study nanobiotechnology publications available in the *SCOPUS* database. Scientometrics itself has been evolving in its rigour in recent years and the study uses multiple parameters and indices to measure, calculate and quantify the volume and quality of nanobiotechnology research of countries and institutions.

Not surprisingly, the USA leads the world in terms of quantity of research output. In terms of average citations per paper, Canada comes first, though their share of papers is lowest amongst the ten top ranking countries. India and China also figure in the top ten, but both fall behind others in collaborative research.

Such a vantage point would allow researchers and managers of science understand trends and chalk out policies to further the research activity. Still in its nascent stages, nanobiotechnology research has already thinned the line between science fiction and reality. Gold nano-rods that bind to cancer cells, artificial stem cells to treat heart diseases, limbs that replace prosthetics, are all, testament to the path breaking potential of research in nanobiotechnology. This article, however, is only just the beginning; there is still plenty of space at the bottom to explore.

Microspherical drug delivery vehicles

Repaglinide is an oral drug used to treat type-2 diabetes. It is called a 'short action secretagogue' because it, for a short duration of time, rapidly enhances insulin secretion by opening up the calcium channels of the pancreas. The efficacy of pure repaglinide, however, is limited by a short half life and a poor absorption rate. A gastro-retentive drug delivery system, could therefore prove to be an ideal method to improve the duration of action. A Research Article on **page 1518**, presents a novel drug delivery system: Repaglinide encapsulated in resin based microspheres.

Cholestyramine resin is a bile acid sequestrant and has been used for certain kinds of diarrhoea. The resin microsphere, by encapsulating the drug, increases the buoyancy of the drug, reduces wastage and improves the solubility of the drug in the acidic environment of the gut. The article compares the efficacies of the repaglinide encapsulated in the resin and the pure repaglinide in diabetic mice. The resin slowed the release of the drug, thus decreasing the number of doses required to maintain a normal sugar level.

Diabetes, today, has afflicted four hundred million people worldwide. Drug delivery systems that are synergistic in action need to be developed to allow people the most childlike of indulgences, a sweet tooth.

Fuzzy grading in educational system

Grades are usually computed using hard computing techniques which gloss over the individual aptitudes of students and resolve all the dimensions of a student's capability to a single letter of a grade. Recently studies have cited soft computing techniques that prove to be superior tools for grading students. Unlike hard computing, soft computing is based on fuzzy logic. In practice, however, the optimization of an ideal grading system using either hard or soft computing depends on the data collection process, the clustering students based on marks.

A Research Article on **page 1505**, analyses various methods based on fuzzy logic to seek for an ideal grading system useful to allocate students to classes. Amongst the five methods, a hybrid of subtractive clustering and an adaptive neurofuzzy inference method is the most efficient method to evaluate academic performance.

In the next ten years three hundred million students will have enrolled in colleges and universities worldwide. Thus a rationalization of student evaluation has huge psycho-social and economic ramifications.

Somendra Singh Kharola
sciencemediacentre@iiserpune.ac.in