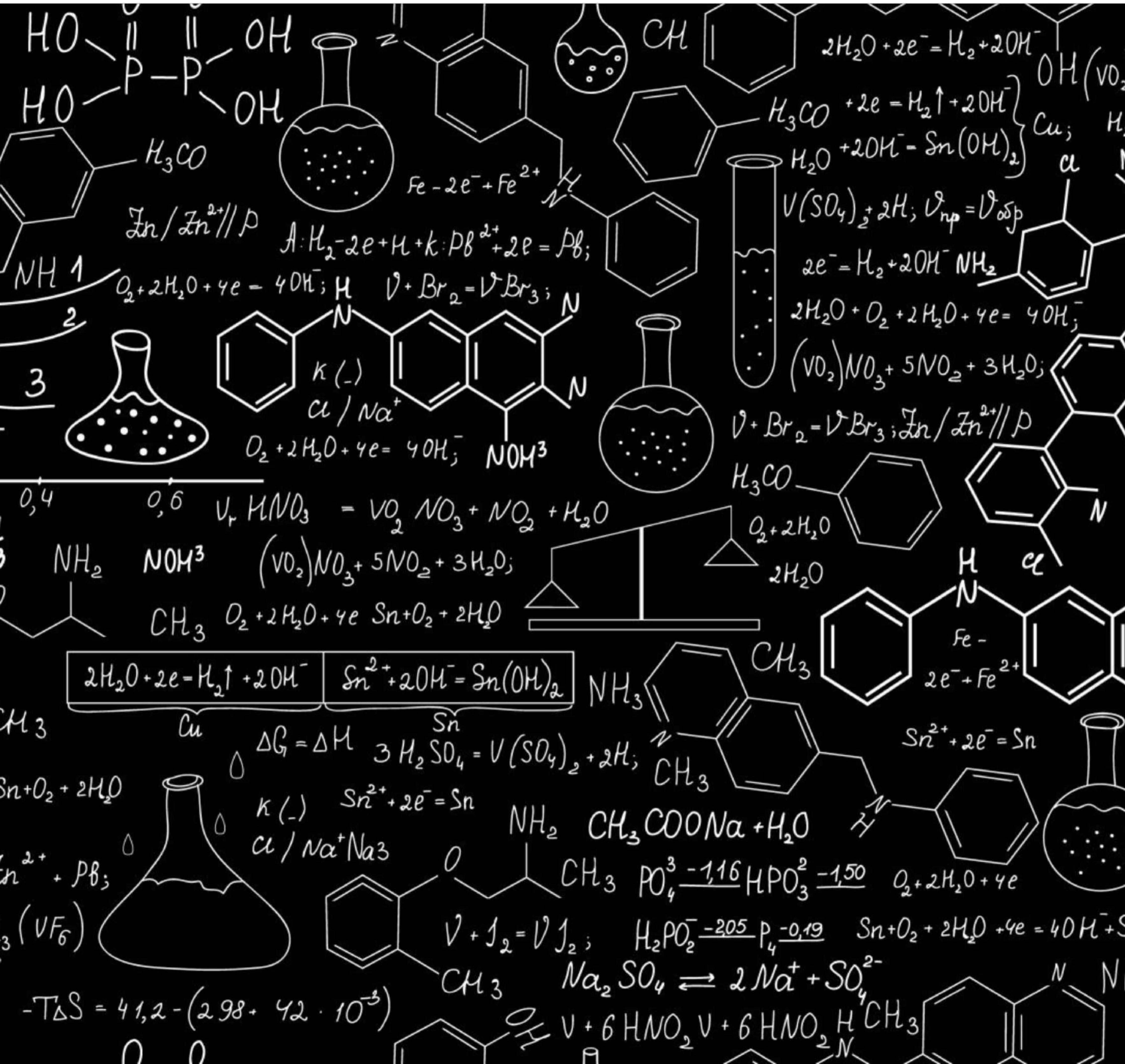
CHEMMUNIQUÈ

8th edition, 2018-19



DEAN'S MESSAGE

CHEMMUNIQUÉ IS THE NEWSLETTER PUBLISHED BY THE CHEMISTRY DEPARTMENT, SINCE 2011. HAVING TAKEN ITS BIRTH IN THE AUSPICIOUS 'INTERNATIONAL YEAR OF CHEMISTRY' (AS DECLARED BY IUPAC), IT HAS SERVED ITS PURPOSE OF POPULARIZING CHEMISTRY AMONG STUDENTS AND FACULTY, THROUGH A RANGE OF ARTICLES PUBLISHED EVERY YEAR. NOW, IN ITS EIGHTH YEAR, IT PROMISES TO BRING MORE ARTICLES, QUIZZES, AND NEW INFORMATION, CONTRIBUTED BY STUDENTS AND STAFF OF THE CHEMISTRY AND OTHER DEPARTMENTS OF THE DEANERY.

CHEMMUNIQUÉ IS ALSO A PLATFORM FOR THE STUDENTS TO SHOWCASE THEIR TALENTS IN THE AREA OF CHEMISTRY, THROUGH THEIR ARTICLES, DRAWINGS, CARTOONS, QUIZZES, ETC. FOR THE READERS IT WILL BRING A WHOLE RANGE OF NEW KNOWLEDGE, AND THOUGHT PROVOKING IDEAS.

I WISH TO THANK EACH CONTRIBUTOR AND THE MEMBERS OF EDITORIAL TEAM FOR THEIR EFFORT IN BRINGING THIS ISSUE OF CHEMMUNIQUÉ, THROUGH THEIR HARD WORK AND KEEN INTEREST. I AM SURE THE STUDENTS AND FACULTY WILL CARRY FORWARD THIS TRADITION AND STRIVE TO UPGRADE THE QUALITY OF PAPERS EVERY YEAR.

DR. SURENDRA KULKARNI
DEAN - SCIENCES

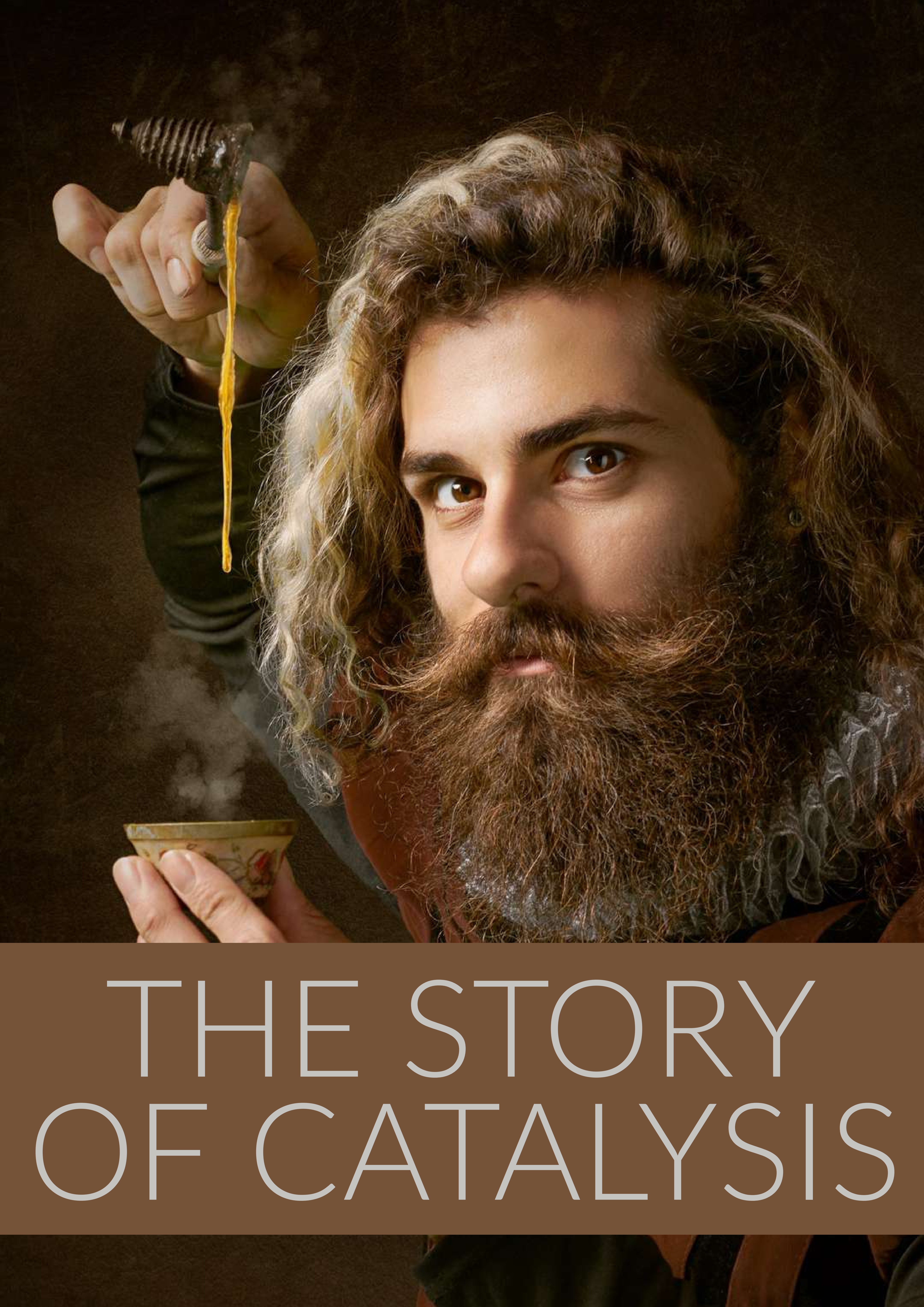
FROM THE
EDITOR'S DESK

50 glorious years have passed since CHRIST (Deemed to be University) was established. 50 brilliant years, bringing together students from all disciplines across the world and cherishing each and every culture that it entails. The subject of Chemistry is one of the oldest subjects taught in our institution. Coincidentally, it has been 50 years since the structure of Insulin was deduced by Dorothy Hodgins and her colleagues at Oxford University. Also it has been a 100 years since Fritz Haber and Carl Bosch demonstrated the Haber Process for the first time. The field of chemistry has grown in leaps and bounds since then and has become a vital component in our attempt to comprehend the universe around us.

Chemmuinque, is us, as chemists, doing our part to popularize the subject we love and adore. The objective behind publishing this magazine is to bring together those incredible ideas that have struck our world over the past year. We thank each and every student who took time out of their hectic schedule to contribute to this year's edition. We had a lot of fun designing the magazine and reading through the articles that were sent to us, and we apologize to the students whose articles did not make it to the magazine. We hope that you enjoy this year's magazine just as much as we did compiling it and keep those articles coming for the next edition as well!

EDITORIAL TEAM

Dr. Riya Datta
Prof. Dephan Pinheiro
Karthikeyan N
Labeeb Ajmal T



THE STORY OF CATALYSIS

Alchemists and chemists have always known how to increase reaction rates by raising the temperature. Only much later, chemists realized that the addition to the reaction of a third chemical substance, the catalyst, could give rise to the same effect. Catalysis, whose discovery date is difficult to establish, goes back to the period of transition from alchemy to chemical science. Actually, it is a type of science with a prominent interdisciplinary character. Several branches of scientific disciplines have contributed to its development, including chemical kinetics; inorganic, organic, and protein chemistry; material and surface science; advanced physical methods, and computer modelling. The early development of catalysis science received a great impulse from the contribution of many scientists active in the nineteenth century and in the first decade of the twentieth century. To mention only a few, Berzelius coined the word "catalysis," Van't Hoff and Arrhenius are remembered for their discoveries in the field of chemical kinetics, and then Davy, Dobereiner, Thenard, and Philips, for having discovered the catalytic properties of platinum. This group could be considered the fathers of heterogeneous catalysis. They were great scientists in a period of great discoveries and advancements, and their work has formed the basis of catalytic science. However, it is only with Sabatier and Ostwald in the first decade of the twentieth century that catalysis in its heterogeneous version became worthy of Nobel Prize recognition.

Homogeneous catalysis came later with the seminal contributions of Roelen (use of cobalt carbonyls as catalysts in hydroformylation reaction) and of Wilkinson and Osborn (hydrogenation reactions using organometallic complexes as catalysts), and they are only a few who can be considered the initiators.

The start of enzymatic catalysis could coincide with the isolation and crystallization of the first enzymes by Sumner (urease) and Northrop (pepsin) and the structural determination of lysozyme by Chilton Phillips. However, it is worth recalling that already in the eighteenth century, Payen correctly recognized the catalytic action of a particular biological substance, which he termed "diastase," and then at the end of the nineteenth century, Fischer had the remarkable intuition to use the so-called key and lock model to explain the selectivity of enzymes. After these starts, the number of publications involving explicitly the word "catalysis" in all versions (heterogeneous, homogeneous, photo, and enzymatic) gradually increasing from few tens in the 1920s to several hundred in the 1950s and to more than ten thousands in the 2000s, which is a consistent fraction of all the documents having chemistry as a keyword. This exponential growth is continuing today. In a parallel way, the number of Nobel laureates directly or indirectly involved in catalysis greatly increased in the twentieth century, approaching the total number of about 40 in 2014. This number is only a small fraction of all valuable researchers who have contributed to the development of catalysis science and technology. Catalysis science and technology are still evolving and can be a source of inspiration for the present and future generation of scientists.

Prof. Dephan Pinheiro

Why do the spectra of open cluster show the presence of heavy elements while globular clusters do not?

Stars are found to form in clusters. There are two types of clusters. Globular clusters, which contains many thousands of stars and older stellar population. Their spectra suggest that they are deficient in heavy atoms. Large clouds have gravity which exceeds the internal pressure.

The gravity attracts all the matter and the gravitation potential created increases the temperature. This stage of star formation is Protostar. Absorption Spectrum of this stage is dominated by Balmer Lines. At this stage, hydrogen molecule dissociation occurs and leads to ionization. Temperature reaches to 106 K. Collision of protons induces nuclear fusion reactions. Pressure from nuclear fusion and gravity are in balance and it contracts.

The core shrinks and the electron gas will gain an increase in temperature. This leads to the Triple-alpha process and helium is converted to carbon, carbon to oxygen, nitrogen and so on, till iron is formed at the core and other elements move over to the shell. Helium moves to shell and outburst the outer elements. This is a planetary nebula. The new stars that are in open clusters are formed from this outburst and hence their spectra have heavy elements.

CHAITHRA K P
2MCHE

CAN YOU THINK OF LIFE WITHOUT FRENCH FRIES?

FRYING IS AN IMPORTANT PROCESS DURING COOKING AND WE CANNOT IMAGINE HAVING FOOD THAT IS UNCOOKED. SAME GOES TO FRENCH FRIES. IT IS REFLECTED BY SALES AND A LARGE SPECTRUM THAT AROUND 20 MILLION TONS OF FRYING OIL ARE CONSUMED EACH YEAR. HENCE, THIS INTERESTS US TO KNOW ABOUT THE THEORY BEHIND DEEP-FRYING. OIL UPTAKE CAN BE CLASSIFIED INTO THREE MECHANISMS- WATER REPLACEMENT, COOLING-PHASE EFFECT AND SURFACE-ACTIVE AGENTS.

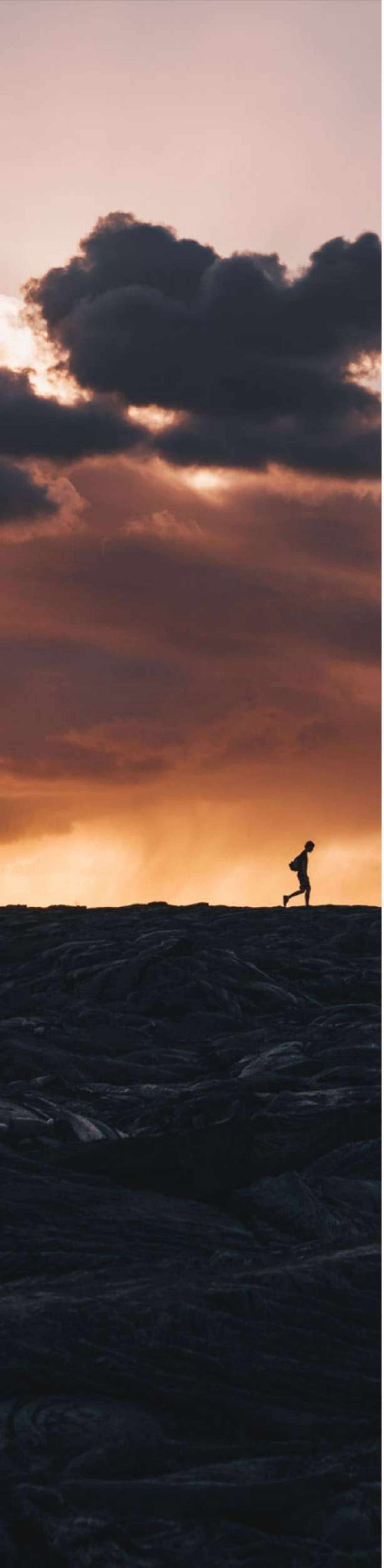
WATER REPLACEMENT - AS THE FOOD IS EXPOSED TO COOKING TEMPERATURE, MOISTURE FROM THE FOOD STARTS EVAPORATING IN THE FORM OF STEAM. A DRY CRUST IS FORMED ON THE OUTER SURFACE OF THE FOOD PERTAINING TO A POSITIVE PRESSURE GRADIENT. THE ADHERING OIL TO THE SURFACE ENTERS THE VOIDS, CRACKS AND OPEN CAPILLARIES FORMED BY THE ESCAPING STEAM DUE TO THE POSITIVE PRESSURE GRADIENT AND NO RESISTANCE. OIL PLAYS AN ESSENTIAL ROLE IN MAINTAINING THE STRUCTURAL INTEGRITY OF THE FOOD.

COOLING-PHASE EFFECT - THE PRODUCT STARTS COOLING DOWN WHEN IT IS REMOVED FROM THE FRYER AFTER FRYING IS COMPLETE. THIS LEADS TO A DECREASE IN INTERNAL PRESSURE AND WATER VAPOUR STARTS CONDENSING. OIL ADHERED TO THE FOOD IS THEN SUCKED IN DUE TO THE 'VACUUM EFFECT' CREATED. OIL UPTAKE IS A SURFACE PHENOMENON THAT INVOLVES EQUILIBRIUM BETWEEN ADHESION AND DRAINAGE OF OIL AS THE FOOD IS REMOVED FROM OIL BATH. HERE SURFACE PLAYS AN IMPORTANT ROLE AS OIL UPTAKE AND ITS DISTRIBUTION ARE DETERMINED BY THE CRUST MICROSTRUCTURE DEVELOPED DURING THE FRYING PROCESS. THE VISCOSITY OF OIL INCREASES WITH INCREASED FRYING TIME DUE TO THE FORMATION OF VARIOUS POLYMERISATION PRODUCTS.

SURFACE-ACTIVE AGENTS - WITH THE PROGRESS IN THE FRYING PROCESS, OIL DEGRADES AND CHANGES FROM A PURE MIXTURE OF TRIGLYCERIDES TO A MIXTURE OF A VARIETY OF COMPOUNDS. WATER EVAPORATING DURING FRYING CAUSES HYDROLYTIC REACTIONS WHICH CLEAVE THE BONDS BETWEEN GLYCEROL AND FATTY ACIDS. HIGH FRYING TEMPERATURE ACCELERATES HYDROLYSIS AND SUBSEQUENTLY FORMS- DIGLYCERIDES, MONOGLYCERIDES, FATTY ACIDS AND GLYCEROL. THE MONO AND DIGLYCERIDES ARE SURFACE ACTIVE AGENTS AND POLAR COMPOUNDS THAT INCREASE THE FOAMING TENDENCY OF FRYING OIL. FOAMING ENTRAPS STEAM BUBBLES RELEASED FROM FOOD FOR A LONGER PERIOD AND ACCELERATES THE HYDROLYTIC REACTIONS. SURFACTANT FORMATION AFFECTS HEAT TRANSFER AT THE OIL-FOOD INTERFACE AND REDUCES SURFACE TENSION BETWEEN THE TWO IMMISCIBLE MATERIALS, THEREBY ENHANCING THE CONTACT BETWEEN THE FOOD AND FRYING OIL, RESULTING IN ABSORPTION. AS CONTACT TIME INCREASES, THE FRYING OIL INCREASES MORE HEAT TRANSFER TO THE FOOD CAUSING HIGHER DEHYDRATION AT THE SURFACE AND WATER MIGRATION FROM THE CORE TO THE EXTERIOR.

THUS, HIGHER SURFACTANT CONCENTRATION PRODUCES OIL-SOAKED PRODUCTS WITH AN OVERCOOKED EXTERIOR AND UNDERCOOKED INTERIOR.

MOULISHA ROY
1 MCHE



Drugs show their action depending on age/sex/race

Myth or Fact?

Yes it is a fact. The age, sex, race etc. affect the rate of metabolism of the medicine we take, in fact it differs from person to person based on various aspects like ADME (Absorption, Distribution, Metabolism, Excretion) properties which depend on log P, pH, solubility, size of the molecule, stability etc. The various drugs we consume have various above mentioned properties and thus this one of the reasons why certain drugs are taken orally, some are taken through intravenous, some are taken in form of syrups or drops etc. This is also one of the reasons why some of the drugs designed elsewhere in world may not work exactly as expected, to the patients here in India.
The metabolism rate in elderly people and infants is irregular and not similar to the one of healthy adult. Thus the rate at which the drug is available in their body varies.
Women are slower alcohol metabolizers than men.
Therefore the way certain drugs are metabolized will vary depending on the sex. If the patient has a very complicated medicinal history with allergies, then extreme care should be taken while administering the drugs as their body may react very differently to the drug, harming themselves. In some other cases there are chances of drug combining with other drugs taken for other purposes and may increase the bioavailability for the drug, thus it is very important to know the clinical or physiological conditions of the patients.

Certain drugs, for example Ioniazid (an Antitubercular drug or an anti tuberculosis drug) varies their bioavailability based on the race. This drug in Africans and Caucasians will remain in their blood for long duration as they are known to be "Slow acteylaters" and may cause an increase in drug toxic reactions whereas the Asians who are "Rapid Acetylaters" will tend to have less or absence of drug toxic reactions.

Syrups are administered to kids or at certain times even to adults instead of tablets as the absorptivity is increased manifold and thus the drug reaches its target site much faster and thus would show its effect quickly and therefore the disease or the symptom would reduce at a faster rate.

Recently there is an emergence of the concept of personalized or precision medicine which caters to the need of individual patient and corresponding drugs and doses are administered to minimize the side effects and increase their lifespan. Our response to drugs is determined by our genotype thus analyzing our genotypes could give better drugs. Therefore designing the drugs through modern ways for Indians or Asians should be done here rather than abroad to minimize unwanted results in drug administration. Thus BE AWARE of the drugs you consume.

Vibha S.
1 MCHE

ARTIFICIAL LEAF

Artificial leaf is a silicon-based device that uses solar energy to split hydrogen and oxygen in water, thereby producing hydrogen energy in a clean way, leaving virtually no pollutants. The technology, which was designed to simulate the natural energy-generating process of photosynthesis used by plants, was first successfully developed by American chemist Daniel G. Nocera and his colleagues in 2011.

The basic component of an artificial leaf is a silicon chip that is coated with chemical catalysts, that speed up the water-splitting reaction. In an open vessel of water, when solar energy hits the chip, a chemical reaction similar to photosynthesis occurs—the hydrogen and oxygen molecules of water are split apart, resulting in the separation of protons and electrons. The protons and electrons are captured on the chip and are recombined to form hydrogen gas, which can be used for immediate generation of electricity or stored for later use.

Challenges of this technology accounts to the poorefficiency, concerns about the safety of hydrogen fuel storage andremaining potentially expensive.

SANDRA JOSE
1MCHE

The Chemistry Behind Curls

All women have a love-hate relationship with their hair. It's extremely hard to understand the behavior of our hair. Someday, its straight and on others, they tend to curl. To some extent, the shape and structure of our hair is predetermined by our genes. According to a study, it has been reported that heritability of waves and curls is about 85-95%.

If we look at the chemical structure of hair, it is made up of protein chains held together by series of physical and chemical bonds which give the hair its shape and strength. While styling the hair, the side bonds of the hair play an essential role. Breaking and reforming these side bonds allow us to rearrange the pattern of hair. There are two types of side bonds: physical and chemical side bonds. The physical side bonds can be easily broken by heat and water. That's why when we tie our hair in a particular pattern and blow dry them, they tend to reform into curls. However, for perming the hair, the chemical bonds must be broken, by a chemical reaction called "reduction".

For permanent curls, the reduction process involves addition of hydrogen. The disulfide bonds join one sulfur of one polypeptide chain to another sulfur atom on a different polypeptide chain. For perming the hair, saloons use reducing agents containing thiol compounds, which break the disulfide bonds by adding a hydrogen atom to each of the sulfur atoms within the disulfide bonds. When the disulfide bonds are broken, the polypeptide chains are able to form a new shape. The broken disulfide bonds are reformed through a process called "neutralization" of the thio compound. The most common neutralizer is hydrogen peroxide and the chemical process that removes the hydrogen atoms and reforms the disulfide bonds is called "oxidation", to give you permanent curls.

Debarati Bhowmik
1 MCHE

Dwindling Arts and Advancing Science

Imagine a world with all the technological devices you dreamt of, but none of the entertaining aspects of today's entertainment sector. Would you be happy, and would you be able to live in such a world? That would happen if science was given more importance than the arts we've taken for granted.

With scientific advancements made as the days' progress, we tend to forget an area of life which is equally important. A question that needs to be answered without delay is the reason behind our negligence in the field of arts that many of us enjoy.

Before talking about the negligence of arts and the favouring of sciences, a proper distinction of what I mean by science and arts has to be mentioned to avoid any misunderstandings. Science could be used to mention all discoveries and inventions used to help man live in a better way. For me, things like paintings, literature, movies and standup comedy all fall under the umbrella of arts.

Science and art are two fields filled with abundant talent, but art isn't given its proper credit. Their contributions to each other are what one can call two sides of the same coin. In a hectic world of science, art gives the much-needed break, while science pulls us back to reality.

Focusing on the real situation and not just questions to be asked, it can be easily found that many students who have a leaning towards the arts are not backed by their parents. Parents want their children to pursue something in the realm of science, mainly the STEM (Science, Technology, Engineering and Mathematics) subjects. Since then, science has been consciously manoeuvering through those interested in the field, while many forced faces also show up for the college classes. On the other hand, numbers for art courses have dropped throughout the years.

Being people who enjoy artistic works as well as using country-wide technological improvements it becomes a shame on those who let art colleges to dwindle out into oblivion.

Labeeb Ajmal T
4 PCM

FIND THESE FAMOUS SCIENTISTS IN THE CROSSWORD

Abegg	Arrhenius	Avogadro	Baeyer	Berzelius	Bosch	Boyle	Bronsted
Bunsen	Cavendish	Curie	Dalton	Davy	Dewar	Dow	Erlenmeyer
Fischer	Gay lussac	Gibbs	Goldschmidt	Haber	Hahn	Hess	Hodgkin
Kekule	Lavoisier	Lewis	Mendeleev	Moissan	Nobel	Paracelsus	Pasteur
Pauling	Perkin	Priestley	Sanger	Scheele	Seaborg	VantHoff	Wohler

R	K	D	F	E	H	H	B	C	B	S	G	B	S	S	V	H	C	B	E
L	E	S	I	S	H	H	A	U	R	L	L	O	I	E	S	E	O	G	R
E	D	L	L	H	N	A	E	B	N	O	N	Y	B	V	D	A	R	V	I
E	E	R	H	M	P	P	R	I	E	S	T	L	E	Y	I	O	A	S	S
R	T	A	H	O	D	I	E	R	R	R	E	E	R	G	B	E	W	T	E
Y	S	O	S	I	W	W	Y	M	H	U	L	N	Z	A	E	M	E	Y	H
E	N	F	I	S	C	H	E	R	H	E	C	E	E	Y	S	N	D	E	V
G	O	L	D	S	C	H	M	I	D	T	N	S	L	L	E	I	E	B	H
I	R	E	N	A	U	L	N	N	B	S	W	I	I	U	O	K	E	K	B
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S	S	S	A	N	G	E	R	E	I	S	I	O	V	A	L	P	K	L	Y
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U	L	K	N	E	S	S	I	E	F	A	A	D	D	I	Y	Y	V	A	D
B	I	E	S	T	H	E	A	V	O	N	D	K	I	E	0	V	N	S	D
L	S	N	G	M	R	O	R	U	H	S	S	G	E	A	S	L	O	U	R

GOOD LUCK!

Sneha
1 MCHE