Patrika

July 1987 No. 15 Newsletter of the Indian Academy of Sciences

53rd Annual Meeting

At the invitation of the National Geophysical Research Institute and the Regional Research Laboratory, Hyderabad, the 53rd Annual Meeting of the Academy will be held at Hyderabad from Saturday 7 November to Monday 9 November 1987.

The tentative scientific programme for the Meeting consists, as usual, of scientific symposia, evening lectures and a series of lecture presentations by Fellows and Associates of the Academy.

The two specialized symposia are on "High Temperature Superconductivity" and on "Frontiers in Chemical Sciences". E V Sampathkumaran of TIFR, Bombay, G V Subba Rao of IIT, Madras, A V Narlikar of NPL, New Delhi, G Baskaran of Matscience, Madras and P Ganguly of IISc, Bangalore are expected to speak in the Symposium on "High Temperature Superconductivity".

The speakers for the Symposium on "Frontiers in Chemical Sciences" are:

G Mehta – New strategies in organic synthesis

P Balaram – Approaches to the chemical synthesis of an artificial protein

K N Ganesh – Synthesis, spectroscopic and structural studies of short DNA fragments

B Venktaraman – Study of fast chemical reactions

B Bagchi – Theory of chemical reactions in the absence of a barrier

There will be 14 lecture presentations by Fellows and Associates:

Two-dimensional NMR spectroscopy – Anil Kumar

Some problems in Riemann Zeta function – R Balasubramanian

Unequal reactivity condensation polymerizations – S K Gupta

On the use of size-extensive and size-consistent models in quantum chemistry – D Mukherjee

Defects in liquid crystals – G S Ranganath

Thermodynamic and conformational analysis of the carbohydrate binding by *Artocarpus* lectin reveals its unique specificity for Thomsen-Friedenreich tumor antigen – A Surolia

Emerging concepts in fluorosis research – A K Susheela

Studying star formation through infra red – S N Tandon

Modelling and control of automated manufacturing systems – N Viswanadham

Solar seismology – H M Antia

Novel electronic effects in radicals and radical ions – J Chandrasekhar

Experiments on a single layer of electrons – Ravi Mehrotra

New dynamical experiments with spin glasses – A K Raychaudhuri

The stability of solidification microstructures – J A Sekhar

All Fellows and Associates attending the Annual Meeting will be paid first class return railway fare from their place of residence to Hyderabad and back, in case they are unable to obtain travel support from other sources. Arrangements for the stay of the Fellows and Associates will be taken care of by the local organizers.

During the period of the Annual Meeting, the Editorial Boards and Sectional Committees will also meet at Hyderabad.

Evolution in Astronomy and Biology

Academy Lecture given by Prof Fred Hoyle at Bangalore on 23 February 1987

Prof Fred Hoyle is well known for his fundamental contributions to astrophysics and cosmology and for his brilliant and thought-provoking writings. Most recently, he has proposed a new picture of the origin and development of life, which challenges long-held beliefs in biology and astronomy. These new views formed the subject of his Academy lecture.

The textbook picture has an evolutionary tree rooted in a single origin of life on earth, branching out by random mutations and natural selection to its present diversity and complexity. Prof Hoyle started his lecture by pointing out that the evidence for this tree from the fossil record is extremely weak, especially at the vital branching points. The broad chemical similarities of different life-forms should rather be regarded as evidence of a common pool of components. For example, arthitectural forms show similarities arising from common materials rather than a single origin.

Even within the conventional view of evolution, the need for swift changes rather than slow drift is increasingly being recognized. On the new view, this can be compared to the incorporation of new subroutines into an existing computer program which can produce dramatic changes. The components are to be identified with the sea of viruses which surround and invade all other forms of life. Modern genetic engineering is, in fact, based on the possibilities of incorporating new genetic material into old, to an extent which could not have been foreseen a generation ago. While most of the changes produced in this way could have negative effects, the new successes would pass into evolutionary history as new forms. This scenario squarely confronts the incredible complexity of the present day life, which Prof Hoyle suggested is a major difficulty with the conventional mutation/selection thesis.

A remarkable aspect of virus infections such as influenza has been noted in some studies in the medical literature. The probability of a person catching the infection is not significantly increased by another case in the same house or by living in the more crowded environment of a city rather than the country. Direct spread from person to person cannot explain these facts, and would further imply an extreme all or nothing' infection rate in environments, such as boarding schools, which is contrary to fact. The large scale mingling of people from remote corners of the globe in airliners would again lead to a disastrous spreading, if the mechanism were contact. Prof Hoyle strongly advocated the alternative view that the viruses rain down from the upper atmosphere. This could explain the well known cyclic annual variation of the infection rate, with a peak in winter in both hemispheres. Separate studies suggest that this is not a temperature effect and could therefore be directly correlated with atmospheric mixing. It is at this point that astronomy comes in. The earth sweeps up a thousand tons per year of interplanetary materials and a significant fraction could be of biological origin. Studies of interstellar and interplanetary matter rest heavily on the characteristics of the radiation which it absorbs and emits, at infrared wavelengths. Recent observations include matter ejected from the nucleus of Comet Halley and that surrounding the so-called Trapezium Star cluster in Orion. In both cases, Prof Hoyle felt that the organic material, proposed by himself and Wickramasinghe, gave a significantly better account of the observations than alternatives such as silicates. A related and much older problem is the wavelength dependence of the extinction of starlight by interstellar dust. Prof Hoyle recounted how the main stumbling block had been the need for a low average refractive index and the crucial step was the realization that dried-out bacteria have just this property. The final picture which emerges is an interstellar medium with significant quantities of material, which is biological in origin. The formation of stars is accompanied by clouds of comets, which provide a possible environment for amplification of this material, with the kind of efficiency that only biological processes can have. Much of this is recycled back into interstellar space by radiation pressure as the comets disrupt, while a small fraction finds a home in places like the earth.

Ending on an even more speculative note, Prof Hoyle stated that in his view, postulating separate origins for biological material even in different galaxies was unnatural. It must ultimately have a common cosmic origin, whose elucidation will prove to be one of the main tasks, if not the cornerstone, of any future cosmology.

The lecture was followed by a lively discussion including topics such as the Viking experiment on Mars and the evidence from protein sequences for evolution. What this summary cannot fully convey is the unique nature of the scientific enterprise which Prof Hoyle described, in which the stakes are nothing less than the entire universe.

Special Issues of Journals

Magnetism in Solids, January 1987 issue of the *Proceedings—Chemical Sciences,* Vol. 98, Nos. 1 & 2.

Magnetism in both its technological and academic aspects has sustained its growth and importance through the development of new materials, techniques and theories; and many new concepts such as dimensionality, super exchange, spin dynamics, magnetic order, etc have recently emerged. This special issue was compiled to project some of the present-day chemistry and physics behind magnetism and new experimental techniques, using low frequency EPR and neutron diffraction employed to establish magneto-structural correlations.

March 1987 issue of the *Journal of Biosciences,* Vol. 11, Nos. 1-4.

This special issue is dedicated to B K Bachhawat on his 60th birthday and contains 55 papers by scientists from India and abroad. The range of topics covered include: cell surface macromolecules and their interaction, interaction of purified enzymes and proteins with ligands, translational and transcriptional control, transport of small molecules across membranes, membrane architecture and small molecular interactions.

Reactions and Reaction Engineering, April 1987 issue of *Sādhana,* Proceedings in Engineering Sciences, Vol. 10, parts 1 & 2.

This special issue commemorates the 60th birthday of Dr L K Doraiswamy and is essentially a collection of eighteen specially invited research papers from scientists around the world on chemical reaction engineering, the field in which Dr Doraiswamy has made significant contributions. The papers cover areas ranging from the multiplicity and stability of chemically reacting systems, fluidized bed reactors, modelling of gas-solid catalytic and non-catalytic systems, parametric sensitivity in fixed bed reactors and catalytic deactivation, to other areas of chemically reacting systems which reflect modern trends in building innovative systems or constructing operational modes for "intensification", three-phase reactors in chemical industry and trickle bed reactors.

May 1987 issue of *Pramāna,* Journal of Physics, Vol. 28, No. 5.

This special issue is a collection of papers presented at the second Indo-Soviet Conference on Low Temperature Physics, held at the Institute for Physical Problems of the USSR Academy of Sciences, Moscow from 15-25 May 1986. The papers cover presentations on various topics in low temperature physics, which has interconnections with almost all branches of condensed matter and quantum phenomena.

June 1987 issue of the *Journal of Astrophysics and Astronomy,* Vol. 8, No. 2.

This special issue on nucleosynthesis in the galaxy from the study of low-mass stars is a collection of ten of the twelve papers presented at the meeting of the I.A.U. Commission 29 held at New Delhi on 27 November 1985, during the XIX General Meeting of the International Astronomical Union.

Hydrophobic Effect—June 1987 issue of the *Proceedings—Chemical Sciences,* Vol. 98, Nos. 5 & 6.

The importance of the hydrophobic effect began to be first realized in colloid chemical studies on the formation of soap molecule aggregates, and its role as a determinant in biopolymer structures was appreciated some thirty years ago. This issue is a 'Symposium in Print' by well-known workers in the field both in India and abroad, who did not formally meet but offered to contribute to a common theme.

Associates—1987

Chitra Sarkar, All India Institute of Medical Sciences, New Delhi — Neuropathology

P K Ghosh, Alchemie Research Centre, Thane — Chemistry of clays

J Gowrishankar, Centre for Cellular and Molecular Biology, Hyderabad —Molecular genetics

P K Gupta, National Chemical Laboratory, Pune — Plant tissue culture

D Home, Saha Institute of Nuclear Physics, Calcutta —Quantum mechanics

G Marimuthu, Madurai Kamaraj University, Madurai —Chronobiology

K Pande, Physical Research Laboratory, Ahmedabad —Geochemistry

R Pandit, Indian Institute of Science, Bangalore — Condensed matter theory

E V Sampathkumaran, Tata Institute of Fundamental Research, Bombay —Valence fluctuations in rare-earth systems

D D Sarma, Indian Institute of Science, Bangalore —Surface chemistry of intermetallics

G Sundararajan, Defence Metallurgical Research Laboratory, Hyderabad —Material deformation and fracture

S Vasudevan, Indian Institute of Science, Bangalore —Chemistry of layered compounds

Towards Quality with Social Justice

A letter to the President of the Academy from Prof P M Mathews, Fellow is reproduced below. The points raised by Prof Mathews are of great importance and the President would be glad to receive comments and constructive suggestions from Fellows and other scientists interested in the vital question of achieving quality in education with social justice.

Madras
20-2-1987

Dear Professor Siddiqi,

Thank you very much for your kind response to my letter.

The task of transforming the educational system of today into an approximation of what it should be is indeed a daunting one. But at least a serious attempt must be made to approach this task on scientific lines. My submission is simply that the Academy is far better situated than any other organisation to undertake this and to place a rational and at the same time reasonably workable scheme before the decision makers.

You have asked if I have any ideas to put forward. For the moment, I shall just enclose a copy of a short manuscript that I had prepared. I have refrained from putting down more specific proposals so as to avoid distracting attention from the concepts on which they are based. I look forward to hearing from you soon about your reaction to these basic ideas.

With kind regards,

Yours sincerely,
Sd/-
P M Mathews

Towards Quality with Social Justice in Education

Among the multitude of problems one is confronted with, while attempting to prepare a policy framework for education, there are two which appear to me to be among the most troublesome. Firstly, how does one resolve the crisis of quality in education? Secondly, how does one ensure social justice while doing this?

A system of higher education, whose products do not meet high standards of quality, offers very poor returns for the scarce resources invested in it, and cannot escape degeneration, which becomes progressively faster with time. On the other hand, a quality system in which all sections of society cannot participate equally is simply unacceptable.

If we are even to begin to move towards quality in education, we have to openly acknowledge the obvious—that it cannot be achieved or maintained without rigid insistence on the quality of teachers, as well as on the quality of students admitted (both in terms of intellectual abilities and aptitudes, and the requisite level of preparation). If such an insistence is to be acceptable to the society at large, mechanisms must first be set up which would ensure that this would not result in denial of social justice. To be more specific, the mechanism needed is one which would enable children who possess the innate abilities needed for higher studies – irrespective of the socioeconomic strata they belong to—to reach the portals of higher education, well-prepared to meet the demands of quality.

A passive scheme like the present scheme of reservations stops far short of doing this. It leaves the children from the poorer sections to swim or sink, while they try to struggle through the school system; to those few who manage to survive, it holds the doors of higher educational institutions wide open— whether or not they arrive there equipped or in fit condition for the further arduous journey which awaits them. One has to move forward from such a scheme to a new programme, with a commitment to *actively seeking out* the best from everywhere and nurturing them all the way. Without this, the demands of social justice would remain incompatible with quality in education.

What should the essential ingredients of such a new programme be? Firstly, "nurturing" must necessarily include financial assistance (scholarships) which may, to a poor youngster, mean all the difference between dropping out and staying on. Secondly, the support must go to the best students *in every given local environment,* and for this purpose I would consider the school as the relevant unit. Granting the premise that all are born equal, it must be presumed that the distribution of *inborn* abilities must be the same among the children of every typical school. On this basis, I would propose that the scholarships should be made available to the *same proportion* of students in every school. (This may mean that a child in an "ordinary" school, who has "achieved" less than a child of the same intrinsic ability in an "elite" school, may be in the top scholarship eligible bracket in his own school, while the latter is not; this kind of "compensation" for the economic and environmental handicaps of the former, relative to the latter, should be explicitly welcomed). Thirdly, the helping hand to the bright ones must be offered from as early a stage of schooling as possible. Nothing can serve better to induce a motivation for effort in later life, than enabling

one to see from an early age that good performance, even in one's own restricted environment, is encouraged and rewarded. By the same token, facilities granted to whole sections of society without any demand of performance can only propagate a "something-for-nothing" culture, which will be self-defeating in the long run.

The essential purpose of the whole scheme is to see that within a few years, it should become possible to insist that only capable and well-prepared students would be admitted for higher education, with a confidence that this would not result in any section of society being left out in the cold. Till then, talk of improving the quality of education is fruitless. Till then, any meaningful reform of the examination system or attempt to beef up standards, will necessarily result in a steep rise in drop out and failure rates, which society is unlikely to tolerate.

Let us turn now to the second requirement for quality, namely quality teachers. In this context, it is extremely important to note that complete inbreeding is an essential and inescapable feature of the educational system as a whole. Teachers who are to man the system tomorrow are, of necessity, products of the very same system of today. It is surprising that one finds this fact hardly ever mentioned, despite its profound consequences. The laws of genetics say that in an inbred system, any weakness gets amplified in succeeding generations till the system becomes unfit to survive. It takes little imagination to see that the educational system is not immune to these laws.

A second point, which also seems little appreciated, is that the quality of College and University teachers is crucial for the health of the entire educational system. This is because they, especially PG level teachers, are the ones who determine the final level of preparation and knowledge of those who complete their PG degrees and enter the teaching profession soon afterwards. It is also to be noted that more teachers-to-be pass through the hands of a PG teacher in a couple of years, than perhaps in a lifetime through the hands of an elementary school teacher, and therefore their impact *on the system itself* is correspondingly greater.

Let me take it then that there will be no question about the need for insistence on higher quality, while choosing persons for appointment as teachers. But this by itself is far from sufficient. Let me pose the question. What fraction of the College and University teachers will be able to claim that they know today all that they learned in their own subject as PG students? Of these, how many can state with confidence that they know enough to get a first class or even a pass in all the papers in the PG examinations in their own respective subjects today? I will leave these questions unanswered and simply go on to assert that the only way to build up and maintain a high quality teaching body is by building into the system a scheme of incentives and rewards which would make it *natural* for those teachers, who are capable and interested, to keep deepening, expanding and updating their knowledge and skills. Specifically, each teacher should have the opportunity, if he so desires, to prove himself once every few years throughout his service and to earn stipulated rewards, these rewards must be on an increasing scale with each successive proof of quality. The rewards could be monetary (e.g. a lumpsum reward the first time, an extra increment in salary the next time etc) or in terms of academic privileges (e.g. examinerships, eligibility to be question paper setters etc may be reserved for those who have proved themselves one or more times), or a combination of the two. Once the incentives are there as a catalytic agent, refresher courses, summer courses etc will cease to be lukewarm affairs and will begin to work wonders. Incidentally, I may mention here my conviction that requiring teachers to acquire a one-time additional qualification will do very little good in the long term: the threat of penalties may produce the appearance of compliance, but what is accomplished in reality will be very little and evanescent at that.

In closing, I would like to add that I have refrained from suggesting specific mechanisms for implementation of the above schemes, not for want of ideas, but because I do not want to distract attention from the concepts propounded which would first need to be accepted. The concepts themselves are clearly elitist, but with an elitism based not on social background or money power but on the intellectual and physical endowments conferred by Nature on the individual. Srinivasa Ramanujan's genius could not be stifled by poverty, but there are millions of children scattered around our urban slums, as well as in our farms and villages, with enough native talent to carry them through to the highest levels of education, whose futures have been crushed by the burden of their bondage to poverty and ignorance and social backwardness. If a new education policy can now begin to enable them to start thinking of their talents as something of value, then they can begin to dream of a better future at least by the time we enter the twentyfirst century.

Ninth Annual Meeting

The Ninth Annual Meeting of the Academy was held, jointly with that of the National Academy of Sciences, at Hyderabad from 26 to 28 December 1943. The session was attended by 32 Fellows and a large number of delegates from different parts of India.

The Inaugural Function, held at 10 AM on Sunday, 26 December at the Town Hall, Public Gardens, Hyderabad, was inaugurated by his Highness the Prince of Berar. Prof Mohd Abdur Rahman Khan, President of the Hyderabad Academy and Chairman of the Reception Committee, welcomed the Fellows and the delegates for the Session. Sir C V Raman then delivered the Presidential address on "The Fundamentals of Crystal Physics". Prof Birbal Sahni, on behalf of the Indian Academy of Sciences and the National Academy of Sciences, thanked the Hyderabad Academy for their kind invitation to hold the Joint Session of the Academies at Hyderabad, and the Reception Committee and public of Hyderabad for their having been able to invite the two Academies to hold a Joint Session at Hyderabad and to have secured an opportunity to listen to the discourses of some of the leading scientists of India.

The Inaugural Function was followed by a Symposium on "The Electronic Constitution of Solids", at the Nizam College from 11.30 AM. The Symposium was opened by an address by Prof K S Krishnan and papers by three authors were read and discussed.

A scientific meeting of the Physico-Mathematical Group was held at the Nizam College in the afternoon. The meeting was presided over by Prof K S Krishnan. Eight papers were read and discussed and five were taken as read.

At 6 PM the Exhibition Committee was "At Home" to the Fellows and the delegates. At 7 PM Sir C V Raman delivered a Public Lecture on "Diamond—the Prince of Solids" at the Town Hall, Public Gardens, Hyderabad.

On Monday, 27 December, a Symposium on "The Natural Resources of the Deccan" was held at the Nizam College, from 9.30 AM. The symposium was presided over by Prof Birbal Sahni, FRS. Eight papers were read and discussed. Seven papers were taken as read.

The Business Meeting of the Academy was held at the Nizam College in the afternoon. 25 Fellows were present at the Business Meeting. Sir C V Raman, the President, was in the Chair.

The Secretaries' Report for the year 1943, which had already been circulated, was taken as read. Prof Birbal Sahni moved the adoption of the Report and Prof T R Seshadri seconded the motion. The Report was then thrown open for discussion. Prof T R Seshadri enquired about the position of the election of new Honorary Fellows. The President informed him that owing to the unsettled conditions on account of the war, it was felt that it would be preferable to defer the elections of new Honorary Fellows till the end of the war. The Secretaries' Report was then adopted.

Dr N S Nagendra Nath and Dr P Suryaprakasa Rao were appointed scrutators for scrutinising the voting papers relating to the election of Fellows and Professors K B Madhava and C S Pichamuthu as scrutators for scrutinising the voting papers relating to the election of Office-bearers and the Members of Council for the period 1943-46. The following were elected as Fellows:

1. Major Inderjit Singh, Officer-in-charge, Brigade Laboratory, Allahabad.

2. Dr R S Krishnan, Physics Department, Indian Institute of Science, Bangalore.

3. Prof G P Majumdar, Professor of Botany, Presidency College, Calcutta.

4. Dr G V L N Murthy, Research Chemist, Tata Iron and Steel Works, Jamshedpur.

5. Prof L Narayana Rao, Professor of Botany, Central College, Bangalore.

6. Dr V Ramaswami, Head of the Department of Mathematics, Andhra University, Guntur.

7. Dr K L Ramaswamy, Superintendent of Works, Mysore Chemicals and Fertilisers Ltd., Belgola.

8. Prof K P Rode, Head of the Department of Geology, Andhra University, Guntur.

9. Dr U Sivaraman Nair, Assistant Professor of Mathematics, University College, Trivandrum.

10. Prof K Sreenivasan, Head of the Department of Electrical Technology, Indian Institute of Science, Bangalore.

11. Prof C S Venkateswaran, Professor of Physics, University of Travancore, Trivandrum.

12. Dr Muhammad Zaki Uddin, Senior Lecturer in Physics, Muslim University, Aligarh.

The following office-bearers were elected:

President:

Rajasabhabhushana Sir C V Raman

Vice Presidents:

Dr H J Bhabha

Diwan Bahadur Dr K R Ramanathan

Prof Birbal Sahni

Lt Col S S Sokhey

Secretary for Section "A"

Prof B S Madhava Rao

Secretary for Section "B"

Principal A Subba Rau

Treasurer:

Prof B Sanjiva Rao

Members of Council:

Principal S Bhagavantam

Lt Col S L Bhatia

Prof R Gopala Aiyar

Prof K S Krishnan

Prof A Narasinga Rao

Rajasevasakta Dr B K Narayana Rao

Prof S Ramachandra Rao

Mr B Rama Rao

Prof L Rama Rao

Prof T R Seshadri

Prof Shri Ranjan

Prof M R Siddiqi

Dr S Siddiqui

Sastravaidyapravina Dr S Subba Rao

Dr K Venkataraman

Prof K S Krishnan moved that the following rule be added to the existing rules regarding the subscription of Fellows of the Academy:

> "Any Fellow of the Academy who is also a Fellow of Academies or Institutes, as may be recognised for this purpose from time to time, shall be entitled to a rebate of 25% in the annual subscription payable to the Academy. For the purpose of this rule, only those Academies or Institutes will be recognised that will allow a similar rebate in the subscriptions to be paid to them by such of their Fellows as are also Fellows of the Indian Academy of Sciences".

Prof B Sanjiva Rao seconded the resolution.

The resolution was unanimously adopted.

By the vote of those present, the meeting then resolved itself into a joint meeting of the Fellows of the Indian Academy of Sciences and the National Academy of Sciences, with Sir C V Raman as the Chairman of the joint meeting.

The following resolutions were unanimously adopted:

1. The Fellows of the Indian Academy of Sciences and the National Academy of Sciences desire to convey to the President and members of the Hyderabad Academy their cordial appreciation of the action of the Hyderabad Academy in having invited the Indian Academy of Sciences and the National Academy of Sciences jointly to hold their meeting at Hyderabad. They also wish to express their great appreciation of the excellence of the arrangements made for the conduct of the meetings, which contributed greatly to the success of the Session.

2. The Fellows of the Indian Academy of Sciences and the National Academy of Sciences desire to convey to the Chairman, to the Secretary and to the Members of the Reception Committee their grateful appreciation of the welcome given to them and of the many acts of kindness and hospitality which made their stay at Hyderabad most pleasant and agreeable.

3. The Fellows of the Indian Academy of Sciences and the National Academy of Sciences wish to express to Prof M R Siddiqi the great appreciation of the initiative he took in the matter of arranging for a joint meeting of the two Academies at Hyderabad. They also wish to convey to him their warmest appreciation of the labour and thought he devoted to the work of organising the Session.

4. The Fellows of the Indian Academy of Sciences and the National Academy of Sciences desire that their cordial thanks be conveyed to Rao Sahib T P Bhaskara Shastry for the great personal interest he took in making the arrangements for the Joint Annual Session and providing for the comfort of the Fellows and the delegates during their stay at Hyderabad.

This was followed by a Scientific Discussion on "Recent Advances in the Chemistry of Natural Fats and Waxes" at the Nizam College, from 4 PM. The discussion was presided over by Prof T R Seshadri. Prof Seshadri gave an introductory address and this was followed by the reading of three papers and the discussion thereon. At 6 PM the Reception Committee was "At Home" to the Fellows and delegates.

At 7 PM Prof Birbal Sahni delivered a Public Lecture on "The Scientific Study of Scenery" at the Town Hall, Public Gardens.

On Tuesday, 28 December, the Scientific Meeting of the Biological Group was held at the Nizam College, from 9.30 AM to 12.30 PM and 2.30 PM to 4 PM. Prof Birbal Sahni presided over the meeting and opened the meeting with his address on "The Age of the Salt in the Salt Range, in the light of Recent Evidence". Fourteen papers were then read and discussed: 23 papers were taken as read. The Scientific Meeting of the Chemical Group was held at the Nizam College, from 4 PM to 6 PM the same afternoon. Prof T R Seshadri presided over the meeting. Four papers were read and discussed. Nine papers were taken as read.

At 6 PM, Prof M R Siddiqi was "At Home" to the Fellows and delegates. At 7 PM Prof K S Krishnan delivered a Public Lecture on "Form and Symmetry in Nature".

At the conclusion of the lecture, which was the last item for the Session, Sir C V Raman expressed the grateful thanks of the Indian Academy of Sciences and the National Academy of Sciences for the kind invitation extended by the Hyderabad Academy for holding the Joint Session and expressed appreciation of the hospitality and the co-operation of the Hyderabad Public and also thanked the volunteers for their excellent service. With Prof Mohd Abdur Rahman Khan's vote of thanks to all those that contributed to the success of the Session, the Session was dissolved.

Obituaries

Prince **Louis de Broglie** was the first to develop the principle that an electron or any other particle can be considered to behave as a wave as well as a particle. This wave-particle duality is a fundamental principle governing the structure of the atom, and for its discovery de Broglie was awarded the 1929 Nobel Prize in Physics.

Louis de Broglie was born in Dieppe, France, on 15 August 1892, the second son of a noble French family. In 1909 he entered the Sorbonne in Paris to study history. It had been his intention to enter the diplomatic service but he became so interested in scientific subjects, partly through the influence of his elder brother Maurice, whom he helped in his extensive private laboratory at the family home, that he took a physics topic for his doctoral dissertation rather than one on French history.

At the University of Paris, de Broglie received his *Licencié ès letters* (1910), *Licencié ès sciences* (1913), and *Docteur ès sciences* (1924). He stayed on at the Sorbonne until 1928 but moved to the Henri Poincaré Institute in 1932 as Professor of Theoretical Physics, retaining this position until 1962. From 1946 till his death he was a senior adviser on the development of atomic energy in France.

In 1922, de Broglie had derived Planck's formula $E=h\nu$, where E is the energy, h is the Planck's constant and ν is the frequency of the radiation, using the particle theory of light. This probably suggested the idea of wave particle duality to him, because it prompted the question of how a particle could have a frequency. Using this idea and Einstein's mass energy equation $E=mc^2$, he derived $E=mc^2=h\nu$. Now, mc is the momentum of the particle and C/ν is the wavelength λ of the associated wave, which later came to be known after him. Hence the momentum $=h/\lambda$. This relation between the momentum of the particle and the wavelength of the associated wave is fundamental to de Broglie's theory.

The extension of this idea from light particles (photons) to electrons and other particles was the next step. Niels Bohr, in his model of the atom, found that the angular momentum of an electron in an atom must be $nh/2\pi$, where n is a whole number. de Broglie showed that this expression for the angular momentum of the electron could be derived from his momentum-wavelength equation, if an electron wave exactly makes up the circular orbit of the electron with a whole

number of wavelengths and produces a standing wave i.e. $n\lambda = 2\pi r$, where r is the radius of the orbit. de Broglie's idea gave a further explanation of Bohr's model of the atom.

If particles could be described as waves, then they must satisfy a partial differential equation known as a wave equation. de Broglie developed such an equation in 1926, but found it in a form which did not offer useful information when it was solved. A more useful wave equation was developed by Erwin Schrodinger later in 1926. de Broglie himself, however, drew immense satisfaction in having induced Schrodinger to formulate a new branch of mathematics called wave mechanics.

de Broglie's momentous hypothesis remained ignored until Einstein noticed its true worth and went on to extend the basic concept to all matter. When his theories found experimental substantiation in 1927, in the works of Davisson and Germer, and George Thomson, who independently produced electron diffraction patterns, recognition and accolades were not slow in coming.

He was elected to the French Academy in 1944, to the US National Academy of Sciences in 1948, to the Indian Academy of Sciences in 1951, to the Royal Society of London in 1953, and to the American Academy of Arts and Sciences in 1958.

Throughout his life, de Broglie was concerned with the philosophical issues of physics and wrote a number of books on this subject. He pondered whether the statistical results of physics are all that there is to be known or whether there is a completely determined reality, which our experimental techniques are as yet inadequate to discern. During many of his years as a professional scientist, he inclined to the former view but his later writing suggests his belief in the latter.

He wrote several books, *Matter and Light: The New Physics, New Perspectives in Physics, The Current Interpretation of Wave Mechanics: A Critical Study, La thermodynamique de la science* and edited *Wave Mechanics and Molecular Biology.*

He passed away on 23.3.1987.

Bangalore Srinivasarao Madhavarao was born on 29 May 1900 at Chamarajanagar in Mysore District. He took his Bachelor's degree in Mathematics with a first class, coming first in the Mysore University. He obtained his Master's degree in 1921 and the D. Sc. degree with his thesis "Born's nonlinear field theory" in 1938, both from the Calcutta University.

He spent the first few years of his academic career teaching pure and applied mathematics and engineering mathematics in the Central College, Bangalore. He collaborated closely with Prof Max Born, Prof Sir C V Raman and Prof H J Bhabha during the forties and published over 50 research papers on the geometry of curves, analytical dynamics, Born's electromagnetic field theory, quantum mechanics and on the theory of elementary particles. He was the first to prove the inadequacy of the neutrino theory of light and he discovered a new type of algebra related to elementary particles referred to as "Madhavarao algebra" and "Madhavarao ring". He was awarded the Ramanujan Prize of the Madras University for this work in 1945. He was also the author of "Madhavarao's theorem on apolar cubics" and "Madhavarao's action functions".

After a long and distinguished career as Professor of Mathematics and later Principal of the prestigious Central College, Bangalore from 1921-1955, he joined the Indian Institute of Armament Technology, Poona in 1955 as Professor of Ballistics. He was Lokamanya Tilak Professor of Applied Mathematics at the University of Poona from 1960-1965.

He was closely associated with the Centre for Theoretical Studies at Indian Institute of Science, Bangalore from 1966 till his death, first as a CSIR Scholar and later as Associate.

A keen sportsman, he captained the Mysore University Hockey Team and was champion in tennis both at Bangalore and Poona. He took keen interest in all sports and was actively associated as President and Vice President of various State hockey, lawn tennis, table tennis and basketball associations.

Active to the end he passed away at Bangalore on 10 June 1987. He leaves behind his wife, five daughters and two sons.

Salim Moizuddin Abdul Ali, world renowned ornithologist and naturalist, died on June 20 1987, at his residence in Pali Hill, Bombay.

Born on November 12, 1896 in Kehtwadi in Central Bombay, he lost his father when he was just one year old. His mother Zeenat-un-Nissa died two years later. The youngest in a family of five brothers and four sisters, he was brought up by his maternal uncle Mr Amiruddin Tyabji and his wife Hamida Begum.

His interest in ornithology began accidentally in 1908, when he was 12. During his school days he shot a yellow-throated sparrow with an airgun. The yellow throat of the bird baffled the young boy who could not

identify the bird. He went to his uncle, who sent him along to the Bombay Natural History Society (BNHS) where he met the Honorary Secretary Mr W S Millard who opened the world of ornithology to him. Thus began his life-long interest in birds and a life-long association with the BNHS of which he was the President for many years.

Explaining his interest in birds he wrote in his delightful autobiography "The Fall of a Sparrow" (1985), "As a boy I had found it far pleasanter to be chasing birds in pleasant places than doing ridiculous sums in elementary mensuration in the classroom. Since then I have watched birds through half a century and more, and chiefly for the pleasure and elation of the spirit they have afforded. Bird watching provided an excuse to go to the mountains or the jungles away from the noisy rough and tumble of the dubious civilization of this mechanical high-speed age. A form of escapism, may be, but one that hardly needs justification".

The path to ornithology was not easy. Since he was not interested in studies, he was sent to Burma in 1914 to join his brother in looking after family business interests. After the business was closed down in 1918, he returned to Bombay where he completed a year's formal course in commercial law and accountancy and also the B.A. (Hons.) course in Zoology under the stimulating tutelage of Prof J P Mullan. He also spent all the spare time he had in the Bombay Natural History Society's rooms familiarizing himself with Indian Birds. But having never acquired a formal degree he found it increasingly difficult to find suitable employment. He worked for a while in a clerical capacity and later as a guide lecturer in the Prince of Wales Museum. After 2 years he realized that his real metier was birds and applied for a year's training in systematic ornithology in the Berlin University Zoological Museum under Dr Stressmann, one of the leading ornithologists of the time, and was accepted.

On his return to India in 1930, having failed to find any employment anywhere, he moved with his wife Tehmina, whom he had married in December 1918, to Kihim in Raigad District. Here he carried out one of his greatest studies, the breeding habits of Baya weaver birds. This and his classic studies on bird pollinators were way ahead of ecological and behavioural studies at the time, not only in India, but the world over. He often used to admit to his friends that his inability to find a job was one of the luckiest things that ever happened to him.

While unemployed, at Kihim, the idea of regional ornithological surveys first came to him. Supported to a limited extent by the tradition of natural history amongst the princely houses of India, he started with the Nizam's Dominions in 1931, and conducted ornithological expeditions in most of the unexplored and little-known regions of the Indian subcontinent and the neighbouring countries, in Travancore and Cochin, Kathiawar, Western Himalayas, Sikkim, Bhutan and Arunachal Pradesh, Western Tibet and Afghanistan, Burma and Malaya. And with these surveys he established a solid basis for the systematic study of Indian birds over four decades, culminating in the monumental "Handbook of Birds of India and Pakistan". It was at his suggestion that the water bird breeding colony of Ranganthittu was set up as wild life sanctuary as early as 1942. Another early success was saving the Keoladav Ghana wetland at Bharatpur as a sanctuary. It was here that he carried out his pioneering investigations on bird migration. His most recent conservation campaign was saving the magnificent rainforests of Silent Valley.

Till the last, he did not lose his zest in life. In his late 80's he undertook a trek to Ladakh to study the black-necked crane. In 1985 he had planned a Himalayan expedition for the elusive mountain quail, but it fell through due to his indifferent health.

A legend in his lifetime, he was amongst the first to realize the plight of India's wild life and one of the earliest to begin a battle for nature conservation in our country. More than any other man, he is responsible for the present day consciousness for preservation in our country. Passionately interested in both birds and conservation, he wandered from place to place, studying birds and saving them from extinction. There is perhaps no place on the Indian subcontinent which he did not visit in pursuit of birds.

It was a struggle for him against heavy odds, in a society utterly indifferent to natural history and nature conservation. With his handful of students and a few others whom he inspired, he established a sound tradition of scientific study of living birds and animals and of a scientifically based conservation effort in the country.

Several national and international honours came to him for his single-minded pursuit of ornithology and conservation of wild life. He was awarded honorary degrees from many Universities. He was awarded the Joy Gobinda Law Medal in 1953, the Padma Bhushan in 1958, the Union Gold Medal of the British Ornithologists' Union in 1967, the John Phillips Memorial Medal for Conservation in 1969, the

Sunderlal Hora Memorial Medal in 1970, the Pavlosky Centenary Memorial Medal in 1973, the Paul Getty Wildlife Conservation Prize and Padma Vibhushan in 1976, the C V Raman Medal of the Indian National Science Academy in 1979, the Gold Medal of the Asiatic Society of Bangladesh in 1980, and the National Award for Wild Life Conservation of the Government of India in 1983. He was nominated a member of Rajya Sabha in 1985. He was elected a Fellow of the Academy in 1975 and was an Honorary member of almost all National Societies of Ornithologists in the world. He was President of the Bombay Natural History Society and Vice-Chairman of the Indian Board for Wild Life.

A man of wide culture, he was famous as much for the way he wrote about birds, as for the commensurate depth of his knowledge of avifauna. His books include *The Book of Indian Birds* (1941, now in its 9th edition), *The Birds of Kutch* (1945), *Indian Hill Birds* (1949), *The Birds of Travancore and Cochin* (1953) Second edition as *Birds of Kerala* (1969), *The Birds of Sikkim* (1962), *A Field Guide to the Birds of the Eastern Himalayas* (1977), *Handbook of the Birds of India and Pakistan* with Dhillon Ripley (1968-1974), and *Common Birds* with Laeeq Futehally (1967).

His wife Tehmina died in 1939. They had no children.

Nikolai Nikolaevich Semenov was born on 16 April 1896 at Saratov in Russia. After completing his education in Physics at the Petrograd University in 1917, he started research under Academician A F Ioffe at the State Physico-Technical Roentgen Institute, later the Leningrad Physico-Technical Institute, where he was chief of the Electronic Phenomena Laboratory from 1920-1931. He soon became interested in chemical processes. In 1927, he proposed the fundamental idea of branched chemical chain reactions to explain critical phenomena observed in his laboratory during the 1920's. Later he created a general theory encompassing both branched and unbranched chain processes. This discovery signified the beginning of the rapid development of a new field of science—chemical physics. All the investigations and results accumulated by the beginning of the 1930's were published in his famous monograph on "*Chain Reactions*" (1934). In 1931 he became the first Director of the Institute of Chemical Physics of the USSR Academy of Sciences.

The second stage of the investigations of chain reactions was a further development of the theory, in particular the study of the relationships between reaction rates and the structure of the reacting molecules. His second monograph on *Some problems of chemical kinetics and reactivity* was published in 1954.

He also took a leading part in the development of a number of new scientific fields such as fermentation catalysis, low temperature polymerization, fixation of nitrogen from the atmosphere, metal-complex catalysis etc. He was deeply interested in problems in molecular biology and bioenergetics and created a Department of Chemical Genetics in his Institute, where the work done led to remarkable developments in agriculture.

He was an excellent organizer. Several years after his Institute was transferred to Moscow, he started a new Division at Noginsk, which led later to the establishment of the Noginsk Scientific Centre of the USSR Academy of Sciences with many scientific institutes. Academician Semenov was Chairman of the Council of Directors of this Centre.

He also established within the Siberian branch of the Academy of Sciences, an Institute of Chemical Kinetics and Combustion. He was directly associated with the creation of the Kharkov and Tomsk Physico-Technical Institutes and the Institute of Chemical Physics of the Armenian SSR Academy of Sciences in Erevan. During the war he created the Department of Chemical Kinetics in the Moscow State University, of which he was the head till his death. From 1920-1944, he was lecturer and then Professor at the Leningrad Polytechnic Institute and played an active role in the creation of the Moscow Physico-Technical Institute. Convinced as he was that only large-scale collectives of highly qualified specialists alone are capable of solving major scientific and applied problems successfully, he organized in addition a special faculty for the preparation of specialists in chemical physics.

A member of the Academy of Sciences of the USSR since 1932, he was elected to the academies of science in several countries, the Royal Society of London (1958), the Indian Academy of Sciences (1960) and US National Academy of Sciences (1963). He was awarded the State prize in 1941 and shared with Hinshelwood the 1956 Nobel Prize in Chemistry for his work on chain chemical reactions. He was elected three times as a Deputy to the Supreme Soviet of the USSR.

His last book on *Science and Society* was published in 1981. He actively participated in the Pugwash Movement.

He had a remarkable ability to fascinate

others by his ideas and to infect them by his own enthusiasms. He was greatly admired, respected and loved by his numerous friends and students for his remarkable talent, his indefatigable creative activity and personal charm.

Bettadapur Narasimhaiah Sreenivasaiah was born on 24 July 1904 at Hassan in Karnataka in a family of classical scholars. His earlier schooling was at the Kannada High School at Holenarasipur in Hassan District, from where he passed the Lower Secondary examination with a first class and first rank. He passed the SSLC examination from the Government High School, Hassan again with a first class and a second rank in the State. He had his university education at the Central College, Bangalore and the University College of Science and Technology, Calcutta. A brilliant student, he won many scholarships and prizes in both school and college. He took his B. Sc. with physics and mathematics from the Central College in 1925 and his M. Sc. in physics from the Calcutta University in 1927, work done under Prof C V Raman on the X-ray analysis of the crystal structure of paranitrotoluene forming his research thesis.

He started his career as a lecturer in physics at the Intermediate College, Bangalore in 1928 and joined the India Meteorological Department as an Asst. Meteorologist the same year. He worked as a forecasting officer at Agra, Pune and Karachi till 1942, when he was promoted as a meteorologist and posted to Bangalore and Madras. He served as the Regional Director, Nagpur from 1949 and as Director, Aviation Services at Delhi till 1956, when he was promoted and posted to Poona as the Deputy Director-General in charge of Climatology and Geophysics. He retired from the Meteorological Department in 1959. He served as Administrative Officer at the Physical Research Laboratory for a short period from 1962-65 and as Associate Scientist from 1967-69.

A man of high moral and religious principles and integrity, he was the most generous of colleagues and friends. While his observance of religious practices was extremely strict, in his dealings with his friends, he was most informal and affectionate. A great human being, he will be sadly missed by his many friends and admirers.

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