

CHEMISTRY

I N S R I L A N K A

75
YEARS
1941-2016

1941 - Chemical Society of Ceylon
Institute of Chemistry Ceylon - 2016

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Institute of Chemistry Ceylon
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Launching of the special Issue of Chemistry in Sri Lanka

The launching of the Special Issue of Chemistry in Sri Lanka dedicated to the late Professor J N O Fernando was held on **2nd October 2015** at Adamantane House. This was organized by the Council of the Institute of Chemistry Ceylon. The **Chief Guest** was **Prof. Nalini Ratnasiri**, Emeritus Professor, The Open University of Sri Lanka, and **Engineer B R Oclen Fernando** was the **Guest of Honour** for this evening. **Mrs. Mandrupa Fernando**, wife of the late Prof. J N O Fernando graced this occasion.



Chemistry in Sri Lanka

ISSN 1012 - 8999

The Tri-Annual Publication of the Institute of Chemistry Ceylon

Founded in 1971, Incorporated by Act of Parliament No. 15 of 1972

Successor to the Chemical Society of Ceylon, founded on 25th January 1941

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January 2016

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Theme for the year -

Ethics and Responsibilities of Professional Chemists for the National Development

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Outline of our Institute

The Institute of Chemistry Ceylon is a professional body and a learned society founded in 1971 and incorporated by act of Parliament No. 15 of 1972. It is the successor to the Chemical Society of Ceylon which was founded in 1941. Over 50 years of existence in Sri Lanka makes it the oldest scientific body in the country.

The Institute has been established for the general advancement of the science and practice of Chemistry and for the enhancement of the status of the profession of Chemistry in Sri Lanka. The Institute represents all branches of the profession and its membership is accepted by the government of Sri Lanka (by establishment circular 234 of 9-3-77) for purposes of recruitment and promotion of chemists.

Corporate Membership

Full membership is referred to as corporate membership and consists of two grades: **Fellow (F.I.Chem.C.)** and **Member (M.I.Chem.C.)**

Application for non-corporate membership is entertained for four grades: **Associate (former Graduate) (A.I.Chem.C.)**, **Licentiate (L.I.Chem.C.)**, **Technician (Tech.I.Chem.C.)** and **Affiliate Member**.

Revision of Membership Regulation

All Special Degree Chemists can now apply directly to obtain **Associate (Graduate) Membership**. Three year B. Sc. Graduates (with an acceptable standard of Chemistry) can

- directly become **Licentiate**
- obtain corporate membership in a lesser number of years.

Tech.I.Chem.C.

Those who have passed the DLTC examination or LTCC examination or have obtained equivalent qualification and are engaged in the practice of Chemistry (or chemical sciences) acceptable to the Council are entitled to the designation **Tech.I.Chem.C.**

Members/Fellows are entitled to the designation of **Chartered Chemist (C.Chem.)** on establishment of a high level of competence and professionalism in the practice of chemistry and showing their commitment to maintain their expertise.

All corporate members (Members / Fellows) are entitled to vote and become Council/ Committee members whether Chartered Chemists or not.

Membership Applications

Any application for admission to the appropriate class of membership or for transfer should be made on the prescribed form available from the Institute Office.

Current Subscription Rates

Fees should be paid on 1st of July every year and will be in respect of the year commencing from 1st July to 30th June

Fellow	Rs. 1500
Member	Rs. 1500
Associate	Rs. 1200
Licentiate	Rs. 1000
Technician	Rs. 500
Affiliate	Rs. 1000
Membership for Life	Rs. 15000

Entrance Fee

All the grades	Rs. 1000
Processing Fees*	Rs. 500
Processing Fee for Chartered Chemist designation	Rs. 1000
Institutional Members	Rs. 2500

*per application for admission/transfer to any grade

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Council 2015/2016

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CHEMISTRY IN SRI LANKA

Chemistry in Sri Lanka is a tri-annual publication of the Institute of Chemistry Ceylon and is published in January, May and September of each year. It is circulated among the members of the Institute of Chemistry and students of the Graduateship/DLTC course and libraries. The publication has a wide circulation and more than 1000 copies are published. Award winning lectures, abstracts of communications to be presented at the annual sessions, review papers, activities of the institute, membership news are some of the items included in the magazine.

The editor invites from the membership the following items for publication in the next issue of the Chemistry in Sri Lanka which is due to be released in May 2016.

- Personal news of the members
- Brief articles of topical interests
- Forthcoming conferences, seminars and workshops
- Latest text books and monographs of interest to chemists

All publications will be subjected to approval of the 'Editorial and Publicity Committee' and the Council of the Institute of Chemistry Ceylon.

Further, prospective career opportunities for chemists, could be advertised in Chemistry in Sri Lanka at a nominal payment. The editor welcomes from the members suggestions for improvement of the publication.



INSTITUTE OF CHEMISTRY CEYLON 75 Years of Service to the Nation

Professor S. Sotheeswaran

B.Sc. (Honours, Chemistry, Ceylon), Ph.D. (Hull, UK); D.Sc. (Hull, UK),

Emeritus Professor, The University of the South Pacific, Fiji and

Senior Visiting Professor, College of Chemical Sciences, Institute of Chemistry Ceylon.

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The Institute of Chemistry Ceylon was established in the year 1971 for the general advancement of the science and practice of Chemistry in Sri Lanka, and is the successor to the Chemical Society of Ceylon founded in 1941. It is the oldest professional body in Sri Lanka and is a non-profit organisation.

The Golden Jubilee of the Institute was celebrated in 1991 & the Diamond Jubilee in 2001. **The 75th Anniversary falls on 25th January 2016.**

The Logo of the Institute contains the structure of Adamantane, which is a stable molecule that was synthesised in 1941, the founding year of the Institute's predecessor, the Chemical Society of Ceylon. The Institute has now a 75 year old history and has remained stable like adamantane and has grown from strength to strength over these many years. A dream was realised with the opening of its own headquarters aptly named Adamantane House on 25 February 2005 at Rajagiriya. An extension to Adamantane House was completed in January 2014.

The Institute was declared an approved charity by an Order published by the Hon'ble Minister of Finance in the Government Gazette No. 121 of 26 December 1980. Donations made by any institution or individual to the Institute of Chemistry Ceylon are therefore deductible from the assessable for income tax purposes.

The Institute of Chemistry Ceylon maintains very close links with the Sri Lanka Section of the Royal Society of Chemistry, UK (founded, 1953) and invites the Chairman of the latter body to attend its Council meetings on a regular basis.

The Institute is (since 1980) a member of the Organisation of Professional Associations of Sri Lanka (OPASL) and maintains close contact with numerous other professional and learned bodies in Sri Lanka.

At an international level, the Institute is a founder member of the Federation of Asian Chemical Societies (FACS, established 1979). Two Executive Committee

meetings of FACS have been held in Sri Lanka in 2004 & 2014. It is, since 2009, a full member of the International Union of Pure & Applied Chemistry, (IUPAC). Regular contact is maintained with the Royal Society of Chemistry, UK, the Royal Australian Chemical Institute, the American Chemical Society and parallel professional bodies in other countries. The Royal Society of Chemistry, UK co-ordinates the external moderation/examination of question papers/answer scripts of the Graduateship in Chemistry Examinations conducted by the College of Chemical Sciences, which is the educational arm of the Institute of Chemistry.

The Australian National Chemistry Quiz conducted by the Royal Australian Chemical Institute was conducted in Sri Lanka for the nineteenth consecutive year in July 2015. Students in the Senior Division who answer all questions correctly are annually awarded scholarships to follow the entire Graduateship in Chemistry Programme conducted by the Institute of Chemistry Ceylon free of charge.

The Institute of Chemistry Ceylon also conducts various professional academic and dissemination activities every year. These include Quiz competitions and Titration Competitions amongst school children, Lectures, Orations, Training Seminars, Exhibitions, Industrial visits and Social activities.

However, the principal annual activity is the Annual Session that is conducted every June and enables members to present their research papers at technical sessions. The Annual Session commences with a formal Ceremonial Inauguration, during which the out-going President delivers a Presidential Address and the Annual Awards of the Institute are presented. More recently, it has become the practice to invite a number of foreign scientists to participate in the seminar. In line with these developments regional /international seminars have been conducted from 2005.

This activity reached a peak with the conduct of a fully organized international conference called **CHEMTECH** in 2007 as part of the 36th Annual

Sessions. Another International Conference on the theme “**The Role of Chemistry Research in National Development**” was held in June 2012 as part of the 41st Annual Sessions.

In 2014, another International Conference, under the Chairmanship of the late Professor J N O Fernando, was held on the theme “**Chemical Education**”. A

meeting of the Council of the Federation of Asian Chemical Societies (FACS), of which the Institute of Chemistry Ceylon is a founding member, was also held as a part of this conference in April 2014 at the headquarters of the Institute of Chemistry Ceylon at Adamantane House.

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Call for Nominations for Institute of Chemistry Gold Medal 2016 by 31st March *(Under Revised Rules)*

This Gold Medal was the very first of such awards to be donated to the Institute and was made possible through a generous donation made by **Mascons Ltd** in memory of their founder, **Mr A Subramaniam** in 1978/79. It recognised contributions made to National Development through research and development involving Chemical Sciences. The Gold Medal Fund was supplemented recently through a further contribution from Mascons Ltd. This criteria governing the award were changed in 2011 since there were no applicants since 2007 in order to enable the award to be made to a mid-career Chemist in recognition of honorary services to the Institute.

Nominations are now being invited for the 2016 Award from amongst **Corporate Members** of the Institute who have fulfilled the following minimum criteria;

- Nominees should be not more than 55 years of age and should have been Corporate members of the Institute for at least 10 years on 1st of June 2016
- Nominees should have made significant contributions towards the activities of the Institute through yeoman services in an honorary capacity during the period of membership. These activities could include holding office, membership in committees, coordination of events such as workshops, social events etc.

Nominations could be made by any **corporate member** of the Institute and should include the consent of the nominee and details of the contributions made by the nominee in accordance with the above guidelines. The Award will be presented at the 45th Annual Sessions. **Nominations should be forwarded to reach the Hony. Secretary, Institute of Chemistry Ceylon not later than 31st March 2016.**

Graduate Chemists Welfare Fund

This fund has been established with effect from 1-1-2012. The principal benefits towards CCS Graduate Chemists would be,

- I. To provide partial assistance towards international travel of those proceeding abroad for PG degrees (once a life time). Assistance for
Active Graduate Chemists : Rs. 60,000
Passive Graduate Chemists : Rs. 30,000
- ii. To provide partial assistance towards registration fees in respect of IChemC /CCS events such as international Conferences.
- iii. To provide assistance towards registration fees for IChemC /CCS training seminars etc.
- iv. To provide partial assistance towards activities of the Alumni Association.

Note : Depending on the demand, Graduate Chemists who maintain positive contact and participate in IChemC/Alumni activities will get preference for the above mentioned assistance scheme.

Cover Page

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History of the Chemical Society of Ceylon from 1941 to 1972 and the Institute of Chemistry Ceylon from 1972 to-date

T Kandasamy

Past President, Institute of Chemistry Ceylon

Background to the formation of Chemical Society, Ceylon

Chemistry was taught as a pre-medical subject at the medical school as early as 1900 in Ceylon. Later it was taught at the Ceylon Technical College for medical students and students taking the external general degree examination of the University of London.

The University College in Ceylon was established in January 1921. With the establishment of the University College as an institution for graduate studies, chemistry was one of the science departments, set up under the Headship of Mr. W. Rae. With Mr. L.P.C. Chandrasena joining Mr. Rae, courses for the London External Degree Examination in B.Sc. (General) and B.Sc. (Special) were started.

At that period of time, there were the three Research Institutes set up by the Colonial Regime; Tea Research Institute, Rubber Research Institute and Coconut Research Institute. Besides, there were the Department of Agriculture, the Agricultural Research Institute and the Government Analyst's Department. Except for the University College and the Government Analyst's Department, all the other organisations were not in Colombo.

Mr. D. H. Balfour with chemistry as a subject in his Tripos from Cambridge University, joined the Ceylon Civil Service. He felt that there were possibilities of starting chemical industries in Ceylon. He convinced the Minister of Industries, Mr. C. G. S Corea and obtained a Treasury Grant to carry out research. He set up the Industrial Research Laboratory where chemistry graduates initially worked before they found suitable employment.

During the Second World War, when many of the essential items were scarce or were not available, Ceylon decided to produce some of these essential items. The factories were set up not in the main city but at a fair distance from the city. Chemists were appointed to these factories and these chemists would not have personal contacts among themselves.

In 1940, the Chemists engaged in different chemical fields such as University teaching, chemical research, analytical chemistry, forensic chemistry and those working in these factories felt the need to have a Society of their own, to meet and exchange views and

discuss current problems. There was a need for professional interaction.

Dr. N.G. Baptist and Dr. A.A. Hoover approached Prof. A. Kandiah, Professor of Chemistry, University College, with a proposal to start an Association. Prof. Kandiah showed some reluctance at first but later realising the importance of having an association agreed to the proposal. May be, he was cautious as Ceylon was still a colony under the British rule.

The government employed many of the chemists and permission had to be obtained from the Government for these chemists to be members of such an Association. Dr. Hoover addressed a letter to the Chief Secretary on 19th December, 1940, seeking permission for the formation of the Chemical Society. The letter gave the objectives of the society and names of likely office bearers. The Chief Secretary by his letter No. HB 4/41 of 23rd January, 1941, informed the Registrar, Medical College through whom the application was sent, that there was no objection to Dr. Hoover or any Public Officer becoming a member or holding office in such a society provided the objectives were purely scientific and did not involve them in any breach of Public Service Regulations.

As a result of these activities, a meeting of all interested in the formation of the Chemical Society, comprising about 35 chemists working in different fields, met on 25th January, 1941, in the Chemistry Lecture Theatre of University College and the Chemical Society was inaugurated. This was indeed a historic event and arguably marks the first ever beginning of the organisation within the basic sciences in this country.

The conveners sought the help and cooperation of the senior chemists from the Agricultural Department (Dr. A.W.R. Joachim), the Tea Research Institute (Dr. A. Norris), the Rubber Research Institute (Mr. T. O'Brien), the Coconut Research Institute (Dr. R. Child), the Department of Industries (Mr. D.H. Balfour), The Government Analyst's Department (Mr. W. R. Chanmugam) and the Salt Department (Mr. C.E. Foenander).

The first Meeting of the Ceylon Chemical Society was held on 7th June, 1941, when members were elected as office bearers of the Society. Prof. A. Kandiah was

elected as the President and Dr. A.A. Hoover and Dr. M.L.M. Salgado as Honorary Secretaries. Five members were elected as Vice Presidents namely, Dr. R. Child, Dr. A. W. R. Joachim, Dr. E. L. Fonseka, Mr. D. H. Balfour and Mr. T. E. H. O'Brien. The names of those present at the first meeting, and the organisations they worked in, are given in **Annex 1**. A group photograph was taken after this meeting. This is produced in **Annex 2**.

The objectives of the Chemical Society of Ceylon

- To cultivate and promote the cause of chemical sciences by all practical means;
- To raise the status and advance the interests of the Profession of Chemistry in Ceylon.

Membership Categories

- Foundation members – Those who were invited to the inaugural meeting – 35 members;
- Ordinary members – Persons interested in chemistry. Any person interested in Chemistry could apply for membership. This open clause was accepted because the Professor of Physics, Prof. A. W. Mailvaganam suggested that the membership be open and not restricted to graduates in chemistry or practicing chemistry;
- Honorary members – Persons distinguished in chemical science or elected for any other reason – not more than five at any time. (There is, however, no record of any Honorary Members being elected during the duration of the Chemical Society);
- Student members – Bonafide students interested in chemistry. Student members were elected by the committee. In 1952, the committee encouraged student membership and the University Chemistry lecturers encouraged students to attend Chemical Society meetings.

Office Bearers

During the first three years, the office-bearers were:

- The President
- Five Vice Presidents
- Two Honorary Secretaries
- The Treasurer
- Six Elected Members

Activities: Meetings, Seminars and Symposia

From its inception, the Chemical Society of Ceylon had shown a special interest in the applications of chemistry. A number of seminars, symposia,

workshops and lectures were held on important subjects. Lectures were on specialised subjects and semi-technical subjects covering wide areas. Senior members gave talks on the work they were involved in. Among the speakers were those who returned after their postgraduate studies and foreign scientists passing through Ceylon. These lectures served to keep chemists informed of the developments in their discipline.

It was the general practice to arrange, whenever possible, meetings jointly with the Royal Institute of Chemistry, Ceylon Section. From 1954, joint meetings were also held with Section E of Ceylon Association for the Advancement of Science.

The first scientific meeting “The Chemical Industry in Ceylon” was held on June 07, 1941. At this meeting, the President, Professor A. Kandiah stressed the importance of planning in the development of industries in Ceylon. The President had to stress on planning because of wartime scarcities made the Government to start industries without proper planning. He gave, as an example, the opening of a Quinine factory without adequate Cinchona plantation although wartime scarcities were a certain justification.

Mr. C. Satkunathan, President, Chemical Society at the Twenty fifth Anniversary Presidential address said, “The first scientific meeting of the Chemical Society twenty five years ago was about the Chemical Industry in Ceylon”.

As a part of the 25th Anniversary celebrations, a two-day symposium on “Chemistry in National Development” was held from October 15 – 16, 1965. The Chief Guest was Hon. D. Philip. R. Gunawardena, Minister of Industries and Fisheries. It appears that it was the first instance when a Cabinet Minister participated in the Proceedings of the Chemical Society. It was on this occasion that Mr. Phillip Gunawardena commended the upward growth of the Chemical Society, from as he put it the “days of Balfour's boys”.

Other Activities:

- A Scientific Advisory Committee was formed in December 1941 with Prof. Kandiah as the Chairman. Other members of the Committee were, Mr. A. Bruce, Mr. D. H. Wadia, Dr. N. G. Baptist, Dr. R. Child, Dr. S. L. de Silva, Dr. A. A. Hoover, Mr. T. H. O'Brien, Dr. A. W. R. Joachim and Dr. E. L. Fonseka. In December, formal recognition was granted to this committee by His Excellency the Governor of Ceylon with the suggestion to include

Mr. W.R. Chanmugam (Acting Government Analyst), Dr. R.V. Norris (Director, Tea Research Institute), Mr. M.V. Phipott (Rubber Research Institute) and Mr. H.E. Foster (Imperial Chemical Industries, Colombo).

The committee was formed by the Chemical Society to offer its services to the government. To make suggestions as to what steps should be taken to develop new industries to meet the urgent needs of the period and also to assist the Department of Commerce and Industries in their research work so that all available scientific ability in the country may be marshaled to the crisis of the period.

- As an extension to the Scientific Advisory Committee, the Chemical Society recommended the establishment of a Central Planning Committee in Ceylon, in which the best scientific talent in the country could be represented at an advisory level when proposals for establishment of industries can be discussed and this Committee was formed in 1943 and the Government referred all scientific problems to this committee which after discussions assigned them to various specialised groups. One such problem was the provision of drinking water to the armed forces in the Maldives during the Second World War. On the advice of the committee, the Government sent the Government Analyst and Assistant Analyst to study the problem and recommend a solution, which they did.
- Ceylon Association for the Advancement of Science. Within three years of its own inauguration, the Chemical Society felt the need for a larger scientific body where all branches of science would be represented. This larger scientific body will include Agricultural, Medical, Engineering, Physical and Natural Sciences. The Ceylon Association for the Advancement of Science was thus inaugurated on July 29, 1944.
- Following the sudden death of the founder President, Prof. A. Kandiah in February 1951, the Chemical Society, the Ceylon Section of the Royal Institute of Chemistry and Ceylon Association for the Advancement of Science inaugurated the 'Kandiah Memorial Fund'. It was inaugurated by Prof E.L. Fonseka on December 18, 1958 at the Annual Session of Ceylon Association for the Advance of Science.
- Portrait of Prof A. Kandiah was unveiled at the Chemistry Lecture Theater on December 20, and a portrait of Prof. E.L. Fonseka was unveiled on

December 14, 1963 at the Chemistry Lecture Theatre.

It will be noted from the time the Chemical Society was started, the emphasis was on the discipline of chemistry rather than on the profession. It was similar with the Chemical Society in UK started in 1841 from its inception; the Chemical Society of Ceylon has shown a special interest in the applications of chemistry. There were a number of seminars, symposia, workshops and lectures on important subjects. There were number of social events and interests of chemists were looked after.

Formation of the Institute of Chemistry, Ceylon:

The formation of a professional body of chemists was first discussed at the Annual General Meeting of the Chemical Society on December 13, 1968. A committee was given the task of preparing the constitution for formation of Institute of Chemistry, Ceylon based on the Constitution of the Royal Institute of Chemistry, UK and the Institution of Engineers, Ceylon in August 1970. The draft constitution for the formation of the Institute of Chemistry, Ceylon was finalised.

At a Special General Meeting held on July 5, 1971, the following resolution was passed. "The Chemical Society of Ceylon resolves to reconstitute itself into a body here-in-after called and known as the Institute of Chemistry, Ceylon". Dr. M.A.V. Devanathan was elected as the first President of the Institute of Chemistry, Ceylon.

The Incorporation Bill was presented by Mr. Mahinda Rajapaksa, M.P. for Beliatta and Mr. Wilfred Sennanayake, M.P. for Homagama for adaption by Parliament. The Institute of Chemistry, Ceylon was then incorporated by the Act of Parliament No.15 of 1972, the effective date of assent being April 28, 1972.

The objectives of the Institute are given in several clauses in the Act. The Institute is to be a Professional and Academic Institution with the purpose to promote and advance the science of chemistry and to promote the education of chemistry at all levels and assist the Private Sector and the Public Sector in all aspects and look after the interests of chemists in general.

The Institute of Chemistry Ceylon is now a professional qualifying body and a learned society. The Institute has been established for the general advancement of the science and practice of chemistry and the enhancement of the status of the profession of chemistry in Sri Lanka.

The Institute represents all branches of the

profession and its membership is recognised by the government and its qualification, particularly the Graduateship Certificate (GIC) is accepted by the private and public sector organisations as equivalent to a university degree in chemistry. The Royal Society of Chemistry, UK and the Royal Australian Chemical Institute have accepted the GIC qualification for admission to their societies. Besides, many universities in Sri Lanka and in foreign countries have accepted the qualification for the students to continue their postgraduate studies in their universities.

The Institute reached the above recognition by planned series of activities.

The Laboratory Technician Training Course

There was a great need to have Middle level personnel like laboratory technician in many laboratories involved in teaching, research, services and quality assurance activities. In 1973, trained personnel available as laboratory technicians were the Medical Laboratory Technicians (MLT). MLT were recruited by the Health Department and they were trained for a period of two years and then they were attached to hospitals and other medical institutions.

The Institute started a training course with a syllabus in basic chemistry and subjects in some specialised areas so that these technicians could fit into any laboratory. The syllabus was revised periodically. Then in 1998, the Laboratory Technicians Certificate course was upgraded to a Diploma Course (DLTC). By then, there were about 600 technicians trained. Those who underwent this training could apply to follow the GIC course. Some have done that and now they are graduate chemists. Up to 2015 the number of qualified chemical technicians the Institute has produced is 1,026. Eighty qualified as chemical technicians in 2015.

Graduateship Course in Chemistry (GIC)

The need for a course in chemistry equivalent to a four-year special degree in chemistry provided by the universities was considered by the Institute Council. 1970s were a period, when admissions to the universities in Sri Lanka were becoming more and more competitive. Many students with good grades at the GCE (Advanced) level examination failed to enter the universities because of the system of admissions. There were also students, who entered the universities but were unable to do a special four-year course in chemistry because the number of places available for such course was limited in the university. There were

also many in the industry who wanted to follow a course in chemistry to enhance their career. The Royal Society of Chemistry (RSC) had several courses that helped many who wanted to qualify while working.

With the decision to start this Graduate course, the Council successfully negotiated with Aquinas College of Higher Studies (ACHS), where the Institutes Licentiate Technician Training Course (LTTC) was already functioning, to conduct the Graduateship in Chemistry Course PART I on Friday evenings, full day on Saturday and Sunday morning. Based on the request, ACHS advertised the Part I course with the course fees fixed by them. Out of 175 applications received, 72 were selected by the Institute appointed selection committee. With permission obtained from the universities, the lecturers from the universities conducted these classes. The management was with ACHS. Part I course proceeded without any problem.

The time to start the Part II and the chemistry practicals, the Institute approached ACHS with the proposals. For some unexplained reasons, in 1980 ACHS agreed to complete the two-year Part I course but refused to continue the Part II and the practicals.

The council did not understand the reason behind this refusal and the council was in serious trouble. They could not let the first batch of 72 students down. There were members in the council who were very critical of the officials for starting a programme of this nature without a detailed study. But a programme of this nature may never have commenced if every possible problem had to be cleared. Now it was not a time to find faults but jointly find a solution. Many members decided to find a suitable solution. Looking for another avenue for conducting the course was the easier way of solving the problem. The office bearers in the council visited schools and teaching establishments with laboratory facilities. They visited Zahira College, Visaka Vidyalaya, Stafford Ladies College, Pembroke Academy and St. Thomas' College, Mount Lavinia.

Institute decided to discuss the subject of starting the courses with S. Thomas' College (STC). The Board of Governors of this college agreed to allow the use of the new science building and the laboratory to conduct our classes. The Council of the Institute of Chemistry was grateful to the Warden Mr. I.C. Illangovan, Bishop Swinthin Fernando, Chairman of the Board of Governors, Mr. G.A.C. Sirimanne, Secretary to the Board and other members of S. Thomas' Board of Governors.

Finding a suitable, good avenue was a great success to the Institute. STC provided the Institute the

necessary infrastructure and resources but the college was not agreeable to run the programme in a manner similar to that at ACHS. The Institute had to manage programme like taking over the administration and financial arrangement. STC provided a Coordinator (a science teacher) and staff for laboratory and classrooms. All the staff had to be remunerated by the Institute.

Having been able to get a venue to run the programme, the Institute had to plan various other activities like management of the course, to see everything went according to a set plan.

Educational Committee and the College of Chemical Sciences

The Institute took over the complete management of the Graduate programme from January 1981. In order to place the programme in sound footing, the Council created an Educational Committee that would specifically promote education and academic affairs on behalf of the Council. The Educational Committee took over the duties to promote education, training and other academic affairs in addition to other management needs. The Educational Committee received the fees and deposited it as a separate account with the approval of the council. Once there was a misunderstanding about the utilisation of this fund, whether the fund could be used by council activities such as holding of international conferences or seminars. It was decided by the council in July 1981, "Educational fund and Graduate courses money must be utilised as decided by the Educational Committee". However, a part of the Registration fees was given to the General Institute account for the management by the Institute.

The Educational Committee functioned well and courses were managed by the appointment of Coordinators to each course. The committee looked into the course content and made necessary changes and introduced several optional courses.

In January 2001, the Diamond Jubilee year of the Chemical Society and its successor the Institute of Chemistry, the College of Chemical Sciences was inaugurated with the view to increasing the activities and obtaining recognition as an Educational Institution. At the Council meeting of June 1, 2001, the rules of the College Chemical Sciences were approved and adopted at the subsequent Annual General Meeting of the Institute. It states that,

"The College of Chemical Sciences (referred to as College) shall be established to conduct all educational and training activities of the Institute. The College shall

be governed by the Council of the Institute. The Council shall have the power to decide on any activities and functions of the Board. At the start the Council announced 9 functions for Board."

Institute's Educational programme started with Laboratory Technicians Training programme in 1973 and the Graduateship course in 1979 and the courses are still being conducted to this day. Up to 2015 a total of 1,075 graduate chemists and 1,025 chemistry technicians have been produced by the Institute.

The graduates from this course have been employed as chemists in private sector. A number of them have done postgraduate degrees. The first Graduate Chemist, that too from the first batch of Graduate, did an M.Phil. Degree from the University of Kelaniya. Universities all over the world, particularly the Universities in United Kingdom, United States of America have recognised the qualification and accepted these students for Postgraduate studies. About 300 graduate chemists have obtained postgraduate degrees and of these about 100 have received Ph.D degrees. The Royal Society of Chemistry, U.K, besides accepting the Graduate Qualification to become member of their Society, have accredited the course. The Institute continues its valuable service as today 600 have enrolled to follow the course. Credit should go to all members of the Institute and the teaching staff.

The Institute has link with Northumbria University, UK and the University of Cincinnati, USA. The Students after completing a part of their course of study at the Graduateship level can join one of these universities to complete their degrees.

Graduate course has in Part I the courses in all branches of chemistry and subsequently a number of optional units which allows the students for a wide choice.

There are a number of bursaries, awards and prizes. These prizes and awards in each subject has been donated by members of the Institute and well-wishers. Awards are incentive to do well in studies and are helpful when they apply to foreign universities for Postgraduate studies.

The New Building

Chemical Society and then the Institute of Chemistry until 1977 had no office or staff. All the activities were looked after by the Chairman and officials. The need for building to conduct the activities was felt badly and various efforts were made to have a building. In the meantime, in 1981, the Sri Lanka

Association for Advancement of Science (SLAAS) agreed to rent a small room in their building. The Institute for the first time employed a full time clerk typist and a retired store keeper as Office and Course Assistant. Later, they were able to get a larger space to accommodate increased staff and greater activities.

Finally after great efforts, the Institute obtained a land in Rajagiriya and built a Headquarters building and named it as Adamantane House. The building with about 20,000 square foot of floor space has an auditorium, lecture theatres, large library space, laboratories, instrument room, Board room and staff rooms. All lectures and practicals of the courses are conducted in the building.

Library Facilities

Since the Institute started the Graduate course, it was necessary to have library facilities. The Institute did not have a building of its own and space rented by them was not large enough. The Institute was in contact with the British Council. They were able to obtain a series of books on Overseas Development Administration (ODA) grant. They also obtained books from Asia Foundation. Books were also donated by University lecturers who left the country in 1983. The Institute requested CISIR a space to accommodate these books. They accepted the request and the books were housed in a separate section of their library till 1992. The Institute is very grateful to the CISIR for offering this facility.

In 1992, when the CISIR withdrew the facilities, a house on Galle Road, Mount Lavinia was rented to keep these books. The place was closer to St. Thomas College. A part of this building was also used as office with regard to the Course.

Today, the Institute has a spacious library with many modern texts books and journals at their Headquarters building.

Other Activities

- The all Island Inter School Chemistry Quiz and the Australian National Chemistry Quiz Competition

The holding of these two Quiz competitions are important activities of the Institute. They are held annually. The competitions are conducted to increase interest of students in chemistry and to provide chemical education. The competitions have become very popular and number of schools are presently participating in these competitions. Briefly they are.

- (a) The all Island Chemistry quiz is for G.C.E (Advance Level) Students. On the basis of the Preliminary written paper the best school in each Province is selected. The best individual performer is selected. The selected schools then contest for the Challenge Shield.
- (b) The Australian National Chemistry Quiz is conducted annually in July by the Royal Australian Chemical Institute in a number of countries especially in Asia Pacific Region. The Australian Organisation provides the question paper, the multiple choice answer sheets and other materials in English. The Sri Lankan organisation took the additional responsibility of translating the question paper to Sinhala and Tamil. Over the years number of districts and number of students have participated in this competition. The performance of students from Sri Lanka has been good. Many have answered all 30 questions. The Institute has issued free tuition if these students want to enroll and follow Graduate course.

Seminars, Workshops and Training Programmes

At the start, the Institute had a number of lectures, seminars and workshops. These have been replaced by Training seminars and workshops as these activities will help many professionals, academics and industrialists in updating their knowledge and experiences. Responses are good and mostly well attended. During every Annual General Meeting there is a two day seminar in addition to presentation of research papers.

Several monographs by teaching staff on important subjects have been prepared as reading material particularly for the Graduateship students.

Staff

There is the Registrar, Deputy Registrar, and a complement of good office staff. There is the Dean of Studies and number of Permanent lecturers. A number of Sri Lankan University Lecturers during their Sabbatical leave join the Institute.

ANNEX 1

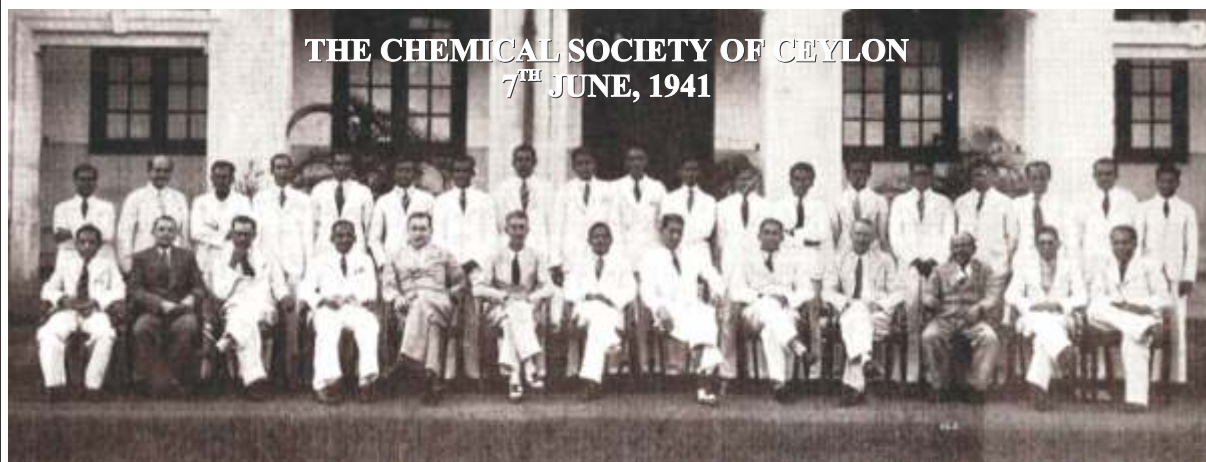
NAMES OF PERSONS PRESENT AT THE FIRST MEETING ON JUNE 7, 1941

NAME	OFFICE	ORGANISATION / INSTITUTION
Prof. A. Kandiah	President	University of Ceylon
Dr. R. Child	Vice President	Coconut Research Institute
Dr. A. W. R. Joachim	Vice President	Department of Agriculture
Dr. E. L. Fonseka	Vice President	University of Ceylon
Mr. D. H. Balfour	Vice President	Department of Industries
Mr. T. E. H. O'Brien	Vice President	Rubber Research Institute
Dr. A. A. Hoover	Hony. Secretary	Medical College
Dr. M. L. M. Salgado	Hony. Secretary	Coconut Research Institute
Mr. J. E. R. Hensman	Treasurer	Department of Industries
Mr. W. R. Chanmugam		Government Analyst Department
Mr. G. A. C. Sirimane		Government Analyst Department
Mr. V. Kulanayagam		Government Analyst Department
Mr. N. Jayatunga		Government Analyst Department
Mr. S. Ramanathan		Government Analyst Department
Mr. C. E. Foenander		Salt Department
Mr. M. W. Philpoth		Rubber Research Institute
Mr. C. Charavanapavan		Department of Agriculture
Mr. T. H. Ganjuwa		Leather Industries
Mr. D. Sunthrael		Cement Industry
Mr. S. M. Chanmugam		Bamber & Bruce
Dr. N. G. Baptist		Industrial Research Laboratory
Dr. S. L. de Silva		Industrial Research Laboratory
Mr. S. F. Laurentius		Industrial Research Laboratory
Mr. V. Perampalam		Industrial Research Laboratory
Mr. R. Sivaramalingam		Industrial Research Laboratory
Mr. T. Selvaratnam		Industrial Research Laboratory
Mr. G. Ponnamparuma		Industrial Research Laboratory
Mr. R. Bhuvanendram		Industrial Research Laboratory
Mr. C. A. Cooray		Civil Service
Mr. S. L. C. Caspersz		
Mr. C. D. Wijeyadevendram		
Dr. D. E. V. Koch		

All these persons attended the Annual General Meeting held on June 7, 1941 were present at the Group Photograph.

ANNEX 2

THE GROUP PHOTOGRAPH OF THE MEMBERS WHO WERE PRESENT AT THE FIRST MEETING



Seated (L to R): Dr. A. A. Hoover (Hony. Secretary), Dr. D. E. V. Koch, Mr. J. E. R. Hensman (Hony. Treasurer), Mr. W. R. Chanmugam, Dr. R. Child (Vice-President), Mr. T. E. H. O'Brien (Vice-President), Prof. A. Kandiah (President), Mr. D. H. Balfour (Vice-President), Dr. E. L. Fonseka (Vice-President), Mr. M. W. Philpoth, Mr. C. E. Foenander, Dr. A. W. R. Joachim (Vice-President), Dr. M. L. M. Salgado (Hony. Secretary)
Standing (L to R): Mr. R. Bhuvanendram, T. H. Ganjuwa, Mr. C. Charavanapavan, Mr. S. L. C. Caspersz, Mr. S. M. Chanmugam, Mr. S. Ramanathan, Mr. C. D. Wijeyadevendram, Mr. N. Jayatunga, Mr. V. Kulanayagam, Mr. G. A. S. Sirimanne, Dr. N. G. Baptist, Mr. R. Sivaramalingam, Mr. T. Selvaratnam, Mr. C. A. Cooray, Mr. G. Ponnamparuma, Dr. D. Sunthrael, Dr. S. L. De Silva, Dr. S. F. Laurentius, Mr. V. Perampalam

The Chemical Society of Ceylon and Just Snapshots from my Memory

Dr. R O B Wijsekera

Past President, Institute of Chemistry Ceylon

When colleagues have asked me the question: When did you join the Chemical Society?, then I have tended to respond with the remark that I was never certain; I seemed to have grown up in it. That seemed to be the true situation. I was as a student a more than interested member of our student chemical society serving as its honorary secretary in my first honors course year and then as its president in my final year. All the time I was a welcome follower of the main chemical society and I recall many of the highlights including a wonderfully lucid lecture by Professor Kandiah on Penicillin. I recall that at the time the structure of Penicillin had just been elucidated and Professor Kandiah was so much on the ball so to say. He indeed was the leading light in those days in the chemistry scenario providing the leadership to the small chemical community as it then was and the inspiration to the budding students specializing in chemistry.

The Chemical Society of Ceylon had been founded in 1941. My first initiation into it commenced in 1947. Kandiah was our genial idol and it was tragic that in my final year that is in 1951 our colossus was felled by a sudden heart attack at a meeting of the University board, and he was no more. The chemists in Sri Lanka lost so much by that blow.

In 1953 I was a simple research scientist at the Medical Research Institute when following the resignation of the charismatic Dr W.L.W. Ludekens from the post of honorary secretary I was shunted into it on the suggestion of Dr Ludekens himself (I believe)!. I was not yet twenty-five years of age but many of the members of the society had known me personally due to my association with affairs of the society that I was readily accepted. My first co-joint secretary was Sam J. Duraisamy, of the government Analyst's department but he too soon left for his training in the U.K. and was succeeded by Dr. M.A.V. Devanathan. So we were almost two rookie secretaries now in position. However I think we did well organizing an exhibition and a successful annual dinner in our first year. We were well supported by the big names of the day including the President who was Mr. L.J.D. Fernando, a charming personality who happened to be the chief of the Geological survey. At the time Geologists too were members of the Chemical Society. Mr. Fernando together with Dr. Noel Baptist, a biochemist, was the

initiator of the Ceylon Association for the Advancement of Science (CAAS predecessor of the SLAAS), a few years before this time.

The methodology of the Chemical Society and then the CAAS was based on the trend of the times. This was the dissemination of scientific knowledge via lectures and exhibitions and contending with the reforms initiated by the government mainly concerning the salaries of scientists in a public service dominated by a colonial style civil service. Remember, Ceylon was still then a crown colony with a Governor and three Secretaries covering Financial, Legal and Administrative affairs, with the elected State Council only with limited powers. It is interesting to recall now how the style of activity of our chemical society had evolved.

We had regular monthly meetings, special meetings when distinguished scientists were available in Colombo as they stopped over when their liners called at Colombo Harbor on the way to Fremantle, in Australia. One such event was when the great Professor Edgar Lederer, the "Father of Chromatography" called here, and delivered a fascinating lecture on the origins of Chromatography. Our Society funds came from a modest government grant and the meagre subscriptions collected from our members. The monthly meetings were a sort of get-together of the community and I do not recall any spectacular lectures from our own members. The style of popular lectures had not evolved and members tended to delve deeply into the subjects of their own theses as they returned from their stints overseas.

Among the leaders of the time I may recall the following: Eric Fonseka was then the Reader in Chemistry and afterwards succeeded Kandiah as Professor. He was a popular figure and had an attractive style of lecturing. There was Dr. A W R Joachim the Director of Agriculture, Dr. M L M Salgado the Director of the Coconut Research Institute, Mr. W R Chanmugam, the Government Analyst, who was able to fascinate audiences when speaking in a popular mode on the subject of crime detection, Dr A A Hoover, of the Medical Research Institute who indeed was a good speaker on his special subject of microbiology. There were others such as Dr Baptist, very knowledgeable on biochemistry as well as on the

approach to Government commissions on policy matters. Besides our monthly meetings, we had the annual dinner which it could not be said was enthusiastically attended, but it was enjoyable in that some of the post-dinner speeches were entertaining. Once I do recall when Mr. L J D Fernando was President Dr. N M Perera, then Mayor of Colombo was invited as the Chief Guest, The hot subject at the time was the relatively unattractive salaries given to scientists. Dr. Perera accepted fully this view, and said in his speech that he noted “the lean and hungry looks of the scientists, but wondered as to why they did not seem to apply to their wives”. Mrs. L J D Fernando was of ample dimension; but accepted the reference in good humor.

The methodology at the time was that followed all over the world in scientific societies. It must have conceivably been derived from the initiatives of Francis Bacon, Lord Chancellor of England, Statesman, Politician and Scientific visionary. He it was who in 1604 had recommended the “Advancement of Learning” calling it “*Novum Organum*”. He advocated the method of Induction, Experimentation, and indeed what came to be noted as the “scientific method”. This sequence was adopted by all in the Eurocentric fashion of the day although; we now know that ancient systems too had adopted this method. We were at the time in the post-colonial phase and our scientific endeavors were indeed Eurocentric in method. Bacon had determined that Science should benefit all mankind and not be a vehicle for personal gain or national competition. Bacon's initiatives led to the founding of classical scientific bodies like the Royal Society, and the European Academies, and societies such as the Chemical Society of Great Britain from which we seemed to take our lead.

Our Chemical Society was indeed proud of its role in initiating the formation of the CAAS, which was the very first Voluntary organization in our country representing all the sciences.

The Activities of our Chemical Society remained academic, reflecting on national issues such as the creation of a National Research Council and fringe policy matters. When in 1955 The World Bank Expert Dr Francis Godwin was in the island, and proposed the formation of what came to be identified as the Ceylon Institute of Scientific & Industrial Research, or (CISIR), the Society was unable to muster a firm concerted opinion on the trends and requirements. Dr. Godwin had proposed that the Plantation Research Institutes of Rubber, Coconut and Tea needed a Technology arm to advance these industries into a new

phase, and viewed the role of the future CISIR in that light.

There was divided opinion as to whether the Industrial Research Laboratory, founded by that far seeing colonial civil servant Dr. Balfour, should form the nucleus of such an Institute.

Dr A. Sundralingam, the Rubber Technologist was supportive of the formation of the CISIR and he was a leading figure within it when the World Bank initiative was realized with Dr Godwin at the helm. As a young scientist one wondered then as to why stronger initiatives were not placed with the World Bank as to the exact form and structure of the Institute, but it may have been done perhaps within other forums. In the nineteen fifties I was a fledgling scientist and not in a position to be cognoscenti of the happenings at the core of policy formulation in government.

It was in 1970, that I was elected as the President of the Chemical Society with my colleagues Lakshman Jayewardene and B.D. Fonseka as joint secretaries. I was by then a senior scientist at the CISIR, then eleven years after its formation, - and ventured into changing the tenor of our activities at the Chemical Society. Devanathan was to follow me as President and after him Sente Shanmuganathan. We decided to work collectively with an eye to the future.

However the dominant priority at the time was the conversion of the then Chemical Society into the future Institute of Chemistry, Ceylon, this being the trend and followed the change in the Chemical Society of Great Britain into the Royal Society of Chemistry. It was our intention too to follow the new trend to mandate our own chemical society with wider functions and responsibilities and give it the scope to play a more dominant role in national affairs.

I was to initiate a newsletter called “Orbital” for distribution to all members but since all the work had to be done only by our amateur selves this initiative did not last too long. In my address as the President I called on the membership to usurp the initiative of policy formulation with the formation of a Committee for the Chemical Sciences to concentrate on Policy matters. However the necessities that were demanded by the need to concentrate on the legislative requirements of the change from an academic society to an Institute on the trail of the changes in the UK took priority.

Devanathan succeeded me and so became the last President of the Chemical Society as it was, and the first President of the new Institute of Chemistry, Ceylon. Devanathan was a scientist of considerable stature and this made him popular with the influential politicians of

the day including T.B. Subasinghe and Colvin R. de Silva, and they readily answered his invitations to attend the meetings of the institute and lent valuable support to obtain the legislative needs in the finalization of the Institute of Chemistry.

This was finally achieved in the Presidency of his successor, Sente Shanmuganathan, who declined to court politicians, and used senior members instead. In the final phase of Sente's most successful year of Presidency during which the Institute was Incorporated by an Act of Parliament, Sente was to stage the Annual Dinner at the newly built CISIR Canteen premises. He declined to stage it in Hotels and the supportive ladies of his Institute committee decorated the canteen for the occasion. I had told Sente that after dinner speaking at these dinners was not my favorite pastime as the membership was not in the mood to enjoy jokes but Sente with the rustic nature of his brand of humor was to prove me wrong. His Chief Guest was the very senior chemist Dr A.W.R. Joachim and he too joined in the festive atmosphere to complete a successful dinner event. Sente's year secretaries were R.S. Ramakrishna and Seetha Rodrigo who were popularly referred to in the terms of the mythical Rama & Sitha, and they accomplished much that year.

The passing of the Act of Incorporation of the Institute of Chemistry (Ceylon) in 1972 brought a Paradigm Change in the affairs of Chemists in Sri Lanka. It brought about the training of chemists in the country and initiated a professional qualification later to be regarded on par with a degree in chemistry.

The epoch making changes came about with government recognition as well as the Royal Society recognition of the courses that the institute's membership devised and implemented. A new generation of membership had accomplished much in a brief period of time. Their problems were many such as: Lack of laboratory facilities, accommodation, limited teaching facilities, literature and teaching staff. These were overcome with single-minded leadership, ingenuity, and dedicated sacrifice by the new generation of chemists, with singular leadership from those who now manned the Institute of Chemistry like JNO Fernando, and HD Gunawardhana. Considerable are the results of this paradigm change. The establishment of the Sri Lanka College of Chemical Sciences was indeed a landmark event.

Adamantane, was the structure of a molecule synthesized by the Czech Nobel Laureate Vladimir Prelog in 1941, and since this was the year that the

Chemical Society was born Devanathan and I, unilaterally in 1970 began to use this molecular structure as the logo of our Society, although our reason was then the aesthetic attraction of the structural representation. We also made it legitimate by placing it before the AGM in 1970. There was some opposition to it on the grounds that it had no "local flavor", and I recall then that Professor Hoover got up and said "It looks just like a Wesak Lantern", and amidst the ensuing laughter the logo came to be accepted!.

Adamantane House came to be named as such but the great achievement was in its construction, and I was privileged to lay the foundation stone of the building. In 2005 I was privileged again, to be the Chief Guest at the opening.

Looking at the recent history of the Institute of Chemistry Ceylon one becomes conscious of the themes that have underlined the success.

- It is necessary to dream heroic dreams as they give rise to ideas that compel implementation.
- Deep loyalty brings forth the willingness to believe in ourselves and our capacity to perform great deeds.
- Future youngsters can take a lesson from what has been achieved by so few with so little, to derive so much.
- By the initiatives of today we may preserve our morrow to unleash further the individual genius within our membership.
- The price may have been heavy but the few among the membership has hitherto never been unwilling to pay that price. They have brought forth so much for so many.
- Above all else there must be leadership and it is this leadership that has propelled the collective genius among the few.

The coming generations will be thankful for what they have inherited.

I, from an older generation consider it a privilege to be able to salute the success achieved.

Commemoration of the First Death Anniversary of Emeritus Professor J N Oleap Fernando

The death anniversary of the late Emeritus Professor J N O Fernando will be commemorated on 1st and 2nd of March 2016 at the Headquarters of the Institute of Chemistry Ceylon, Adamantane House. Incidentally his birthday falls on 29th February 2016. The commemoration programme includes Buddhist and Christian religious activities followed by the memorial oration delivered by Professor Tuley de Silva, a Past President of the Institute of Chemistry Ceylon. Professor J N O Fernando Memorial Scholarship Fund will be launched during this event.

1st March 2016

7.00 pm – 8.00 pm

Bana; Ven. Professor Induragare Dhammaratana, Senior Professor, Department of Sanskrit, University of Kelaniya. Chief Incumbent at Jethawanaramaya Temple, Induragara, Dunagaha
(Refreshments will be served at the end of Bana)

2nd March 2016

10.30 pm – 1.00 pm

Sangika Dana at Sri Gnanawasa Thripitaka Piriwena, Rajagiriya (Adjoining Adamantane House)

Programme (02nd March (Wednesday) 2016)

2.00 – 2.20 pm Prayer Service

2.20 – 2.30 pm Welcome Address by Mr K R Dayananda
(*President/Institute of Chemistry Ceylon*)

2.30 – 2.40 pm Address by Professor S P Deraniyagala
(*Hony. Rector/College of Chemical Sciences*)

2.40 – 2.55 pm Launch of Professor J N O Fernando Memorial Scholarship Fund and renaming of Rectors Fund as Professor J N O Fernando Memorial Fund by Mr M R M Haniffa (*Dean/College of Chemical Sciences*)

2.55–3.05 pm Address by Dr M Infas
(*Member of the Academic Staff and President, Alumni Association of the Institute of Chemistry Ceylon*)

3.05 – 3.15 pm Address by Mr Tilina Gamagedara
(*President/Student Council*)

3.15 – 4.00 pm Professor J N O Fernando Commemoration Oration by Professor Tuley de Silva, (*Past President, Institute of Chemistry Ceylon, Chancellor, University of Wayamba, former UNIDO Expert, Technical Advisor*)

4.00 pm Refreshments

Origin, initial development and later developments of the Graduateship programme (1979 – 2016)

D B Jayalatharachchi

Student, College of Chemical Sciences

The Institute of Chemistry Ceylon (ICChemC) is the successor to the Chemical Society of Ceylon (founded 1941) and was established in the year 1971 for the general advancement of the science and practice of chemistry. It is a not-for-profit organization, learned society catering to the Chemical Sciences as well as a professional, qualifying and examination body looking after and responsible for the maintenance and enhancement of the profession of Chemistry in Sri Lanka. It is the oldest such body in any branch of the basic sciences in Sri Lanka.

The Institute of Chemistry Ceylon was incorporated by Act of Parliament No. 15 of 1972 with the following aims and objectives:-

- i. To promote and advance the science of Chemistry and its applications in Sri Lanka.
- ii. To advise the Government, and give counsel to public corporations, local bodies and other institutions on all matters connected with the application of Chemistry to the progress and development of the country.
- iii. To promote the acquisition, dissemination and interchange of chemical knowledge by:-providing a forum for the presentation of original communications and discussions thereon; establishing and maintaining libraries; publishing matters of interest to the profession of chemistry and any other mean.
- iv. To promote education in chemistry at all levels and to promote, encourage and foster original research in Chemistry.
- v. To assess the eligibility of candidates for admission to the various grades of membership and to conduct or provide for the conduct of the qualifying examinations for all grades of membership of the Institute and to promote, provide or approve programmes of study for such examinations.
- vi. To conduct or provide for the conduct of examinations for the award of diplomas, certificates and other distinctions, in such branches of Chemistry as the Institute may from time to time, deem necessary and to prescribe, approve or provide programmes of study for such examination.

- vii. To ensure the maintenance of high standards in the professional activities and the general conduct of its members.
- viii. To establish liaison with other scientific and professional organizations.
- ix. To establish and enhance the status of the profession of Chemistry in Ceylon and to take any other measures that may be necessary for the attainment of all or any of the objectives of the Institute.

The Institute of Chemistry Ceylon had since its inception as the Chemical Society and for many years received an annual Government grant through the Ministry of Science and Technology. However this grant to all similar scientific institutions has not been made for the past eight years. Income received by the Institute has been exempted from the levy of income tax by Section 3 of the Inland Revenue Amendment Act No. 8 of 1988.

From the courageous beginning in 1941, management has dramatically succeeded in developing both physical and educational aspects of the institute of chemistry. Since 1996, the institute has turned out to be the largest producer of graduate chemists in Sri Lanka.

The need for a programme in chemistry deemed equivalent to a four year special honours degree in chemistry was also considered by the Council of the Institute as soon as the institute was formed and gathered momentum with the success in running the laboratory technician training programme. This was a period, when admission to the universities was becoming more and more competitive. Many students with good grades at the G.C.E (Advanced) Level examination failed to enter the universities because of the controversial system of admission.

There were also students who entered the universities but were unable to proceed to a special degree in chemistry elongate for 4 years because the number of places available for such a course was limited in the universities. There were also science graduates from the universities who had 3 year bachelor of science “General” degree and they were desirous of reading for 4 year bachelor of science “Special Honours” degree in chemistry. There were

also many in the industry who wanted to follow a course in chemistry to enhance their career. Serious consideration was, therefore, given by the institute of chemistry to start a relevant programme to meet this need.^[4]

The Royal Society of Chemistry (RSC), one of the oldest professional institutes (established in 1841) in United Kingdom, had sponsored conduct of several courses and examinations that helped many who wanted to qualify while working. In fact anyone passing the associateship examination of the society was considered as a qualified professional chemist. This examination was later changed to a Graduateship examination and the course was equivalent to a 4 year special degree in chemistry.

The Graduateship course of the RSC was studied and in September 1973, a committee comprising Dr. O.C Wickremasinghe, DR, L.B de Silva, Dr. Pearlyn Perera, Dr. R.H. Wijenayake, Dr. R.S Ramakrishna, Dr. G.P Wannigama (replaced by Prof. M. Selveratnam in June 1974) and Dr. R.A Rajapakshe were appointed to draw up the course content for the Graduateship programme.

When the course contents were discussed in July 1975, Prof. K. Balasubranium drew the attention to the omission of Biochemistry. A committee comprising Prof. K. Balasubranium, Dr. Stanley Wijesundera, Dr. R.S Ramakrishna and Mr. L.A.C Alles were appointed to draw up the course content in Biochemistry. In November 1975, the contents were referred to Dr. R.S Ramakrishna, Dr. M. Mahendran and Prof. M. Selvaratnam to review Inorganic Chemistry, Organic Chemistry and Physical Chemistry, respectively. The final Graduateship programme structure that was decided consisted of Theory part I (at 3 year B.Sc. General Degree level) and part II (at special degree level). The programme was to be conducted during the weekends in the English medium.

Under the vibrant and long sighted vision of IChemC President Dr. R.S. Ramakrishna, the Institute successfully negotiated with Aquinas College of higher studies, (where the Laboratory Technician training programme was started and successfully conducted since 1973) to conduct the Graduateship programme, part I, on Friday evening, full day Saturday and Sunday morning.

The objective of earning any income for the institute was not a factor at all, since the whole objective was to meet a really felt need of producing graduate chemists in which the universities at Colombo, Peradeniya, Jaffna and Sri Jayawardenapura

were annually producing only about 40 Chemistry special graduates although it was generally estimated that over 75 were needed annually at that period.

It was in such a situation that the entire business of charging fees was left to Aquinas College, who was expected to fix fees and provide the course in their premises in a manner similar to the Laboratory Technician Certificate Course (LTCC) programme. IChemC did not even charge a registration fee. Initially the registration fee for the course was Rs. 500. The names of the lectures were to be provided by the institute which would determine the results and issue the certificates but all financial and other arrangements were solely in the hands of the Aquinas College.

Payments for the lectures were suggested by the institute, to be paid Rs. 30 per hour (a very mediocre payment even by 1979 standards), which was 50% more than the hourly payment of Rs. 20 paid at the time to LTCC lecturers.

Based on the requirements, the Aquinas College advertised the Part I course with course fees fixed by them. 175 applications were received and of that, 72 were selected by an IChemC appointed selection committee comprising of Dr. R.S. Ramakrishna, Mr. T. Kandasamy, and Dr. J.N.O. Fernando. A Graduateship Examination was held in December 1978 for the first time and 3 out of 7 were succeeded at Part I qualification. It was the first step of academic examination in the history of the Institute of Chemistry, Graduateship programme.

Out of 175 applicants, 72 were able to register for the inaugural Graduateship programme. The first Graduateship course was ceremonially inaugurated on 16th May 1979 with Dr. Stanley Kalpage (secretary of the Ministry of Education and Chairman of University Grant Commission) as the Chief Guest.

That period was a stressful and scourging time where the open economy was newly introduced and private institutes were virtually absent. Private sector participation in higher education in Sri Lanka appeared as a challenging obstacle where the influence of Government University education policy of free education was highly appreciated. There were some academics including chemists who were insisting of not permitting university academics to conduct lectures for the Graduateship programme even after working hours and at the weekend saying that they will not be in a good mental and physical state to conduct university lectures on weekdays.

It should be specially mentioned the dogged courage and determination of the institute President Dr.

R.S. Ramakrishna who stood against all accusations thrown at the Institute and fought with the officials to get the permission from university authorities to conduct lectures for first part I course at Aquinas College.

Even though the theory course work started on May 1979 at Aquinas College, the Institute did not require compulsory attendance at a course as a crucial requirement to sit the theory examination. Further, the Institute was not hoping to offer any practical courses; instead they thought to give exemption for the matured or employed candidates who had no less than three years relevant experience in higher education or who had experience in an approved industrial laboratory, from the requirement of appearing for any practical course or examination. The reason for that expectation was that, the IChemC expected there would be a majority of enrollment of adults and employed persons, already working in chemistry related laboratories that would need only the theory knowledge from the Graduateship course offered by the Institute.

With the observations and comprehensive experience of the institute officials had, they could recognize that the population who were following the Graduateship programme was increasingly consisting of young school leavers. Meanwhile most of those who were already employed could not be expected as earlier thought to be able to possess adequate practical experience to enable exemption from the practical component in order to complete the Graduateship course successfully. Thus the officials of the educational committee of the Institute recognized the need of offering a full Graduateship practical course deemed equivalent to the standard that of a B.Sc. Special degree programme in chemistry offered by universities as soon as possible. Therefore, the committee decided to offer the practical programme as a part of the part II course in two sections for administrative convenience. Section A at the B.Sc. General Degree level (200 hours) and Section B at the Special degree level (200 hours).

Though, the first Part I theory course proceeded initially without any difficulties, a few problems were raised with the decision to initiate a fully fledged Graduateship practical course that is compatible with the B.Sc. Special degree programme in Chemistry. Consequently when the officials of the Institute approached the Aquinas College authorities with this new development, they did not receive a positive feedback.

That in fact a huge opportunity for the Aquinas

College to make use of the open economy introduced in Sri Lanka in the late seventies which ensures new Laboratory equipment without any legal barriers by the Government and also a remarkable opportunity to make use of the facilities and resources available at the Institute of Chemistry without any financial stress. From the first batch at the Aquinas College, the Institute was not intend or planned to generate any income and therefore was not yielding any income at all for the Institute since all financial arrangements were handled by the Aquinas College so there were no any financial messes involved with the Institute in establishing a practical course.

The Aquinas College was however not prepared to meet the minimum requirements that the Institute requested for the practical course. Despite the official procedure, personal representations arranged by Dr. E.R. Jansz with the Aquinas College Rector to discuss the issues. The Aquinas College was not prepared to alter their decision.

That issue came to a head when the Aquinas College having agreed in 1978 to provide the infrastructure facilities to complete the first part I course (two years) then in progress, refused to ensure continuity of even the Part II (theory) course thereafter for those students already enrolled. The Council found itself in a serious tangle as a result of these unexpected development. However the Institute was hopeful that it can handle the situation without any effect on the inaugural batch.

There were some controversial accusations as well from even Council members with regard to the commencement of the Graduateship programme without a practical course. Though there was some truth in it, one should clearly realize that, this type of a programme may never have been commenced if every possible problem had to be anticipated and solved or corrected before it arose. The educational officers thereafter took up the challenge of searching for an alternate location for the programme to be shifted in early 1981. Thus to commence the part II (theory) course Zahira College, Visaka Vidyalaya, Stafford College, Pembroke Academy, S. Thomas' College, Mount Lavinia were approached.

Finally the Management of the S. Thomas' College, Mount Lavinia cordially agreed to locate the Graduateship programme in S. Thomas' College. The deepest gratitude and unfailing thanks of the Institute should go to the Board of Governors of S. Thomas' College, Mount Lavinia for coming to the aid and assistance of the Institute at that critical stage. In

particular Mr. M.L.C. Illangakoon (then Warden), Bishop S. Fernando (then Board Chairman), Mr. G.A.C. Sirimanne (then Board Secretary, former government analyst) and other Members of the S. Thomas' College Board of Governors should be remembered for allowing the Institute to use the new science building and laboratories to conduct the Graduateship programme with both theory and practical components with effect from January 1981.

Special appreciation also should go to the then president Mr. T. Kandasamy for the effort he undertook through former Government analyst, Mr. Sirimanne, to make this possible. Though S. Thomas' College, Mount Lavinia authorities kindly agreed to provide the necessary infrastructure facilities and essential physical resources available in the college to conduct the lectures and practical in the new science building, they were understandingly not agreeable to run the programme in a way similar to that of the Aquinas College. The Institute was therefore compelled to take over all the financial and administrative arrangements into their hands. Therefore the payments for the buildings, laboratories, maintaining equipment and all the staff employed either from the college or outside had to be done by the Institute on its own.

The College provided a Co-ordinator, Mr. A.R. Manoharan to co-ordinate the arrangement. The Council approved the new arrangement and S. Thomas' College officials also accepted the offer of the Institute to pay it 10% of theory fees and 25% of the practical fees collected by the Institute. The Institute then had to undertake the complete organization of the Graduateship Programme at S. Thomas' College from January 1981.

While planning to conduct a new Part I theory course on January 1981 at S. Thomas' College, the Graduateship examination of the first batch was held in December 1980. 44 candidates (out of 64 applicants) appeared for the part I Graduateship examination; 11 candidates were successful and 1 was referred. 10 of the candidates who passed had followed the part I course at the Aquinas College. The 3 candidates who had passed the first ever Part I examination appeared for the part II examination and all were referred.

The Board of examiners for that examination was Prof. R.S. Ramakrishnan, Prof. S.G. Gunaratne, Prof. Tuley de Silva, Prof. M. Mahendran and Prof. S. Megeswaran, Dr. H.W. Dias, Dr. R.P. Gunawardena, Dr. H.D. Gunawardhana, Dr. L.M.V. Tillakeratne, Dr. E.R. Janzs, Dr. R.A. Thurasingham, Dr. M.I.M. Wazeer, Dr. W. Mallawarachchi and Dr. J.N.O.

Fernando. All the chemistry answer scripts were externally examined by Dr. D.A. Whiting (organic), Dr. Hey (physical), and Dr. Hubertsey (inorganic). The fourth paper (part I) was externally examined by Prof. K. Balasubramaniam and Prof. S.G. Canagaratna.

The Council welcomed the formation of the Graduateship Students' Society and looked forward to increasing co-operation and support between the students and the Institute. The Council had decided to make a terminal grant of Rs. 5 per registered student towards the funds of the society. The Institute treasurer functioned as the senior treasurer of the society.

Part II (theory) of the first batch commenced at S. Thomas' College in 1981 with the introduction of three new courses. 12 students registered including the 10 students who passed part I (theory) in 1980/81. Meanwhile the Institute advertised for the second batch of Graduateship programme. For the first time Institute levied a registration fees of Rs. 500, a refundable laboratory deposit and tuition fees.

For the upcoming new Graduateship programme Dr. J.N.O. Fernando was appointed as the course co-ordinator and the secretary for the educational affairs. A fourth paper titled "Mathematics and Biology for Chemistry" was also introduced into part I course for the first time in 1981. Graduateship examinations were held in December 1981. Only 2 applicants out of 4 appeared for the part II examination, one candidate passed the examination while all others referred. A Chemistry Special degree graduate was exempted from the practical examination, was the first to complete the Institute's Graduateship examinations. For the first time Section B practical course was commenced at Mount Lavinia in January 1983. The four term course which provided 200 hours of practical instruction up to a special degree level was due for completion by the end of 1983.

For the first time in the history of the Institute in 1980, it became possible to rent out an office space for the Institute. Deep appreciation and thank should go to the Sri Lanka Association for the Advancement of Science for kindly renting out their former duplicating room previously occupied by the Sri Lanka Federation of Women, (on the first floor of Vidya Mandiraya) for a monthly rental of Rs. 500 for two years in the first instance. Simultaneously the Institute employed a clerk typist Ms. Berthelot and since 01st of December 1980 Mr. A.J. Benedict had been helping the Institute on a part time basis with the Graduateship courses and was in charge of the Institute stock of chemicals and glassware at S. Thomas College Mount Lavinia.

The office was formally declared open by the General President of SLAAS Dr. O.S. Peiris in the presence of a representative gathering on 6th April 1981. In August 1983, the Institute office moved into a larger room in the ground floor at Vidya Mandiraya on a rental of Rs. 1000 plus Rs. 100 for the service. Although the Minister of Post and Telecommunications recommended a priority telephone for the office in July 1986, the phone was installed only in February 1990 nine years after the office was opened.

The rapid growth of the education and training activities of the Institute resulted in the Council appointing a sub-committee to draft relevant by laws and rules for the establishment of an Educational Committee that would help particularly in promoting education by overseeing and co-ordinating education, training and academic affairs of the Institute on behalf of the Council. In order that the educational committee may function as a statutory committee of the Institute, necessary amendments to the existing rules and regulations had been proposed at the annual general meeting for adaptation. Pending the formal establishment of the committee, a provisional committee was appointed by the Council with Dr. R.S. Ramakrishnan as the Chairman, Dr. J.N.O. Fernando as the Secretary and Dr. S. Hettiarachchi as the Assistant Secretary. The other members of the first committee which was set up on 8th May 1981 were Professors K. Balasubramaniam, Tuley de Silva, A.A.L. Gunathilake, S. Mageswaran, M. Mahendran and W.P. D. Pereira, and Drs. E.R. Jansz, V. Kumar, S. Kumarasinghe, G.R. Roberts and D.S. Williams.

The first meeting of this committee was held on 8th of May 1981. The committee appointed curricular revision committees to review and report syllabi of inorganic chemistry, organic chemistry and physical chemistry for part I of the Graduateship programme. The review committee was requested to look into the possibility of avoiding overlap of course content and to have a uniform number of lecture hours, 100-110 hours for each course.

That statutory committee obtained formal status with effect from the 1st August 1981 following an amendment to the Institute by-laws at the 1981 annual general meeting. Thereafter Dr. R.S. Ramakrishna became the first Chairman of the educational committee of the Institute of Chemistry Ceylon with Dr. J.N.O. Fernando as the first Secretary while Dr. S. Hettiarachchi became the first Assistant Secretary. Two years later in 1983, Dr. J.N.O. Fernando was appointed as the Chairman, with Dr. S. Hettiarachchi as the

Secretary for Educational Affairs and Dr. T.P. Wijesekera as the Assistant Secretary with the passing out of the first batch of four graduate chemists in 1984. Two of them (Mr. A.I. Perera and Ms. Roberta Fernando) were also co-opted to the educational committee with effect from May 1984.

Until the educational committee was set up, Professor Stanely Wijesundera, then Vice-Chancellor of the University of Colombo, functioned as the Chairman of the Board of Examiners.

Table 01. Chairman, Educational Committee/ Academic Board (1981-2016).

1981 - 1983	Prof. R.S Ramakrishna
1983 - 1986	Prof. J.N.O Fernando
1987 - 1988	Prof. E.R Jansz
1988 - 1994	Prof. J.N.O Fernando
1994 - 1996	Prof. H.D Gunawardhana
1996 - 1998	Prof. E.R Jansz
1998 - 2001	Prof. H.D Gunawardhana
2001 - 2015	Prof. J.N.O Fernando
2015 - 2016	Prof. S.P. Deraniyagala

In order to meet the huge financial commitment that would become necessary in order to conduct section B of the Graduateship practical course, the Council authorized the launching of the Education Purposes Fund in order to collect donations in cash and kind. A big thank should go to Mr. N.A. Goonawardena, Hemas drug Ltd, M.S.J. Industries Ltd, Maharaja Organization Ltd, Paint & General Industries, Pure Beverages Ltd and Royal Society of Chemistry (Sri Lanka Section) for donations which have been received during the first two months of the appeal.

Following a misunderstanding that arose in the utilization of the educational funds for the Council activities (such as holding a proposed international conference in 1981) it was decided by the Council in July 1981 that Education funds in general and Graduateship course money in particular (including interest) must be utilized as decided by the Educational Committee. It was also however decided by the Council on the recommendation of the educational committee to increase the registration fees from Rs. 500 to Rs. 600 and remit 20% of the registration fee to the General account of the Institute in order that the general activities of the Institute could benefit financially from the conduct of Graduateship programme.

That procedure had been continued continuously since then and with instantaneous increases in registration fees a considerable increase in the general institute income has taken place rapidly over the years. With the increase of the registration fee to Rs. 40,000 in 2003, the contribution to general fund was enhanced to 25%. The Council also decided that 15% of this contribution will be specifically devoted from 2004 toward the proposed the IChemC research journal. However, this practice was abandoned within a short time when it was recognized that the IChemC research journal was not a viable exercise.

It is noteworthy to mention that the firm decision which was taken considering the future of the Institute, to earmark the use of educational funds only on a recommendation of the Educational Committee was one of the finest and premature decision taken by the Institute. If not for provision it is quite possible that Educational fund could have been utilized by the Council for other activities which would have harmed the primary purpose for what these money had been collected, saved, invested and expended. The General funds of the Institute of Chemistry had also benefitted in great deal since the annual contribution to the General fund from the educational fund has increased considerably.

From the very start of the educational activities, the Institute realized as a matter of fundamental policy, that the institute can't start a new part I course every year at Mount Lavinia which meant that until a part I course (lasting nearly 2 years together with the time required for conduct of the relevant examination) was fully completed, a second part I course was not commenced. Consequently, Part I courses were commenced in Mount Lavinia in alternate (odd) years such as 1981, 1983.

During the 1980-1982 time period the idea of establishing a Graduateship Programme in Peradeniya was emerged. The activity of the Peradeniya section was revived in May 1980 by conducting one lecture by Dr. N.P.D. Nanayakkara. It was accepted by the Council; consequently to conduct a part I course during the alternating (even) years at the Chemistry Department premises in the University of Peradeniya on weekends. However, it was also recognized that the lack of resources and adequate student numbers would prevent the conduct of part II course as well as practicals at Peradeniya. Simultaneously with the recognition it was also agreed that only one part II course will be conducted at a given time and that was to be in Mount Lavinia. Therefore, the students began to

enter the Part II programme after completing Part I annually either at Mount Lavinia in odd years and Peradeniya in even years.

The part I course at Peradeniya thus organized by the Peradeniya section of the Institute was formally inaugurated on 3rd July 1982 by Prof. B.L. Panditharathna, Vice Chancellor of the University of Peradeniya. Dr. J.S.H.Q. Perera was the first Co-ordinator of the Peradeniya Course. Thus from 1982, a Part I course had been successfully conducted at Kandy without interruption in alternate (even) years while largely serviced by the Peradeniya staff, academics from outside Peradeniya including Colombo also assisted the Peradeniya staff.

Around 1987, National problems had their effects on conducting the courses at the University of Peradeniya since some university students viewed that the conduct of such paid courses by outside bodies would spoil the free education policy of the government. Therefore with effect from 1988 the conduct of Part I Peradeniya programme was shifted to Kingswood College premises where the programme was conducted successfully until 2008. The grateful thanks were extended to the national and provincial (Kandy) education authorities for permitting the Institute to use the Kingwood College during weekends for this purpose. 10% of the tuition fees were paid to Kingswood College weekends subject at minimum of Rs. 1000.

From the start in the early eighties the Graduateship programme both at Mount Lavinia and Peradeniya went quite smoothly without any interruption, however at the late eighties a few problems emerged due to the unstable political situation existed. It was happy to record that the national problems arose in Sri Lanka during the period July/August 1983 and in 1987-1989 had minimal adverse effects directly on the Graduateship course despite all the problems created by difficulties such as lack of transport, threats and curfew etc.

Due to unforeseen circumstances which prevailed in the country the Graduateship examinations scheduled in November/ December 1988 were postponed and instead in January/February 1989 Graduateship examinations were held. The Institute Graduateship programme was continued in Mount Lavinia with virtually no interruption. The only disturbance which occurred was the interruption to the Kandy Programme for a very short period during 1988/1989.

Graduateship examinations however were

conducted every year as scheduled, without any inconvenience but in November 1988 the Institute was forced to postpone the Part II examination to February 1989 due to sudden declaration of a curfew and consequential transport issues that students could not overcome. It was very unfortunately affected the ability of students to appear for the examinations. However through those great difficulties educational committee decided to make the Part II C examination (Research Project) as an optional part of the 1989 examination.

Despite the fact that the Graduateship programme was little interrupted due to the rumpus situation that arose with the national problem existed, it is important to mention that the situation favored a tremendous increase in the number of students registering for the Graduateship course, during the eighties. The closure of the national universities for long periods of time and the inability of even starting the studies for the selected students in these universities during late eighties, resulted in many students applying to join the Graduateship course in the Institute. In 1989, the Institute was able to enroll only 86 out of the 172 qualified applicants at Mount Lavinia due to the lack of lecture room space.

The demand for the Graduateship programme was so great that the institute changed its existing policy and decided to commence a part I course in Mount Lavinia every year. Consequently the Part I course was duplicated at Mount Lavinia with effect from the year 1990. This meant that from that time two Part I (Theory) course and a Part II (Theory) course were conducted at Mount Lavinia in addition to the Part I course at Kandy in alternative years. The number of students following the course reached a peak during that period compared with previous times. To attest the success that the Institute attained over that crucial period, it is glad to extract a part of a paper entitled "Chemical Education- A Partner in progress?" written by Prof. J.N.O. Fernando.

"One of the most laudable and welcome development in the sphere of chemical education over the past decade has been the non-conventional openings provided through the professional Graduate Programme of the Institute of Chemistry Ceylon. The opportunities particularly to those in middle level employment and late developers are tremendous. The nearly 50 Graduate Chemists who had passed out over the past 5 years have proved at their respective places of work that most of them are comparable to university special degree Chemistry graduates. Their production has increased the country's output by 20% at no

expense to the country and at a personal cost of less than Rs. 20,000 per head over 4 years."

An academic dress was proposed by Mr. Eugene de Silva one of the Institute graduate chemists in 1989. He initiated the designation of an appropriate dress for the Institute. It was initially rejected by the Educational Committee. However with the explanation letter from the Royal Society of Chemistry to the effect that RSC had an academic dress for the graduate chemist, the approval was given. The dress was used for the first time when the graduate chemists were included in the annual session procession for the first time at the inauguration of the Golden Jubilee Annual Session in June 1991 at the B.M.I.C.H. The dress was comprised with a black coat, dark orange with a light orange lining and yellow piping. The institute logo is printed in black in the hood. It was included a black colour cap with orange colour tussle.

Very important changes were gradually introduced during the nineties in order to reduce the failure rate and motivate students. As a first step in 1991 each of the three Chemistry Part I papers at the end of two years of study had a structured compulsory section. In 1995, the above change was dispensed with and replaced by having a completely structured paper (with all questions compulsory) on Basic principles in Chemistry (C101) at the end of the first year, at the new part I (A) examination. Students had to obtain at least a grade D in that paper in order to sit for the three part (B) Chemistry papers at the end of the subsequent year. Furthermore students had to obtain a minimum attainment in each of the three areas in order to obtain a pass in this paper. In order to obtain a pass in the Part I examination, students were necessarily required to pass in this paper; also the two papers on relevant section in Mathematics and Biology (C141) had also to be sat by students at end of the first year.

An extensive further revision of the course content came into operation with effect from 1997 for Part I (A) at the end of the first year and in full for both sections of Part I in 1998 i.e with the 1997 student intake. A principal change at Part I was the introduction of four double weight (80 hours) and two single weight (40 hours) papers. Amongst these papers one double weight (Basic Biological Chemistry) comprised the Part I (A) after the first year while the restructured three double weight papers (Physical/Organic/Inorganic) comprised the Part I (B) examination.

The consequential amendments to the part II (Theory) course content with effect from the year 2000, the introduction of eight double weight paper

comprising two in Physical Chemistry, two in Organic Chemistry one in Inorganic Chemistry one in Analytical Chemistry, one in Chemical Technology and Bio Technology and one in Environmental Chemistry and Management, each paper corresponds to a 60 hours lecture content. Another major change that came into operation was in the structure of the evaluation of practical examinations. The change was to have three continuous assessment practical papers comprising an assessment of student performance during the practical classes of the three principal areas of study: the three formal practical examination papers were given double weight status while the continuous assessment papers had single weight status totaling nine for the overall practical evaluation.

Simultaneous with the above changes, the previous rules governing the determination of results were also amended with effect from the year 2000 examination. In summary part I contributed the equivalent of 10 weighted units, part II (Theory) 16 and Part II (practical) 9 totaling 35 units.

It is worthwhile to note that the amended course structure and course content turned out to be a much better evaluation mechanism than what existed earlier. The practical evaluation became very much more meaningful due to the continuous assessment component comprising one third of the overall practical evaluation. It is interesting to note how the authorities responded to contemporary changes and made the programme and evaluation more effective and meaningful with the availability of more resources and personnel over the years.

The basis for these criteria with initial consideration of the entire part I performance as one paper (100 marks) in addition to the six theory papers (600 marks) and three practical papers at Part II (300 marks) giving a total of ten papers and 1000 marks. (Changes have taken place from the year 2000 examination, when the examination structure was changed consequent to a change in the course content with effect from 1997. While no class is awarded to any student who repeat the Part II (Theory) paper, Part II (Practical) examination, those who repeat Part I in full or in part were assigned only 40 marks (C Grade) for such repeat examination/paper for the purpose of determining the class.

The College of Chemical Sciences (CCS) was established in January 2001 during the Diamond Jubilee celebration of the Institute of Chemistry Ceylon. Prof. Tuley de Silva took up the matter seriously and obtained the Council approval to

formally establish the College of Chemical Sciences on 25th of January 2001. As per by law 15 of the Institute of Chemistry Ceylon, the College of Chemical Sciences was established to conduct all the educational and training activities of the Institute. A statutory committee known as the Academic Board of the College of Chemical Sciences is appointed by the Council annually to promote, conduct and co-ordinate all the education, training and academic affairs of the College of Chemical Sciences. Legal sanction for this change however came only through an amendment to the by-law of the institute at the 2001 AGM held in June 2001.

Through these amendments, the Academic Board of the college became the legal successor to the Educational Committee functioned from 1981 for a period of 20 years. All the formal educational programmes are the immediate responsibility of this Board which is headed by the Chairman and includes Vice Chairman, Secretary for Educational Affairs, Assistant Secretary and eleven other elected members. Additionally, the President of the Institute, one of the Honorary Secretaries of the Institute, the Chairman of the Admissions & Ethical Practices Committee of the Institute and the Institute's Honorary Treasurer are ex-officio members of the Academic Board. The Chief Executive Officer of the Board is the Honorary Rector appointed annually by the Council.

The first Chairman of the Academic Board was Prof. H.D. Gunawardhana (July 2001-January 2002) however when he could not continue due to personal involvements, Prof. Tuely de Silva invited Prof. J.N.O. Fernando to take over as the Chairman and additionally with effect from 1st March 2002 as Honorary Dean. Prof. J.N.O. Fernando had continued as the Chairman, Academic Board. Mr. N.I.N.S. Nadarasa, who was the Senior Academic Affairs Officer at the Mount Lavinia sub-Office from 1999 was appointed as the first Registrar of the College of Chemical Sciences with effect from 1st March 2002. With the resignation of Mr. S. Mohodeen Bawa as the Registrar of the Institute Mr. Nadarasa was concurrently appointed as the Registrar of the Institute as well with effect from 1st November 2002.

The Library of the Institute of Chemistry was first set up in the library premises of the Ceylon Institute of Scientific and Industrial Research at 363, Baudhaloka Mawatha, Colombo in 1981. At the initial stages the library received a stock of books worth € 800 gifted by the Oversea Development Authority (ODA), UK, as well as a further consignment of book from the Asia

Foundation. Since the Institute had no library of its own, these books were temporally housed in the CISIR library with the permission of the former Institute President and the CISIR Librarian Ms. C.L.M. Neththsinghe. In 1982 a book stock worth € 1000 was received by the ODA programme of UK.

A major problem of the library at the CISIR was the fact that it was physically housed five miles away from the Mount Lavinia and the fact that students were unable to use it weekends since they were occupied with lectures at Mount Lavinia. This was however a problem which the Institute was unable to surmount at that time with the limited resources at its disposal. The Institute had to be satisfied with the facilities at the CISIR as there was no other alternative.

It was therefore once again in many ways a blessing in disguise that a change of policy at the CISIR resulted in a restructuring of the CISIR library with effect from 1993. The Institute was consequently given a notice in 1992 that the CISIR will not be able to continue to extend the library facility granted to the students much longer. The Institute therefore compelled to look out for premises in or around Mount Lavinia. In May 1993 the library was shifted to 38, Sumanarama Road, Mount Lavinia, a mere 10 minutes' walk from S. Thomas' College and in May 1997 to No. 39, along the same road. It moved to present location the Adamantane House having an area of about 800 square feet on February 25, 2005 and was formally opened as Clodagh Nethsingha Library in honor of the valuable services rendered by her to the Institute and to the library in particular.

The new headquarters building "Adamantane House" was ceremonially opened in February 2005 by Dr. R O B Wijesekera. This is a four storey building which houses the Institute office and the College of Chemical Sciences. There is PPGL Siriwardene Auditorium and several lecture halls including JNO Fernando Hall and ROB Wijesekera Hall. There are two laboratories, which are named MU Sultanbawa Laboratory and RS Ramakrishna Laboratory, at the Adamantane House of the Institute of Chemistry Ceylon. The Sultanbawa Memorial Laboratory was ceremonially declared open in 6th May 2005 and the Ramakrishna Memorial Laboratory was opened in 15th July 2005. HD Gunawardhana Instrument Centre was opened in 2006 and it is now equipped with Instruments such as Gas Chromatograph, Atomic Absorption Spectrometer, FTIR spectrometer, UV-Vis and Fluorescence spectrometer. Five storey extension

to the Adamantane House was opened in 2014 by Mr. Mevan Pieris. This has the Council Room, a laboratory, lecture halls, staff rooms and a penthouse.

From 2005 to date many improvements have been made to the course structure including the practical component. In 2006 research projects were introduced as an important component in the Graduateship Programme. The library facilities have been improved with the expansion of the space. Since 2005 full time academic staff members with the PhD qualification were recruited which has now increased to 14 members. Graduateship programme was accredited by the Royal Society of Chemistry, UK in 2012. With all the progress made over the years the Graduateship Programme has been recognised nationally and internationally.

"This article was written based on the Seminar Presentation report of Mr. D B Jayalatharachchi of the College of Chemical Sciences written under the supervision and the guidance of the late Prof. J N O Fernando."

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History of the Diploma in Laboratory Technology in Chemistry

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Student, College of Chemical Sciences

The Laboratory Technician Training Programme was initiated because of the demand for training of laboratory technicians which was necessary due to the country being on a path of industrialisation. There was a scarcity for trained laboratory technicians in schools as well as in government agencies. The personnel who were working as technicians at that time relied only on their experience. During this period, the batches of the trained personnel in a related field were the Medical Laboratory Technicians (MLT) recruited by the Department of Health and these personnel were attached to government hospitals and other medical laboratories as medical laboratory technicians.

At first, Dr. S. Senthe Shanmuganathan, (ICChemC President, 1972/1973) was appointed as the director of this program and subsequently became the coordinator. It was first proposed to collaborate with the University of Ceylon in Colombo and discussions were held with Professor B.A. Abeywickrema, the Vice Chancellor. Prof. Abeywickrema wanted the details and suggested to include physics and biology, and structure the course into 5 or 6 parts and issue certificates for each part. At the Council meeting held in September 1972, it was decided not to conduct the classes at the University but to have the course at Aquinas College of Higher Studies (ACHS).

This was possible because Aquinas College already had laboratories used to conduct the External B.Sc. (London) programme, which had been stopped by that time.

The formulation of the syllabus for this course was entrusted to a committee in November 1972. The members of the Committee were Dr. J.K.P. Ariyaratne (General Chemistry), Dr. M.W.C. Dharmawardene (General Physics, Mathematics and Statistics), Mrs. R. Curtis (Food), Mr. T. Kandasamy (Drugs and Poison), Dr. A.S.L. Trimanne and Dr. (Mrs) Seetha Rodrigo (Natural Products), Dr. O.C. Wicremasinghe (Mineralogy), Mr. E.E. Jeyaraj (Microbiology), Mr. I. Le Mercier (Electronics), Mr. D. Henry (Glass Blowing). This was then approved by the syllabus review committee which consisted of Dr. R.S. Ramakrishna, Dr. M.E.M.S. de Silva, Dr. E.R. Jansz and P. Paskaranathan, in February 1973.

When it was initiated in 1973, the Diploma in Laboratory Technology in Chemistry (DLTC) was called the **Laboratory Technicians Certificate**

Course (LTCC). As specialisation subjects, Agricultural Chemistry, Clinical and Bio Chemistry and Analytical and Food Chemistry were incorporated in to the program in later years.

The inauguration of the program was done in June 1973 by Mr. M. Sivanathan, the Secretary, Ministry of Industries and Scientific Affairs. Lectures and practical sessions were held at the ACHS where only 36 students from technical laboratories and institutions participated. This program started off with minimum facilities. According to Professor J.N.O. Fernando, "There was not even a table, and as I recall, there must have been a few hundred rupees in the bank account". The institutional administration was done by the Aquinas College of Higher Studies (ACHS) and the Institute only provided the lecturers and dealt with the examinations.

The management of the course was divided between the Institute of Chemistry and the ACHS. The Institute had a Coordinator and a Committee to assist him. They programmed the work such as arranging lectures, examination and examination results. The coordinator was a member of the Council and later the Educational Committee reported the progress of the course to the Committee. From the beginning the coordinators had functioned very satisfactorily and kept to target dates.

The Coordinators were Dr. S. Senthe Shanmuganathan (1973 - 1975), Dr. E. R. Jansz (1975 - 1976, 1980 - 1983 and 1989 - 1993), Dr. J. N. O. Fernando (1976 - 1977), Dr. M. Coomarasamy (1984-1989), Mr. K. Sivarajah (1993 - 1998), Mr. E. G. Somapala (1998 onwards).

In 1980, the Institute received a small space at the Sri Lanka Association for the Advancement of Science (SLAAS), which is also called as "Vidya Mandiraya". The ACHS was unable to draw in the crowd for the DLTC programme, and ultimately the option of advertising the institute address at the SLAAS was also not very successful. With that marginal drop, only four subjects were taught out of the 22 subjects which had been offered by the Institute.

There was the problem of language from time to time. It has always been the Institute policy to conduct all courses in English medium. There were occasions when some students had difficulty in following the course. On such occasions Basic English classes were

organized.

The course was reviewed from time to time and changes were made according to needs of industry and other institutions and in keeping with other developments. In 1987, a course in Industrial Chemistry was introduced in to the LTCC programme. 1987 was also an important year as a complete review of the courses was undertaken. A revised syllabus was discussed by the Council and a new prospectus was tabled on December 1987. It was felt not to have a particular special unit if the number of students were less than thirty (30). A new prospectus was approved by the Council on December, 1987. Further, in this year, the program was divided in to two sections, namely section A and section B which comprised the generalised subjects and the specialised subjects respectively. Section - A comprising of 14 units of general subjects and Section - B comprising of 6 special subject units.

In the 25th year, in 1998 during the silver jubilee year of the LTCC programme, it was queried as to why a course that goes on for one and a half years should be called a certificate where as in other places, there were six month courses called diploma courses. Hence it was decided that this course had all the right to be termed as a Diploma above all the other "mushroom" diplomas. Therefore the subject content was revised again and thus it was named the "**Diploma in Laboratory Technology in Chemistry**" (DLTC). Mr. Peter Rowe, High Commissioner for Australia in Sri Lanka, participated as the Chief Guest at the Silver Jubilee Award Ceremony held in November 1999.

The DLTC programme was conducted at ACHS for 34 years. With the intake of the 32nd batch in 2005, it was shifted to the newly built Adamantane House, Rajagiriya. At that period of time the number of students enrolling to the program was increased considerably. A suggestion was made, to restart the specialisation courses in the DLTC programme. Therefore the subjects were revisited and revised, and the Clinical Laboratory Technology and Industrial & Food Chemistry specialisation subjects were re-instated in 2009.

Recent developments in respect of this programme include an exponential increase of numbers from an average of about 20-25 during the first three decades at Aquinas to as much as 130 in 2013. Large numbers are now joining the programme particularly from the medical sector laboratories since the re-introduction of specialization in a specific field in the second year of the programme. Asiri Surgical Hospital Laboratory has

one of our DLTC products in the capacity of Head Laboratory. For several years this hospital sponsors a large number of their technicians to our programme and they specialize in Clinical Laboratory Technology in their second year.

Those who have completed the DLTC Clinical Laboratory Technology are eligible to register in Ceylon Medical Council as Medical Laboratory Technologist (MLT).

Consequently such technicians having our DLTC qualification are recognized by the Sri Lanka Accreditation Board for Conformity Assessment for Accreditation of medical laboratories under ISO 15189.

The Diploma in Laboratory Technology in Chemistry qualification carries much weight as a certificate issued by an incorporated professional body. Further, recognition is given to the Diploma in Laboratory Technology in Chemistry Certificate by some public sector and private sector organizations who pay the fees of their employees and also give increments and other credit for those employees who successfully complete the course.

The Institute of Chemistry Ceylon gives credit for the Diploma in Laboratory Technology in Chemistry Certificate by incorporating into their regulations the following benefits.

- These include admission to the Graduateship Programme in Chemistry to all those persons possessing a pass at the DLTC Programme in lieu of the normal requirement of three GCE (A/L) Passes
- Furthermore, those students who have Honours passes at the overall DLTC Examination are entitled to a scholarship to follow the Graduateship Programme in Chemistry. The Scholarship incorporates a waving of the registration fees, examination fees and tuition fees of the first two years (Levels 1 & 2) of the Graduateship Programme in Chemistry.
- Those who complete the DLTC programme are eligible to become TECHNICIAN members of the Institute for life. Where so admitted, they are entitled to use the designation Tech.I.Chem.C. after their names.
- Those having a pass at the Graduateship (Levels 1 & 2) Examination and an Honours/Merit pass at the DLTC Examination are also entitled to Licentiate Membership of the Institute after sufficient experience in the Chemical Sciences.
- Those having a DLTC pass and has been a

Technician member of the Institute of Chemistry Ceylon for not less than 8 years and have adequate experience in the Chemical Sciences are eligible to obtain Licentiate Membership (L.I.Chem.C.) of the Institute which is normally open to those having a B.Sc. (3 years) degree including Chemistry as a subject.

Serving the need of the society, as in the very beginning itself, the DLTC programme makes certain that at the diploma qualification the passing out will be thoroughly equipped and well trained in a middle level employment level in Chemistry. The programme remains till today as the only producer of middle level technical expertise in chemistry in the island, having specializations both in Clinical Chemistry and Food & Industrial Chemistry.

The recognition to the qualification of professionalism would be reflected by the fact that Ceylon Medical Councils' (CMC) issuing of the Medical Laboratory Technician (MLT) registration for the Diplomates who get qualified in the Clinical Chemistry field and by the fact that most of the employers of middle level chemical technicians recommend and finance the endeavour of obtaining this qualification by their employees.

Evaluation of the students purpose of joining as well as the analysis of the increasing number of students who join the program each year tell in silent words of the acceptance of the Diploma in a professional capacity. In fact the year 2012 marked the highest intake of students to the programme recording an acceptance of a number 130. Therefore, the quality and recognition of the training is yet again reflected in the statistics of the programme.

The journey so far has not been a walk in the park. Challenges and hardships were part and parcel of the venturous and interesting progress the DLTC programme has achieved. Starting with absolutely nothing, by now the programme has evolved and matured to be a unique and irreplaceable asset to the country.

Being the only producer of middle level employment chemical expertise in the country, the DLTC programme continues to experience an unprecedented growth, markedly from 2005 onwards. The annual enrolment now stands at present well over 100 students.

Cumulative production now stands well over 1000 diplomates as of 2016 and expected to maintain the

increase in rate of annual production of diplomates in the light of the growth in annual enrolment.

The future holds much promise for the programme. With much deliberation and discussion amongst the academics it is agreed that there are opportunities and resources available for the DLTC programme to expand itself into new specialization areas in order to cater to the arising needs of the country which is currently experiencing a development boom.

After careful consideration and assessment of the afore stated facts, in conclusion it could be safely stated that the Diploma in Laboratory Technology in Chemistry programme successfully addresses the needs of the country in the arena of Chemistry and related fields and already has an enormous impact on the Chemical education and professionalism in the island. The programme also offers much hope for the future and is with potential to evolve into a world ranked educational programme.

"This article was written based on the Seminar Presentation report of Mr. S Werakoon of the College of Chemical Sciences written under the supervision and the guidance of late the Prof. JNO Fernando."

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Guest Articles

Synthetic Analogues of Cannabinoids and Cathinones

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A drug, for most of us, means a doctor's prescription of medicine. A drug is defined as "a chemical substance used in treatment, care, prevention or diagnosis of disease or used to otherwise enhance physical or mental well-being".¹ Also it refers to substances which affect the brain. However said, they affect our normal bodily functions on consumption. Drugs can be of benefit or of harm, especially when abusing drugs which are illicitly produced. These are psychoactive i.e. affecting brain functions. Drugs of abuse interfere with the process of normal communication in the brain, producing its effects - described as euphoria or 'high'. Cocaine, amphetamine type stimulants (ATS), and opium products such as heroin or cannabis are some examples of illicit drugs.

There seems to be a dramatic increase in the use of new psychoactive substances (NPS) in the past decade as said in the World Drug Report 2013.² These new psychoactive substances are not under international control. Thus, it is an imminent threat, as producing and marketing of such drugs give high profits without legal penalties. The production or distribution of these substances will be shifted from one country to another when it is controlled by laws, or the chemical structure is slightly modified; so the market is highly evolving to slip through legal loopholes.² Further, there seems to be less scientific research and understanding of their adverse effects, may be due to its recent emergence.²

Some of these substances are chemical analogues (meaning they are structural derivatives of a compound with few chemical modifications compared to the parent) or mimetics - where chemically different substances mimic the pharmacological effects of another possibly by action on the same receptors in brain. This article discusses about two major kinds of such synthetic drugs: synthetic cannabinoids and

synthetic cathinones. Before discussing about synthetic ones let's briefly look at natural cannabinoids.

Cannabis:

Cannabis seems to be produced in virtually every country of the world; this makes it the most widely illicitly produced and consumed drug plant. The cannabis plant (also called the hemp plant), *Cannabis sativa* L. (Cannabinaceae) is a single plant species, though exists in different biological, chemical and/or morphological varieties. It is a cosmopolite, annual plant and can be widely grown throughout temperate and tropical regions of the world. In Sri Lanka, it is the only plant illicitly cultivated for drug production. It is mostly cultivated in dry zones of the Eastern and Southern provinces.

The main psychoactive substance in cannabis is (-)-*trans*-delta-9-tetrahydrocannabinol (THC) (Figure 1). In addition it contains cannabinol, cannabidiol, cannabigerol, cannabichromene, cannabinoid acids *etc.* All these compounds are collectively known as cannabinoids as they are unique to the cannabis plant and believed as responsible for most of its psychoactive effects.

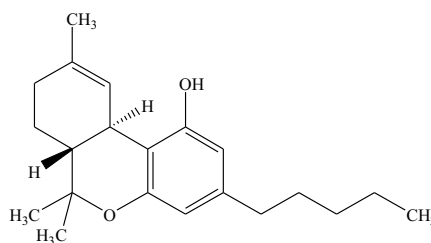


Figure 1: (-)-*trans*-delta-9-tetrahydrocannabinol (THC)

Synthetic cannabinoids

These are synthetic compounds chemically similar to THC in cannabis and mimic the effects of THC

possibly by acting on the same receptors in the brain (acting as agonists). Being more potent than THC, they seem to be currently the most widely used type of NPS.² They are marketed as a mixture of dried herbal material sprayed with synthetic cannabinoids. Being labelled “not for human consumption” had removed its necessity of listing the ingredients of the product thus enforcing their “legality”.³ They are mainly known by the names Spice and K2 in the street. Other common names include fake weed, Yucatan Fire, Skunk, Moon Rocks *etc.*

Four major groups of synthetic cannabinoid agonists are identified (Figure 2)⁴:

1. Classical cannabinoids - which are analogues of THC based on a dibenzopyran ring, *e.g.* HU-210.
2. Cyclohexylphenol (CP) series developed by Pfizer in 1970s referred to as non-classical cannabinoids in scientific literature *e.g.* CP59,540 and CP47,497.
3. JWH compounds like JWH-018, JWH-073 (an alkyl homologue of JWH-018) JWH-398 and JWH-250.
4. Miscellaneous compounds, probably together with fatty acid amides (*e.g.* oleamide - a common contaminant in plastics).

Most common synthetic cannabinoids found in Spice are JWH-018, named for John W. Huffman, and HU compounds (meaning Hebrew University) like HU-210. Synthetic cannabinoids seem to act as agonists, binding to cannabinoid receptors in the brain with a higher affinity than endogenous cannabinoids and THC, but need not always be chemically similar to THC.³ But it is uncertain for oleamide to act as a cannabinoid receptor agonist.⁴ Oleamide is sometimes considered an adulterant as well.³

The herbal material component of Spice is also said to contain psychoactive substances themselves, as they have known traditionally to be marijuana substitutes. Plants like Indian warrior (*Pedicularis densiflora*) and Lion's tail (*Leonotis leonurus*) are assumed to have psychoactive substances based on their known chemical content. However still, little is known about the toxicology and pharmacology of the plant material in Spice.^{3,4}

Some of the Spice products may have its origin in Asia (China), whilst synthetic cannabinoids might have been produced in countries having cheap organic syntheses. It has remained unclear as to how and where these substances are actually produced; both the plant material and synthetic cannabinoids thus the final Spice

mixture.⁴ This might be mainly due to Spice products being a recent phenomenon, largely an online product with few specialized shops rather than clandestine labs,⁴ and the difficulty by law enforcement agencies to act when these substances are uncontrolled.

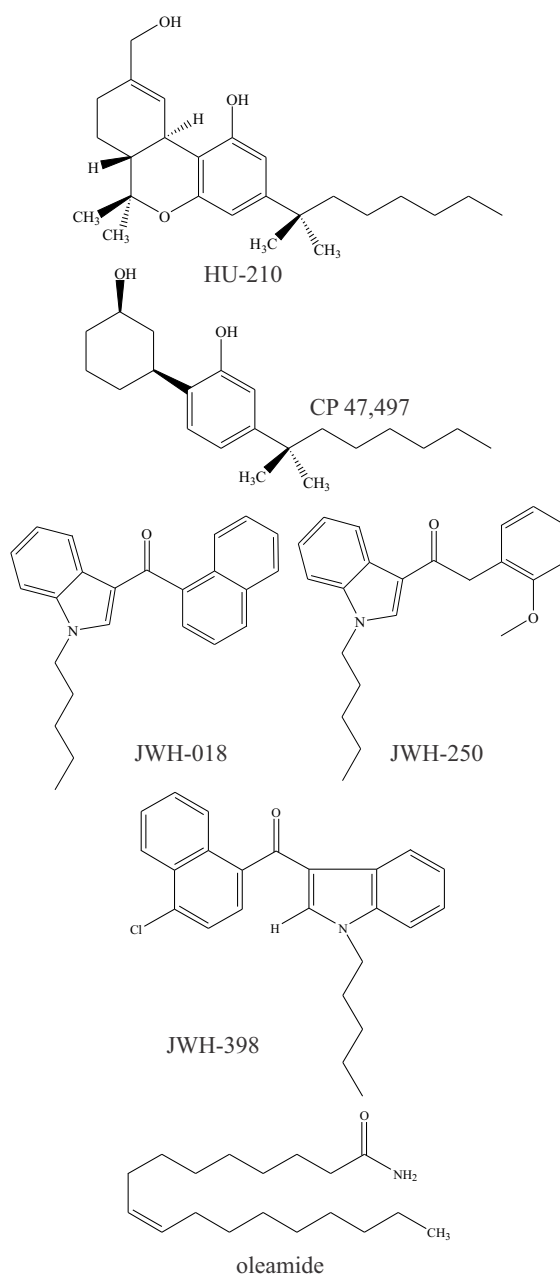


Figure 2. Structures of some synthetic cannabinoids and oleamide

Synthetic cathinones - “bath salts”

The term “bath salts” refer to a group of synthetic derivatives of cathinone, a compound naturally found in khat (*Catha edulis*) leaves.⁵ This should not be puzzled with Epsom salts used to improve the bathing experience that is not psychoactive. Although the synthetic cathinones seem to be a recent arrival, khat leaves have been chewed or dried and drunk as tea for

its stimulant properties in Arabian Peninsula and East Africa, for centuries and still continued today.³ Currently, the synthetic cathinones seem to be the most problematic type of NPS to public health and safety.²

The first synthetic cathinone designed in 1928 was methcathinone, whose abuse was first reported as late as in 1990s. The synthetic cathinones which came up later were mephedrone (in 1929), 3,4-methylenedioxypyrovalerone (MDPV) (in 1967) and methylone (patented in 1996). Structures of cathinone and some synthetic cathinones are shown in Figure 3.

Today, the three major constituents of bath salts include mephedrone, methylone and MPDV.⁵ These are too marketed the same way as synthetic cannabinoids with labeling as “not for human consumption” and using terms like “bath salts” or “plant food” pond cleaners, or even as “chicken feed” to avoid legal prosecution.³

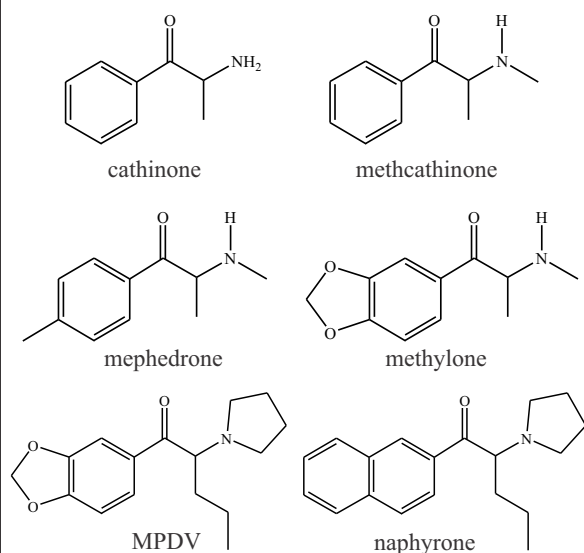


Figure 3. Structures of cathinone and some synthetic cathinones

Synthetic cathinones have structural similarities to dopamine, and the amphetamines. Mephedrone, MPDV and methylone all have the same backbone; phenethylamine with a keto group at β -carbon position. Mephedrone has methyl groups on α -carbon, the amine group and the aromatic ring, showing a structure like methamphetamine and methcathinone. Methylone also has methyl groups at the amine and α -carbon of the β -ketophenethylamine backbone, but has a methylenedioxy ring attached to the aromatic ring. MPDV has the most structural divergence from the other synthetic cathinones because α -carbon has a pyrrolidinyl ring and propane attached.⁶ This makes MPDV more like naphyrone (which has another

aromatic ring, attached in place of the methylenedioxy ring in MPDV).

Health Effects of Synthetic Drug Abuse

The usual abuse patterns are oral ingestion, smoking, snorting or insufflation. Intoxication can occur with doses small as 1 mg of JWH-018 which goes on to show its high potency. The pharmacological effects are thought to be due to combined effects of herbal ingredients, synthetic cannabinoids themselves and other adulterants.

The effects experienced by users are similar to that of cannabis, like euphoria, relaxation and altered perception. Adverse symptoms of Spice were reported to include swift heart rate, nausea, confusion, agitation, and hallucinations. It can also increase blood pressure and reduce blood supply to the heart (myocardial ischemia) and is associated with heart attacks in a few cases. Further, withdrawal and addiction may occur with regular usage.⁷

It is also seen that consumption of synthetic cannabinoids may lead to various defects in pregnancy :-abnormal embryo development, implantation failure, tubal pregnancy, placental defects linked to spontaneous abortion and pre term birth as cannabinoid signaling, which seems to have a major regulatory role in optimizing pregnancy events, becomes imbalanced.⁸

It is to be noted that no pharmaceutical product has emerged so far, and no human studies have been performed with these cannabinoids (only *in vitro* or testing using animals). It may be the case that these drugs might have the potential to cause more harm than THC.

So it is important to identify the threat of these drugs, especially the youth who fall victim to them and ruin their lives. They must be educated to prevent drug use and they must have the self-confidence to stand up against it. Further, it is necessary for Governments to develop new legislation to sustain with the pace of new drugs entering the market. The necessity to improve the present control system at international level should also be emphasized. Deeper examination of the health effects of NPS and methods of detecting and analysing them, once administered, should be improved to benefit treatment of the affected.

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Greener Alternatives for Classical Reduction of Aldehydes/Ketones

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Introduction

Ketones and aldehydes are commonly present in many natural organic compounds and pharmaceutical agents. A variety of biological functions are associated with aldehydes and ketones including flavors and fragrances (e.g. vanillin, cinnamaldehyde, etc.), and hormones (e.g. estrone, testosterone, etc.). Some are essential vitamin precursors, while the others may be drugs such as tetracycline and plant flavonoids naringin. Structures of some biologically active aldehydes and ketones are shown in Figure 1.

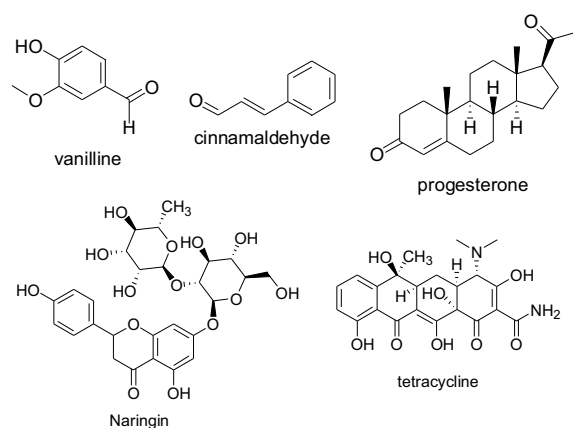


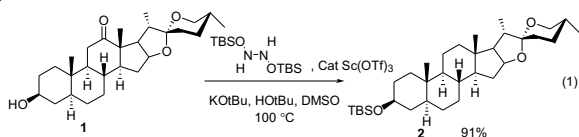
Figure 1: Some Biologically Active Aldehydes and Ketone Compounds

The depletion of fossil fuels has led to increasing interest toward the use of biomass feedstock as a sustainable source for chemicals and biofuels.¹ Since fossil fuels are the major source of greenhouse gases, the challenge of producing next generation of biofuels that can effectively function as “drop-in” replacements

for fossil fuels has led to renewed interests in conversion and utilization of cheaply and readily available alcohols and other oxygenated biomass precursors. Reductive deoxygenation of aldehydes and ketones to the corresponding saturated compounds has attractive features, given its many applications in fine-chemical synthesis² and biofuel production.³ Unfortunately, classical deoxygenation methods of carbonyl compounds, such as those based on either the Barton–McCombie,⁴ Clemmensen,⁵ or Wolff–Kishner⁶ methodologies, are generally associated with harsh reaction conditions and the use of stoichiometric amounts of toxic reagents, as well as poor functional-group tolerance.

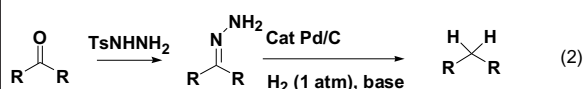
Transition Metal Catalyzed Hydrogenolysis of Carbonyl Compounds

In 2004, Myers and coworkers developed a novel catalytic method for the preparation of *N*-*tert*-butyldimethylsilylhydrazones from carbonyl-containing compounds.⁷ These products can be used as a superior alternative to hydrazones in the transformation of ketones into alkanes. The advantages of this procedure compare to Wolff-Kishner method are considerably milder reaction conditions and higher efficiency as well as operational convenience. The condensation of 1,2-bis(*tert*-butyldimethylsilyl)-hydrazine with aldehydes and ketones with $\text{Sc}(\text{OTf})_3$ as catalyst is rapid and efficient at ambient temperature. As shown in eq. 18, steroidal ketone **1** can be converted to TBS protected alcohol contained steroid **2** in high yield [Eq. (1)].



They showed a broad substrate scope including benzylic aldehyde, benzylic ketone, aliphatic aldehyde, aliphatic ketone, protected sugar and unsaturated aldehyde contained double bonds without reducing C=C double bond. However, the use of freshly prepared dry solvents and the risk of detonation during the distillation of anhydrous TBShs limited its applications in large scale synthesis.

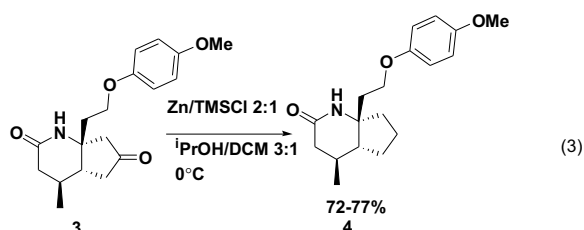
Jianbo Wang group were able to develop a catalytic method to deoxygenate ketones and aldehydes by using a mild and efficient method. The reaction is mediated by N-tosylhydrazine with H₂ (1 atm) as the reductant and 10% Pd/C as the catalyst [Eq. (2)].⁴



This reaction involved a one-pot, two-step deoxygenation of carbonyl to methyl or methylene, which involve hydrogen as a clean reductant. Even though the method has good functional group tolerant they also were unable to avoid use of hydrazine.

The Clemmensen reduction is particularly effective for reducing aryl-alkyl ketones.⁸ With aliphatic or cyclic ketones, zinc metal reduction is much more effective.⁸ However, because of its original harsh conditions (aqueous HCl, reflux) and use of toxic Hg reagent, it is seldom applied in the modern organic synthesis. In late 1960s, Yamamura *et al.* developed an excellent modification of the Clemmensen reduction with a very mild condition (activated zinc, saturated HCl in Et₂O at 0 °C), which avoids the utility of toxic Hg.⁸

Arimoto in 2010 developed the most recent modification to the Clemmensen reduction.⁹ They used trimethyl silyl chloride (TMSCl) with the combination of Zn in alcoholic solvents for the reduction. They were able to reduce steroidal carbonyl compounds to corresponding methylene by using milder conditions. They were able to reduce ketone **3** to methylene compound **4** [Eq. (3)].

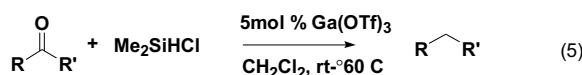
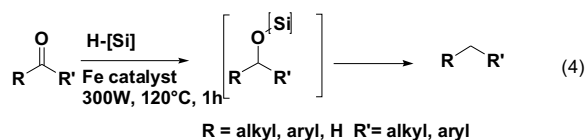


Reduction of Ketone/Aldehydes Using Aluminum, Silane Reagents

Tashiro *et al* in 2003, reported the reduction of carbonyl group to corresponding methylene with Ni-Al alloy in water.¹⁰ Dixon *et al*¹¹ (1959) reported hydrogenolysis of 6-hexylbenzanthrone using LiAlH₄ as the reducing agent. Boleslawski¹² in 1992 reported reductive deoxygenation of ketone and secondary alcohols by organoaluminum Lewis acids. A few of the carbonyl reduction articles are reported using organosilanes as the reducing agents.¹³ An exhaustive reduction of aliphatic carbonyl groups into the hydrocarbons and partial reduction of their aromatic counterparts, as well as aromatic carboxylic acids, have been developed.

Homogeneous Catalytic Reduction Methods

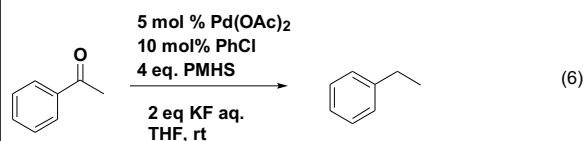
Campagne group established a method to reduce ketones and aldehydes to alkane compounds using FeCl₃ Lewis acid as a catalyst (10 mol %) in the presence of PMHS as the reducing agent at 120 °C microwave irradiation.¹⁴ They believe that the reduction goes through the Lewis acid character of iron salts promotes the reduction of intermediate O-silyl ether [Eq. (4)]. Olah has been reported similar method using Ga(OTf)₃ as the catalyst¹⁵ to deoxygenate aromatic ketones [Eq. (5)].



In 2010, Morris Bullock¹⁶ reported a homogeneous Ru catalyzed reduction of aryl ketone to methylene compounds. In the presence of 1.5 mol% of {[Cp*₂Ru(CO)₂]₂(μ-H)}⁺OTf⁻ in CD₂Cl₂ under 4 atm H₂ and heat at 85 °C for 4 days, acetophenone was cleanly converted to ethylbenzene. The substrate scope only limited to acetophenone.

Most recently, Maleczka¹⁷ reported C-O hydrogenolysis catalyzed by Pd-PMHS nanoparticles in the accompany of chlorobenzene. Catalyst Pd(OAc)₂ and polymethylhydrosiloxane (PMHS), in conjunction with aqueous KF, and a catalytic amount of an aromatic chloride, led to the chemo-, regio-, and stereoselective deoxygenation of benzylic oxygenated substrates at room temperature [Eq.(6)]. The chloroarene additive appears to facilitate the hydrogenolysis process

through the slow controlled release of HCl. Substrate scope is limited to benzylic ketones.

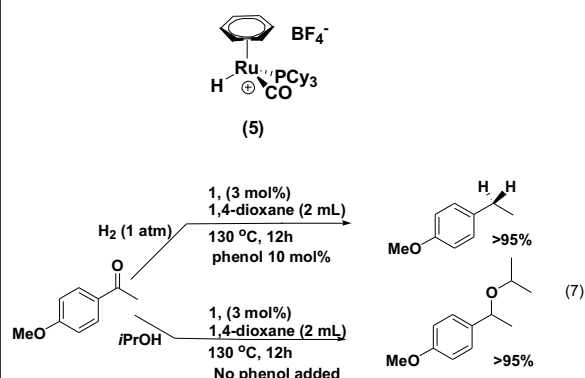


A greener method for reductive deoxygenation and hydrogenolysis of aldehydes and ketones

A greener approach for reduction of carbonyl compounds to hydrocarbons is to use molecular hydrogen as a clean source and to use a catalytic method which avoids or minimize the use of highly active reagents, toxic starting materials, and the formation of unwanted byproducts.

Currently, a number of catalytic protocols are available for the deoxygenation of carbonyl compounds by molecular hydrogen (H_2).¹⁸ Exploring a method to obtain molecular hydrogen as a sustainable source for the reduction of carbonyl compounds to hydrocarbons is an important field of research. In order to achieve this objective from readily available alcohols sources from synthetic and mechanistic aspects of ruthenium catalyzed deoxygenation of carbonyl compounds by using molecular hydrogen was carried out by Yi *et al.*¹⁹

Very recently Yi group found that $[(\eta^6-C_6H_6)(PCy_3)(CO)RuH]^+BF_4^-$ (**5**) in the presence of phenol as a ligand could catalyze hydrogenolysis of 4-methoxyacetophenone with *i*PrOH or H_2 in 1,4-dioxane at 130 °C to give the product 1-ethyl-4-methoxybenzene in >95 % yield [Eq. (7)].¹⁸ In contrast, the coupling reaction produced unsymmetrical ether as the major product in the absence of phenol [eq. (7)]. The catalytic method employs environmentally friendly and cheaply available H_2 and exhibits high chemoselectivity towards C=O bond cleavage reactions. This reaction employs H_2 , does not use any reactive agents and produces H_2O as the only byproduct.



They surveyed the substrate scope of the hydrogenolysis reaction by using the catalytic system of **5**/ PhOH (Table 1). Both aliphatic and aryl-substituted aldehydes were effectively reduced to the corresponding alkyl products without forming any alcohols or other side products (entries 1–4). For the hydrogenolysis of an aliphatic enal substrate, a highly chemoselective hydrogenolysis of the aldehyde group was observed to form the product, without the C=C bond hydrogenation (entry 2). The hydrogenolysis of aliphatic ketones typically required a higher pressure of H_2 than the aryl-substituted ketones, and in these cases, the hydrogenolysis using 2-propanol was found to be convenient in yielding the aliphatic products (entry 2). High chemoselectivity for the carbonyl hydrogenolysis for an enone substrate formed the corresponding olefin product (entry 8). The hydrogenolysis of ketones containing oxygen and nitrogen atoms led to the corresponding aliphatic products (entries 7 and 9).

Table 1: Reaction Scope of Catalytic Hydrogenolysis of Aldehydes and Ketones^a.

entry	carbonyl compound	product(s)	time (h)	yield (%) ^b
1			12	90-95
2			12	72
3			8	91-94
4			16	88-90
5			12	79-95
6			24	65
7			24	94
8			24	78
9			24	54

^aReaction Conditions: (A) ketone/aldehyde (1 mmol), *i*PrOH (2 mL), catalyst **1** (3 mol %), 4-OMe-C₆H₄OH (10 mol %) 130 °C (B) ketone/aldehyde (1 mmol), dioxane (2 mL), catalyst **1** (3 mol %), 4-OMeC₆H₄OH (10 mol %), H_2 (~2 atm) 130 °C, 12 h.

^bIsolated yields.

To further demonstrate its synthetic utility, they examined the hydrogenolysis of highly functionalized, biologically active alcohol and carbonyl substrates. The treatment of cholesterol and progesterone led to the chemoselective hydrogenolysis of alcoholic and ketone groups formed the corresponding methylene products **2a** and **2b**, (Figure 2) respectively. In case of progesterone, a 1:1 mixture of olefin isomerization products was obtained. The chemoselective hydrogenolysis of benzylic alcohol is observed over aliphatic alcohol and amide groups for chloroamphenicol **2c** (Figure 2), while the hydrogenolysis occurred regioselectively at the 9 position for alizarin **2d** (Figure 2). The hydrogenolysis of ebastatine, and haloperidol cleanly yielded the corresponding methylene products **2e** (Figure 2), and **2f** (Figure 2) without the formation of any alcoholic products. The catalytic method exhibits high selectivity towards the hydrogenolysis of benzylic alcoholic and ketone groups while tolerating common oxygen and nitrogen functional groups such as amide, amine and ester.

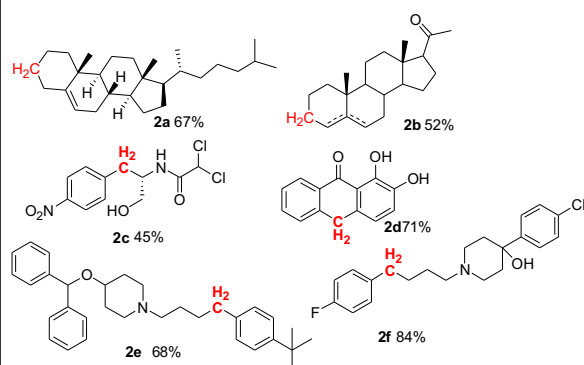


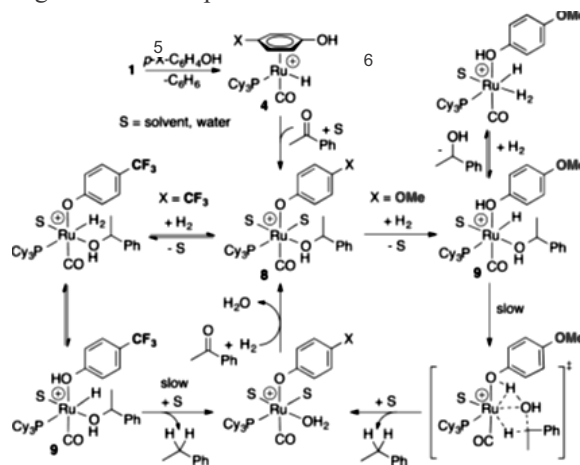
Figure 2: Deoxygenated compound of Biological Active Ketone/Aldehyde

Reaction Conditions: ketone/aldehyde (1 mmol), catalyst **1** (3 mol %), dioxane (2 mL), 4-OMeC₆H₄OH (10 mol %), 130 °C, H₂ (~2 atm), 130 °C, 12 h. Isolated yields.

Proposed Mechanism

On the basis of these kinetic data as well as structural elucidation of the catalytically relevant species, a plausible mechanism for the hydrogenolysis of ketones has been reported (Scheme 1). According to the proposed mechanism the ketone hydrogenolysis occurs in two stages: the first stage involves the hydrogenation of the ketone to an alcohol and the second stage the hydrogenolysis of the alcohol to the corresponding aliphatic product. It has been well

established that both Shvo- and Noyori-type bifunctional ruthenium catalysts are highly efficient for the hydrogenation of carbonyl compounds to alcohols. In this case, the phenol-coordinated cationic ruthenium hydride complex **6** should effectively serve as the catalyst precursor for the hydrogenation of the ketone to give the alcohol product.



Scheme 1: Proposed mechanism for the hydrogenolysis of ketones

The initial hydrogenation of the ketone to an alcohol is relatively fast under the reaction conditions. Compared to the hydrogenation of ketones to alcohols, the mechanism of hydrogenolysis of alcohols to the corresponding aliphatic products has been less well established. Both isotope effect and Hammett data indicate two different mechanistic pathways for the C–O bond hydrogenolysis reaction, depending on the electronic nature of the Ru catalyst.

In the case of the Ru catalyst with an electron-releasing phenol ligand, 1/p-OMe-C₆H₄OH, both a normal deuterium isotope effect and inverse [H₂] dependence are consistent with a mechanistic pathway involving concerted addition of H₂. In this case, a relatively electron-rich Ru center promotes high affinity toward H₂, which results in a competitive inhibition with the ketone (and alcohol) substrate at relatively high [H₂]. It has been proposed that the formation of a Ru–dihydrogen complex has led to the inhibition of ketone (and alcohol) substrates. For the Ru catalyst with an electron-poor phenol ligand, 5/p-CF₃-C₆H₄OH, and an electron-deficient Ru center would have a relatively low H₂ binding affinity. In this case, the observed inverse deuterium isotope effect is consistent with a stepwise reversible binding and activation of H₂ by an electrophilic Ru catalyst. The rate independence on [H₂] supports this notion in that

the coordination of the ketone or alcohol substrate would be favored over the H₂ binding. In transition-metal-mediated H–H and C–H activation reactions, an inverse deuterium isotope effect has been commonly interpreted as having a stepwise activation of H₂ via bifunctional Ru–phenoxo species **8** would be most consistent with the observed kinetics. As observed by the carbon isotope effect on the carbonyl carbon of the product, the C–O bond cleavage step is the turnover-limiting step of the hydrogenolysis reaction for both electron-releasing and -withdrawing phenol ligands 5/p-X-C₆H₄OH (X = OMe, CF₃).

Yi *et.al.* successfully developed a highly effective catalytic hydrogenolysis method for carbonyl compounds and alcohols by using a well-defined cationic Ru–H complex with a tunable phenol ligand among the several carbonyl reduction methods.¹⁹ The salient features of the catalytic method are that it employs cheaply available H₂, it exhibits high chemoselectivity toward the carbonyl reduction over olefin hydrogenation without forming any wasteful byproducts, and its activity can be readily modulated by employing phenol ligands. The detailed kinetic and mechanistic analyses revealed two distinct mechanistic pathways that are guided by the electronic nature of the Ru catalyst 5/p-X-C₆H₄OH. The Ru catalyst with an electron-releasing phenol ligand, 1/p-OMe-C₆H₄OH, facilitates the hydrogenolysis through concerted H₂ addition, while the electron-deficient Ru catalyst 5/p-CF₃-C₆H₄OH features a stepwise binding and activation of H₂ and electrophilic hydrogenolysis of the alcohol substrate. The catalytic method provides a chemoselective and cost-effective protocol for the hydrogenolysis of aldehydes and ketones under environmentally sustainable conditions.

To avoid the generation of relatively high energy Ru(IV) species, they propose that the H–H activation is facilitated by the bifunctional Ru–phenoxo species **8**, in which an electrophilic Ru center and nucleophilic phenoxo group would promote the heterolytic cleavage of a H–H bond in forming the Ru–H species **9**.

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Indirect tRNA Aminoacylation of Asn-tRNA^{Asn} and Gln-tRNA^{Gln} in Microorganisms

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Synthesis of proteins is a multi-step process that involves a cascade of reactions catalyzed by many enzymes. The first step is conversion of the genetic information stored in DNA into mRNA by RNA polymerase. This process is called transcription. Then, the mRNA is decoded systematically by the ribosome into the amino acid sequence of a protein. This process is called translation. The resultant peptide is subjected to folding and post-translational modifications to produce a functional protein. Decoding of mRNA into proteins requires an adapter molecule to bring the cognate amino acid, specified by the mRNA codon sequence, into the A site of the ribosome. Transfer RNAs act as these adaptors by carrying their cognate amino acids into the ribosome in the form of aminoacyl-tRNAs (aa-tRNAs). Transfer RNAs are aminoacylated by the aminoacyl-tRNA synthetases (aaRSs). These enzymes carefully select their specific cognate amino acid and tRNA isoacceptor(s) from a pool of metabolites with similar structures to accurately produce each aa-tRNA. These aa-tRNAs are loaded onto the ribosome by elongation factors for protein synthesis (Figure 1).^{1,2}

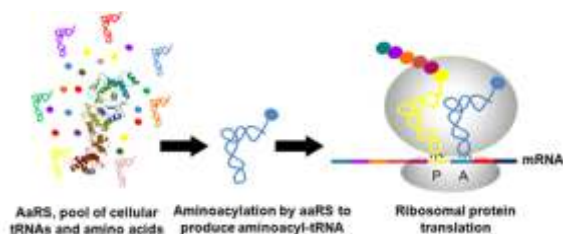


Figure 1: General schematic of the protein biosynthesis machinery.

Classification of aaRSs

The aaRSs are divided into two classes: class I and class II (Table 1). Lysyl-tRNA synthetase (LysRS) is the one exception: examples of both class I and class II LysRS are known.³ The two classes are divided based on the topology of their active sites.^{4,6} The active sites of class I aaRSs are defined by a nucleotide-binding Rossmann fold and contain two signature sequences, KMSKS and HIGH.⁵ In contrast, the active sites of class II aaRSs are designated by a rigid, seven-stranded, anti-parallel β -fold and contain 3 distinctive signature motifs (motifs 1, 2 and 3).⁵

Table 1: Classification of the aaRSs

Class I	Class II
ArgRS	AlaRS
CysRS	AsnRS
GlnRS	AspRS
GluRS	GlyRS
IleRS	HisRS
LeuRS	LysRS (II)
LysRS (I)	PheRS
MetRS	ProRS
TrpRS	SerRS
TyrRS	ThrRS
ValRS	

The structural differences between the two classes define the modes of tRNA and ATP binding. The class I aaRSs bind ATP in an extended conformation and approach the 3' end of the tRNA from the minor groove while class II aaRSs bind ATP in a bent conformation and approach the 3' end of the tRNA from the major groove.¹

These structural differences further divide the two classes with respect to their mechanisms of amino acid activation. The first highly resolved crystal structure of *Bacillus stearothermophilus* tyrosyl tRNA synthetase (TyrRS) provided insight into amino acid activation, tRNA recognition, and aminoacylation by a class I aaRS.⁷ The primary esterification of the activated amino acid can occur at either the 2' or 3' hydroxyl group of the 3' terminal adenosine in the tRNA (Figure 2). Class I aaRSs primarily aminoacylate the 2' hydroxyl group of tRNA, and the amino acid is then transferred to the 3' end of the tRNA prior to entering the ribosome. In contrast, class II aaRSs aminoacylate the 3' hydroxyl group of the tRNA. Therefore, the two classes of aaRSs can be broadly segregated structurally, based on the presence or absence of a Rossmann fold, and functionally, based on the primary site of tRNA aminoacylation.⁵ Typically, class I aaRSs are functional in their monomeric form and class II aaRSs are dimers or multimers.³

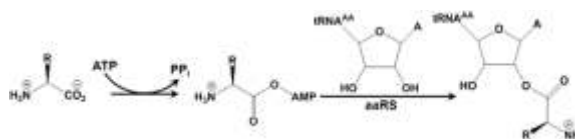


Figure 2: Mechanism of aminoacylation

Direct pathway for tRNA aminoacylation and protein biosynthesis

The primary amino acid sequence of a protein is determined by the codon sequence of its mRNA and accurate pairing of each codon with the anticodon of the corresponding aa-tRNA (Figure 1). The fidelity of protein synthesis is determined at two critical checkpoints: tRNA aminoacylation and codon-anticodon interactions. The majority of aa-tRNAs are produced by direct aminoacylation of each tRNA with its cognate amino acid via a two-step reaction catalyzed by the corresponding aaRS. The first step involves the activation of the amino acid with ATP to form an aminoacyl adenylate (aa-AMP) intermediate. Then, either the 2' or 3' hydroxyl group on the 3' adenosine in the tRNA nucleophilically attacks the aa-AMP to form the cognate aa-tRNA ester linkage (Figure 2). In bacteria, this ester linkage is protected from hydrolysis by EF-Tu:GTP, which forms a complex with each cognate aa-tRNA and delivers them to the ribosome for protein synthesis.^{1,2}

It is critical to maintain accuracy during aminoacylation to prevent translational errors. Mechanisms that safeguard the genetic code guarantee the synthesis of functional proteins required for the survival of an organism. Accurate aminoacylation is determined by the ability of aaRSs to specifically select their substrate tRNA and amino acid from a pool of structurally similar metabolites. For example, arginyl-tRNA synthetase (ArgRS) can recognize its cognate substrate tRNA^{Arg} over tRNA^{Asp} by about 10,000 fold.⁹ This specificity is mainly achieved by a series of interactions with the substrate tRNA; a recognition mechanism used by all the aaRSs. These interactions define the determinants (positive recognition elements) of the substrate tRNAs that are specifically recognized by the respective aaRSs. In addition, the presence of tRNA anti-determinants (negative elements that prevent false aminoacylation) and stabilization of the transition state of aminoacylation prevent misappropriation of non-cognate aaRSs.¹⁰

In contrast to tRNA, the coded amino acids are small and significantly less complex. Hence, successful discrimination between the substrate amino acid and non-cognate amino acids by many of the aaRSs is potentially problematic. For example, discrimination between the amino acids valine and isoleucine by IleRS is inadequate to prevent translational errors. IleRS can discriminate between the substrate isoleucine and non-cognate valine at a frequency of only ~180:1.^{12,14}

However, some aaRSs like IleRS have additional proofreading/editing mechanisms to compensate for the loss in accuracy during amino acid selection and activation. The proofreading activity of IleRS minimizes misincorporation of valine at isoleucine to a frequency of 1:3000.^{11,13}

Indirect pathway for tRNA aminoacylation

For many years, the typical views of aaRSs and tRNA aminoacylation were confined to only a few organisms (e. g. *E. coli*, yeast). In consideration of the presence of 20 standard, encoded amino acids, 20 aaRSs were expected. About 35 years ago, Wilcox and co-workers reported that *Bacillus subtilis* (*B. subtilis*) lacks a functional GlnRS and consequently relies on an indirect pathway for the synthesis of Gln-tRNA^{Gln}.^{14,16} However, this idea did not catch a lot of attention for years. In 1988, Söll and co-workers showed that eukaryotic organelles (plant chloroplasts and animal mitochondria) and cyanobacteria lack detectable GlnRS activity and require an amidotransferase-dependent, indirect pathway for the synthesis of Gln-tRNA^{Gln}.¹⁷

One of the landmarks for uncovering novel mechanisms of aminoacylation was the availability of the complete genome sequence of the hyperthermophilic archaeon *Methanococcus jannaschii* (*M. jannaschii*) in 1996. *M. jannaschii* was the first organism whose sequenced genome revealed only 16 of the 20 known aaRSs.¹⁸ The *M. jannaschii* genome lacked recognizable genes encoding GlnRS, AsnRS, LysRS, and CysRS. It is later reported that *M. jannaschii* carries a lysS gene with no similarity to the bacterial or eukaryal genes that encodes LysRS.¹⁹ This less common archaeal LysRS was categorized as a class I LysRS and can be easily distinguished from the class II LysRSs in eukaryotes and bacteria. Archaeal type LysRS was later found in α -proteobacteria and spirochetes.¹⁹ The mechanisms to compensate for the absence of other seemingly essential aaRSs in *M. jannaschii* were established after the discovery of novel proteins and pathways for tRNA aminoacylation. These non-canonical pathways of tRNA aminoacylation are not confined to *M. jannaschii* and were later confirmed in most microorganisms and eukaryotic organelles (mitochondria, chloroplasts and apicoplasts).^{9,19,20} The genome of *M. jannaschii* is deficient in the gene encoding CysRS and, at the time, the mechanism for the formation of Cys-tRNA^{Cys} was a mystery. An indirect pathway was discovered in methanogens (including *M. jannaschii*) that lack the

canonical CysRS.^{22,23} The first step of the indirect synthesis of Cys-tRNA^{Cys} involves aminoacylation of tRNA^{Cys} with phosphorylserine (Sep) by phosphorylseryl-tRNA synthetase (SepRS). Next, the enzyme Sep-tRNA:Cys-tRNA synthase (SepCysS) catalyses sulphydrylation of Sep bound to tRNA^{Cys} to produce the final product Cys-tRNA^{Cys}.^{22,23}

In archaea, the AdT-dependent pathway for the synthesis of Asn-tRNA^{Asn} was first discovered in *Haloferax volcanii* (*H. volcanii*).²⁰ The missing aaRSs in *M. jannaschii* include AsnRS and GlnRS and formation of both Asn-tRNA^{Asn} and Gln-tRNA^{Gln} proceeds through two closely related indirect pathways. For Gln-tRNA^{Gln} production, a ND-GluRS produces Glu-tRNA^{Gln}, which is subsequently converted to Gln-tRNA^{Gln} by AdT. Asn-tRNA^{Asn} is produced via an analogous process, relying on a misacylating non-discriminating aspartyl-tRNA synthetase (ND-AspRS) and AdT. (Similar to ND-GluRS, ND-AspRS aminoacylate both tRNA^{Asp} and tRNA^{Asn} to produce cognate Asp-tRNA^{Asp} and misacylated Asp-tRNA^{Asn}).⁹

The gram-negative bacterium *Helicobacter pylori* (*H. pylori*), which was the first bacterium identified to be missing genes encoding for either GlnRS or AsnRS.^{9,24,25} The *H. pylori* genome has 2 genes that code for divergent glutamyl-tRNA synthetases: GluRS1 and GluRS2. The function of GluRS1 is to act as a canonical discriminating GluRS that specifically recognizes and glutamylates the tRNA^{Glu1} and tRNA^{Glu2} isoacceptors to generate Glu-tRNA^{Glu1/Glu2}. In contrast, GluRS2 compensates for the absence of GlnRS by misacylating tRNA^{Gln} to produce Glu-tRNA^{Gln}.^{25,26} *H. pylori* ND-AspRS compensates for the lack of AsnRS by producing Asp-tRNA^{Asn}.^{15,27} Finally, these two misacylated tRNAs are repaired by *H. pylori* AdT.

Interestingly, some microorganisms employ both direct and indirect pathways for the synthesis of certain aa-tRNAs. For example, the *Deinococcus radiodurans* (*D. radiodurans*) genome codes for GlnRS, AsnRS, a discriminating-GluRS (D-GluRS), an ND-AspRS and AdT. *D. radiodurans* does not utilize asparagine synthetase for the synthesis of asparagine.²⁸ Thus, the sole route for asparagine synthesis in *D. radiodurans* is through ND-AspRS and the AdT-dependent indirect pathway.²⁸

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LEVEL 2 – AWARDS LIST

1st - W F Peiris Memorial Trust Scholarship	Ms. P S Ishtaweera
2nd - Professor W Pearlyn D Pereira Commemoration Trust Scholarship	Ms. K Chandrakanthan
3rd - Professor G.C.N. Jayasuriya Memorial Scholarship	Ms. L N Dayaratne
4th - Family Leelarathna Scholarship	Ms. M C Haputhanthri
MERIT BURSARIES (in order of merit)	
Ms. K M K G Perera, Ms. M K B K Perera, Ms. K M Wijesinghe, Ms. K A S S Kuruppu	
Subject Prizes For Best Performances	
Yogarani Mahesan & Family Prize for Analytical Chem & Instru. Analysis	Ms. M S A Latheef
Professor Jayantha Welihinda Prize for Biochemistry	Ms. P S Ishtaweera
Introduction to Management, Economics and Finance	Ms. L N Dayarathne
Professor Samitha P Deraniyagala Prize for Inorganic Chemistry	Ms. K P Chandrakanthan
Professor Siromi Samarasinghe Prize for Organic Chemistry	Ms. A M O H Amarasinghe
Professor J N Oleap Fernando Prize for Physical Chemistry	Ms. M C Haputhanthri

Diploma in Laboratory Technology in Chemistry (DLTC), 41st Batch (2013/15)

Honours Pass (09)

Ms. A R Sappidin, Ms. U M Athukorala, Ms. F N M Nazeer, Ms. V C Maduwage, Mr. A W N Ambagasipitiya, Ms. I K T S Nadeeshani, Ms. W J I Soya, Ms. D M J M K Bandara, Mr. R A D Priyanga

(All of them are entitled to follow the first two years of the Graduateship Programme free of charge.)

Merit Pass (51)

Mr. P U B Harangala, Ms. V Rajivini, Ms. D D T S Perera, Mr. A K M Shiraj, Ms. W R N Withanage, Ms. S A N U Dharmapala, Ms. L F Nusla, Ms. F N Ansar, Ms. N G Madurapperumage, Ms. D P Gamaarachchige, Ms. T H P Wasam, Ms. M A A Shahani, Mr. P M Muditha, Ms. T K Weerabandu, Ms. M N F Nafla, Ms. M P Hapuarachchi, Ms. M M A S Hansani, Mr. R M C J Rajaguru, Ms. M J F Isthikara, Ms. V I Mathangi, Mrs. M K M L De Silva, Ms. H M H S Kaushalya, Ms. N M M Hewage, Mr. M T M Rashdhan, Mr. B G S Madhuranga, Ms. S M A T Samarakoon, Mr. C L Arabawela, Ms. C H Ilangage, Mr. H D S Perera, Mr. M F M Fazeeh, Mr. S A C L Ranatunga, Ms. M S F Shafira, Ms. M F F Hazna, Ms. S F Mishna, Ms. A H Aaysha, Mr. A M Hisham, Mr. T M A S Tennakoon, Mr. L M Yasir, Mr. K. Nishanthan, Mr. G K Liyanage, Mr. B P D N Kumara, Mr. B P G D Sampath, Mr. U B B Keerthiwansha, Ms. W D U N Wijayarathna, Ms. S N S B A J Bandara, Mr. U M Mapatuna, Mrs. N S Weerakkody, Mr. G J V P N Harshna, Ms. A S Samarasekera, Ms. T V Udugampola, Ms. S D D N Indrajith

Ordinary Pass (45)

Ms. T J P Kumari, Ms. M F Fameela, Ms. TWMUK Weerasooriya, Mr. A A R Kumara, Ms. A T R Abeyasinghe, Ms. L D C N Liyanaarachchi, Mr. K A M Roshan, Ms. D L A C Fernando, Ms. D K Ranasinghe, Mr. M Z M Zanoos, Mr. Z Z Husain, Ms. P V I Kumari, Ms. M D D Damayanthi, Mr. K W K Kariyawasam, Ms. I S Tucker, Ms. B G B Maheshika, Ms. D L Rathnayake, Ms. W Y G S T Sinhalage, Mr. S T Malimbada, Ms. S Yaseer Rifky, Ms. H P U Rajakaruna, Mr. S I Thawfeek, Ms. D N E Weththasinghe, Ms. K Tharminy, Ms. K F Ferosa, Ms. W M I Damayanthi, Ms. K A T I Siriwardana, Ms. H R N Samarajeewa, Mr. S D D Rathnasiri, Mr. K A N S Perera, H P S K Hewage, Mr. J A R B Jayasinghe, Ms. S G K N K Nawarathna, Ms. K A V Dasanayake, Ms. S L C Roshini, Mr. P M Thenuwara, Ms. I P A Ubayasiri, Ms. C D Udagama, Ms. KVDGS Kumarasinghe, Mr. W A Chaminda Kalum, J A B S G Jayasuriya, Mr. M C B Peiris, Ms. S M S A Jayawardana, Ms. G D H N P Jayarathna, Mr. M P S A Kumara

DLTC Overall Prize List-2015

First	- G C N Jayasuriya Award	- Ms. A R Sappidin
Second	- Dr. Shentheshanmuganathan Appreciation Award	- Ms. I K T S Nadeeshani
Third	- Ms. U M Athukorala & Ms. W J I Soya	
Rohan K Fernando Prize in Industrial and Food Chemistry		- Ms. I K T S Nadeeshani
P. D. Luckmal De Zoysa Prize in Clinical Lab Technology		- Ms. A R Sappidin
D Fernando & S Narasinghe Special Award for Overall outstanding performance in 2015		- Ms. A R Sappidin

Graduateship Examinations in Chemistry, 2015

33rd Batch of 97 Graduate Chemists Pass out in 2015

First Class Honours (06)

Ms. A V K Munasinghe, Ms. L A Wijesekara, Ms. H K C K Halloluwa, Ms. M S N Ranasinghe, Ms. A S N Kurian, Ms. J P S Vidyani

Second Class Honours (Upper Division) (29)

Ms. S M Abdulla, Ms. B P G Ariyaratne, Mr. P V Y Cooray, Ms. G O De Silva, Ms. Y M R De Silva, Mr. S K M C Darshana, Ms. N N K Gallage, Ms. M N Gunasekara, Ms. N C Hapuarachchi, Mr. N M Ikmal, Ms. R Jayawardene, Mr. K J P Kaviraj, Ms. N L Kothalawala, Ms. P K Liyanage, Ms. K T I N Perera, Mr. S K H L Samarasinghe, Ms. D Senarath Yapa, Ms. M T F Simaya, Ms. R Usoof, Mr. W W B P B Wettawa, Ms. I K Wickramarachchi, Mr. K C Yadavan, Ms. M P A P Patabandi, Ms. R Pushparajah, Ms. E T J Silva, Mr. W P D Saranga, Mr. U L A S Perera, Mr. M S Muneer, Mr. G T S De Fonseka

Second Class Honours (Lower Division) (16)

Ms. S S Arachchi, Ms. P H T D De Silva, Mr. G P Fernando, Ms. S K Jayasinghe, Mr. A A D N Perera, Ms. R A H M Ranaweera, Ms. S G Rathnayaka, Ms. M G H Shiromala, Ms. D R L M Wimalagunagekara, Ms. W M T I E L Wijethilaka, Ms. H M D C Herath, Ms. R W L N Rajapakse, Mr. P G D Priyamal, Ms. T M Ranathunga, Ms. H A S Ayodya, Ms. D S W M Mahaliyana

Third Class Honours (19)

Mr. W A Chaturanga, Ms. G D R O R Gamage, Ms. P G N Rangika, Ms. M H J G Gunasiri, Ms. M G D T Karunarathne, Ms. L D D Madushani, Ms. H S Munasinghe, Mr. H M N H B Nedurana, Ms. W W S C Rajaguru, Mr. T D Rajarathna, Ms. M A S T Rathnasooriya, Mr. A R M S Rinas, Ms. I W D N Wickramarachchi, Mr. D G S D Yapa, Mr. S P Weragoda, Ms. N A Bhagya, Ms. H L D N De Silva, Mr. M W M Madusanka, Ms. H M H H Denuwara

Pass (27)

Ms. A H V V Kumari, Ms. D M M N K Dasanayaka, Ms. M S Rishada, Mr. K A M S Perera, Ms. M M T M Ranasinghe, Ms. W M D S U Weerasena, Ms. W R N Weerasinghe, Ms. H L Abeysooriya, Ms. K P S Deepika, Ms. D G K P Danapala, Ms. S C D H W M D V Hapukotuwa, Mr. D A C Gunasinghe, Mr. K K T A C Silva, Ms. R M S Abeyrathne, Ms. S Abeywardana, Mr. W P G R Buddhika, Mr. W D P Fernando, Ms. N P P Harshika, Mr. D I K Jayasinghe, Mr. K A R Pulasthi, Ms. S K B Silva, Ms. P Thilishana, Ms. E A T R Edirisooriya, Ms. P A L N Perera, Ms. S Gayathri, Mr. R A S D Perera, Mr. H A M T Ameen

Overall Examination Awards -2015

1 st	Shireen Jayasuriya Memorial Gold Medal	Ms. A V K Munasinghe
2 nd	Graduateship Silver Jubilee Award	Ms. L A Wijesekara
3 rd	Graduate Chemist (25 th Batch Passing out) Silver Jubilee Award	Ms. H K C K Halloluwa

Overall Excellence Awards covering all levels

Prof. J K P Ariyaratne Award for Inorganic Chemistry	Ms. A V K Munasinghe
Prof. Leslie Gunatilake Award for Organic Chemistry	Ms. A V K Munasinghe
Haniffa Award for Physical Chemistry	Ms. A V K Munasinghe
Saman & Asoka Patiratne Award for Analytical Chemistry	Ms. H K C K Halloluwa

Overall Best Performer Awards (Practical)

Prof. R S Ramakrishna Memorial Award	Ms. A V K Munasinghe
Mr. & Mrs. K Sivarajah and Family Award	Ms. D Senarath Yapa
B A Jayasinghe Memorial Award	Ms. H K C K Halloluwa
College of Chemical Sciences Award (fourth)	Ms. L A Wijesekara
Good Performer CCS Awards (5 th - 8 th places)	Mr. K J P Kaviraj, Ms. E T J Silva, Ms. L D D Madushani, Ms. R Usoof

Levels 3 & 4 Overall (Theory) Prizes

1 st : RSC (Sri Lanka Section) Award	Ms. L A Wijesekara
2 nd : Professor and Mrs. H W Dias Award	Ms. A S N Kurian
3 rd : Nayomi Jayatissa Prize	Ms. M S N Ranasinghe

PUBLICATIONS OF THE INSTITUTE OF CHEMISTRY CEYLON

Monograph	Title	Author	Price
01	Textile Fibers	Mr T Rajasekeram	Rs.50/-
02	Principles of Food Preservation	Prof U Samarajeewa	Rs.75/-
03	Biotechnology	Prof C P D W Mathew	Rs.75/-
04	Recombinant DNA Technology	Prof J Welihinda	Rs.75/-
05	*Natural Toxins in Foodstuffs	Prof E R Jansz & Ms A S Perera	Rs.50/-
06	Fat Soluble Vitamins	Prof E R Jansz & Ms S Malavidana	Rs.50/-
07	Nucleic Acid and Protein Synthesis	Prof J Welihinda	Rs.75/-
08	Extraction of Energy from Food	Prof J Welihinda	Rs.50/-
09	Corrosion of Materials	Dr A M M Amirudeen	Rs.75/-
10	Vitamin C-Have all its mysteries been Unravalled ?	Prof E R Jansz & Ms S T C Mahavithanage	Rs.75/-
11	*Environmental Organic Chemistry	Prof S Sotheeswaran	Rs.150/- (US \$3)
12	Enzyme Kinetics and Catalysis	Prof (Mrs) S A Deraniyagala	Rs.100/-
13	Insecticides	Prof (Mrs) Sukumal Wimalasena	Rs.95/-
14	Organotransition Metal Catalysts	Prof S P Deraniyagala & Prof M D P De Costa	Rs.75/-
15	Some Important Aspects of Polymer Characterization	Prof L Karunanayake	Rs.75/-
16	*Hard & Soft Acids & Bases	Prof (Mrs) Janitha A Liyanage	Rs.65/-
17	Chemistry of Metallocenes	Prof Sarath D Perera	Rs.65/-
18	Lasers	Prof P P M Jayaweera	Rs.65/-
19	*Life and Metals	Prof (Mrs) Janitha A Liyanage	Rs.75/-
21	*Silicones	Prof Sudantha Liyanage	Rs.65/-
22	Pericyclic Reactions: Theory and Applications	Dr M D P De Costa	Rs.65/-
23	Inorganic NMR Spectroscopy	Prof K S D Perera	Rs.65/-
24	Industrial Polymers	Prof L Karunanayake	Rs.75/-
25	*NMR Spectroscopy	Dr (Mrs) D T U Abeytunga	Rs.65/-
26	Mosquito Coils and Consumer	Ms D K Galpoththage	Rs.100/-
27	*Atomic Absorption Spectrometry	Prof K A S Pathiratne	Rs.100/-
28	Iron Management on Biological Systems	Prof (Ms) R D Wijesekera	Rs.100/-
29	Nutritional Antioxidants	Prof. (Mrs) Sukumal Wimalasena	Rs.100/-
30	*-Block Elements	Prof Sudantha Liyanage	Rs.65/-
31	*Scientific Measurements and Calculations	Prof (Mrs) S A Deraniyagala	Rs. 80/-
32	Applications of Organometallic compounds in Organic Synthesis	Dr. Chayanika Padumadasa	Rs. 60/-
32	Organosulfur Compounds in Nature	Prof. S Sotheeswaran	Rs. 200/-

* - Second Edition /new print published on popular demand

CCS Publications

01	Functional Group Analysis in Organic Chemistry	Prof A A L Gunatilake & Prof S Sotheeswaran	Rs. 175/-
02	Zinc Metalloproteins	Prof (Ms) R D Wijesekera	Rs. 175/-
03	Conformational Analysis and Reactivity of Organic Molecules	Prof S Sotheeswaran & Dr. (Ms) H I C de Silva	Rs. 175/-

General Publications

- ★ **Chemist & The Environment** (Rs.300/-)
- ★ **Infrastructure Support Services for Industrial Development** (Rs.200/-)
- ★ **Chemical Industries in Sri Lanka – Part II** (Members: Rs. 200/-, Non-members: Rs.275/-)
- ★ **Proceedings of the Workshop on the Technological aspects of the Production & Processing of Essential oils in Sri Lanka** (Rs.100/-)
- ★ **Proceedings of the Training Seminar on Towards a Cleaner Industrial Environment in the New Millennium** (Rs.150/-)
- ★ **A-Level Chemistry Facts, Patterns & Principles by Dr. Seetha I Rodrigo** (Rs.1500/-)
- ★ **Proceedings of the Prof R S Ramakrishna Memorial Training Seminar on Modern Analytical Methods** (Rs.200/-)
- ★ **Historical Accounts of the Educational Activities (1972 - 2004)** (Rs.350/-)
- ★ **Proceedings of the Training Seminar cum Workshop on Sampling, Statistics and Standardization in Chemical Analysis and Environmental Management** (Rs.150/-)
- ★ **Polymer Industries of Sri Lanka** (Rs. 200/-)
- ★ **Industry & Environment** (Rs. 200/-)
- ★ **Herbal Medicine Phytopharmaceuticals and Other Natural Products: Trends and Advances** (Rs. 500/-)
- ★ **Chemistry in Sri Lanka** (Rs. 150/-)





RSC NEWS

THE ROYAL SOCIETY OF CHEMISTRY SRI LANKA SECTION

1. Membership

According to the records sent to us from the parent body, a breakdown of the membership is as follows:-

Category

Number

CChem, FRSC	11
FRSC	04
CChem, MRSC	12
MRSC	22
AMRSC	12
Affiliate /Under Graduate.	04
Total Membership as at July 2015	65

2. Committee of Management

The following were elected to the Committee at the 54th Annual General Meeting held in July 2015.

Hony. Chairman - Prof. Sudantha Liyanage
(till 25.08.2015)
Mr. R M G B Rajanayake
(from 25.08.2015)

Hony. Secretary - Mr. W K Samarakoon

Hony. Treasurer - Mr. I M S Herath

Committee Members -

Prof. Sudantha Liyanage (from 25.08.2015)
Prof W S Fernando Dr Poshitha Premaratna
Dr Piyal Ariyananda Dr M P Deeyamulla
Dr N Sirimuthu Mr Sulith Liyanage
Mr S Perasiriyan

Co opted Members

Dr Rajitha Hanarasinghe
Mr W A P Silva

3 Activities

3.1 Contributions to Activities of the Institute of Chemistry Ceylon

- (a) Full page advertisement of "Chemistry in Sri Lanka".
- (b) Contribution for the Interschool Chemistry Quiz
- (c) Award for the Best Performance at the Graduate ship Examination in Chemistry Levels 3/4 Theory Examination

3.2 All - Island Inter School Chemistry Essay Competition.

3.3 Inter University Chemistry Essay Competition

3.4 Book donation programme

3.5 A/L Teacher training workshop

3.6 Advanced Level Chemistry Seminar

3.7 Industrial Visit for B.Sc. Special degree students, M.Sc. students and RSC Members

3.8 Collaboration with SLAAS E-2 workshop and seminars

3.9 Supporting Chemical Societies of Universities in Sri Lanka

4. Web Site

The members are reminded of the web site of our Section, the address of which is as follows:-
www.rsc.org/Membership/Networking/Internationalsections/SriLanka/index.asp.

Mr W K Samarakoon
Hony Secretary

CCS Analytical and Consultancy Services

We are happy to announce that the following services are provided by the College of Chemical Sciences (CCS), the educational arm of **Institute of Chemistry Ceylon**.

The H D Gunawardhana Instruments Center of the College is equipped with the following advanced instruments.

Gas Chromatograph
(GL sciences 4000, Japan)



Atomic Absorption Spectrometer with flame
and Graphite furnace
(Hitachi ZA 3000)



Fluorescence Spectrophotometer
(Hitachi, F 2700)



FT-IR spectrophotometer
(ABB MB 3000)



UV- Visible Spectrophotometer
(Hitachi U 2910)



TOTP- H 50 ml High Temperature-
High Pressure Reactor

For the Industry

- Consultancy Services
- Method Development
- R&D services

Analytical Services Offered

- Water Quality Parameters (DOD, BOD, COD, pH, Conductivity, Hardness, turbidity, Nitrate, Nitrite, and Total Nitrogen etc).
- Food and Nutrient Analysis.
- Analysis of specific chemicals in various samples.
- Analysis of heavy metals
- Analysis of paint, textile dyes, pigments etc

Contact any of the following officials for your requirements of Analytical/ Consultancy Services

The Management Committee on Analytical and Consultancy Services

Prof. MDP De Costa, Senior Professor, (Academic laboratory and Analytical / Consultancy Services Coordinator)

Dr. USK Welivegamage, Senior Lecturer

Dr. C Udawatte, Senior Lecturer

Dr. U K Jayasundara, Senior Lecturer

Tel: 011 2861231, 2861653, 4015230



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