tended Periodic Table will certainly cause a lot of discussion within our chemistry community. To verify Pyykkö's claims, accurate quantum chemical calculations including electron correlation and perhaps even quantum electrodynamic effects are required. And whether we will see the production of more super-heavy elements and exciting atom-at-a-time chemistry in near future, we just have to wait and see.

Glenn Seaborg was a well-known advocate of science education and of federal funding for pure research. However, over the last 20 years chemistry has been through a rather bumpy and long winding road with no end in sight - and that despite the fact that so many important recent discoveries were made. Let us all hope that 2011 brings some long-deserved awareness and necessary changes to foster and support chemistry research in our country. There is no quick solution to the many difficult environmental and financial problems human kind will face in not too distant future, but I am convinced that chemistry will contribute substantially to solving these problems. We need to get on with this sooner rather than later. For this we desperately need more Mendeleev's, Rutherford's, Seaborg's, MacDiarmid's and the like, and a better understanding by our administrations of how research really works, *i.e*. in mysterious and unpredictable ways, which makes chemistry such an exciting, creative and innovative subject.

Acknowledgments

I thank Brian Halton (Victoria University of Wellington) for suggesting I write this article. The pictures shown in the article are freely downloadable from Wikipedea sites (copyright expired), and the Periodic Table created in our research centre is free for use as well.

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Chemistry in Canterbury: 1986-2010

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At the University of Canterbury

The most significant constant in the 25 years since 1985 would have to be the ongoing appointments of well qualified, ambitious, experienced academic staff in the Department of Chemistry. Financial constraints have seen the number of established positions shrink from 23 to 18 at the same time as chemistry has spilled well beyond its historical subdivisions. Teaching the current, discernable, main stream topics in the traditional areas of organic, inorganic and physical chemistry is, consequently, that much more demanding. University teachers have research interests in areas that demand proficiency in new knowledge, much of which did not exist 25 years ago.

There have been enormous improvements in analytical chemistry of all types. Modern techniques permit measurements of concentrations at the parts-per-billion level in all states of matter and some interesting applications have been developed locally. Molecular structure analysis has benefited from huge developments, particularly with increasing availability of high resolution, NMR instruments and X-ray area detectors. Applications span all research areas where new compounds are synthesized or isolated from natural sources. Both these techniques have improved in precision and speed synergistically with the increasing performance of computers and the decreasing size of microprocessors. Also, there has been professional development of sophisticated computer programs to exploit the data these instruments pour out. Computational molecular modelling has also advanced a very long way with enhanced computer power. Other applications include polymerisation kinetics and studies of complicated equilibria between the oceans and their atmospheres.

Reviewing the past 25 years of chemistry in Canterbury has required mining annual reports and soliciting personal contributions from colleagues inside and outside the Department but it is neither possible nor desirable to review all individuals' contributions. Rather, some major thrusts in chemical research are outlined and the acquisition of instrumentation and associated developments mentioned where these are essential to ongoing achievement in these areas.

Organic Chemistry

A strong interest in reaction mechanisms, founded over decades by the late Professors John Packer and Jack Vaughan, has continued to interest staff members trained in that school. Professor Michael Hartshorn pursued rearrangements of steroids, monoterpenes, cyclic sulfites and acetylenic alcohols and studied *ipso*-nitration of aromatic hydrocarbons and phenols, including reactions with fuming nitric acid and nitrogen dioxide, and the chlorination of polysubstituted phenols. Other studies involved the reactions of cation radicals generated by the photolysis of aromatic hydrocarbons.

Professor Jim Coxon has reported on the stereochemistry and facial selection in cyclo-addition reactions, developed metal mediated allylation methods and elucidated stereochemistry. He conducted photochemical studies of the use of magic acid to induce ring expansion as a means of making complex skeletons and examined fragmentation and rearrangement of these skeletons. Jim also reported on *ab initio* studies of epoxide rearrangements and intramolecular ring-forming reactions, cycloaddition reactions of alkenes and alkynes, including the effect of proximate lone pairs on facial selectivity. Modelling studies were carried out to predict conformations of macrocyclic compounds, and these were correlated with NMR studies. Software was written to correlate molecular motion with nOe build-up and to examine the secondary structure of biopolymers. Contributions have been made to the development of theozymes for intramolecular reactions and modelling has been used to study intercalation of ethidium in DNA. Most recently these methods have been used to facilitate the development of inhibitors of cysteine proteases, with particular application to slowing cataract development. Other studies have included the mechanism of ring-opening reactions of cyclopropanes, cyclobutanes and epoxides. Jim also pursued a long-term interest in diastereotopic selection in the rearrangements of epoxides.

Professor Peter Steel's research ranges over a number of areas of chemistry. The most common feature has been the presence of heterocyclic compounds; in particular, the design of new chelating and bridging heterocyclic ligands for use in coordination, organometallic and supramolecular chemistry, aspects of which have been summarised in a review (see: Steel, P.J. *Acc. Chem. Res*. **2005**, *38*, 243-250). He has been interested especially in the self-assembly of new metallosupramolecular species, such as cages, helicates (including the first ever quadruple stranded helicate), boxes, rings and coordination polymers. Other aspects include the study of new chiral ligands, the study of cyclometallated compounds and of metal-metal interactions. Peter has also been involved in the organic chemistry of heterocyclic compounds, particularly in the study of the tautomerism of heterocycles and X-ray structures of new heterocyclic compounds, in a long standing collaboration with Alan Katritzky at the University of Florida.

Biological, Medicinal and Natural Product Chemistry

For the past 25 years Professors John Blunt and Murray Munro have been managing a programme for the discovery and development of marine natural products. A large group of Postdoctoral Fellows, PhD and Honours students, and research assistants have made many fascinating discoveries resulting in numerous publications on compounds such as the mycalamides, discorhabdins, halichondrins, variolins, thyrsiferol and pateamine. All of these compounds have spawned many synthetic and biological investigations around the world.

Several of the lead compounds isolated over the years progressed in various trials for development as anticancer agents. For example, variolin B, originally isolated from a sponge collected by their group from under the Antarctic ice, is currently at a pre-clinical phase with the Spanish company PharmaMar SA. Following an innovative synthesis of variolin at Canterbury by Jonathan Morris (now at the University of New South Wales), PharmaMar prepared over 200 analogues and, based on the results, took the variolins to a pre-clinical phase.

One of the most significant results arising from the marine natural products research has been the release in November 2010 of the new anti-cancer drug Halaven, a synthetic halichondrin analogue developed by Eisai Co. (USA). The halichondrins had first been isolated from a Japanese sponge in 1985, but a 10-times richer source was found in a deep-water marine sponge collected off Kaikoura and investigated over the 1988-1995 period. The US National Cancer Institute (NCI) was very interested in obtaining a large supply of halichondrin B to extend studies they had initiated which indicated a novel mode of action for this compound in arresting the growth of tumor cells, and they organized a contract with the UC group for supply. Following an environmental impact report, one tonne of sponge was collected and extracted with the assistance of staff at NZ Pharmaceuticals in Palmerston North; it yielded 310 mg of halichondrin B. This supply enabled the NCI to carry out critical xenograft experiments in mice, the results of which encouraged Eisai Co. to continue work on halichondrin analogues that have led to the future drug Halaven. Dr David Newman, Chief of the Natural Products at the NCI, organized the New Zealand supply contract and subsequent collaborations with Eisai, and he has said: *Without the New Zealand material and the work done in NZ, none of the future development would have occurred*. The release to market of Halaven and the preclinical status of variolin B are good examples of the value of the study of natural products in the development of drugs for human and animal use.

John and Murray have recently received a number of prestigious international awards for their research contributions that include being jointly awarded the UC Research Medal and the Paul J Scheuer Award, the highest award in the area of marine natural products. The most recent was the highest award of the American Society of Pharmacognosy, the 2011 Norman Farnsworth Research Achievement Award, the first in the 35-year history to scientists from the southern hemisphere.

Professor Andrew Abell contributed to the expertise in the area of biological and medicinal chemistry. During his period at UC, his group synthesized a wide variety of biologically active molecules, mainly enzyme inhibitors. These included HIV and serine protease inhibitors and invoked novel structural motifs including photoactive molecular switches and conformationally rigid systems.

Former student and now Associate Professor, Emily Parker explores the evolution and molecular details of enzymatic catalysis. Emily has been Director of the Canterbury Biomolecular Interaction Centre and a member of the Oxygen group, a science advisory group made up of high-flying younger NZ academics who advise the government on developing trends in science to inspire their peers and younger scientists. She received a UC Teaching Award and then later in 2010 the national Tertiary Teaching Excellence Award as one of this country's top tertiary teachers.

Professor Antony Fairbanks, who visited the department in 2006 as an Oxford Exchange Fellow, was appointed to the faculty two years ago and is now Head of the Chemistry. He is a synthetic organic chemist by training, with research interests centred on the chemistry and chemical biology of carbohydrates. His group has worked extensively on the stereochemical control of glycosylation reactions, and has reported the synthesis of a variety of oligosaccharides, glycoconjugates and glycomimetics; the latter as potential therapeutic agents against a variety of disease states and infectious agents. Most recently his group has been developing biocatalytic approaches to homogenous glycopeptides and proteins.

Dr. Andy Pratt is a bio-organic chemist whose interests encompass issues associated with the chemistry of life. He has a great interest in the philosophy of science and in chemistry education, and received the UC teaching award in 2001; he is the director of Biochemistry in the Department. Professor Ian Shaw joined the university a few years ago and has ongoing interests in a plethora of epidemiological issues while Dr. Rob McKeown and Dr. Michael Lever, have continued collaborations with the pharmaceutical and medical worlds respectively.

Physical Chemistry

Professor Leon Phillips has been active in gas phase kinetics and all types of interphase equilibria for the past 25 years, and the 25 years before that! His first graduate student, Professor Murray McEwan, has developed a highly sensitive (ppb) drift tube mass spectrometer, and the company that he set up enjoys some success with forensic applications both here and abroad. Professor Peter Harland's work has been facilitated by the design and construction of specialized instruments, only some of which are described below.

In the early 1980s a drift tube mass spectrometer was designed and constructed to measure the mobilities of positive ions drifting in inert gases under the influence of electric fields. This instrument was used to demonstrate, for the first time, a significant difference in the drift properties of isomeric ions, such as $C_2H_xO^+$, and then applied to identify the isomeric form of an ion-molecule reaction product by measurement of its mobility. Mobility data were successfully inverted to calculate a large number of ion-neutral interaction potentials.

The first stage of a molecular beam machine was designed in the late 1980s as the nucleus for a crossed beam machine which was not completed until the late 1990s. Initially, the single beam machine was used to measure the physical characteristics of supersonic molecular beams and the data used to test mathematical models. This was followed by the addition of a 1.3 m hexapole inhomogeneous electric field filter as an upper Stark state selector for seeded beams of symmetric top molecules and a radio-frequency spectrometer to measure the rotational quantum state population distributions in supersonic beams of symmetric top molecules. Measurements of collisional relaxation cross-sections for upper Stark states of symmetric top molecules (ΛM_J changing collisions) gave values up to 1000 Å^2, which explained why ultra-high vacuums were essential to maintaining quantum state integrity during beam transmission through the machine.

This was followed by the first reported measurement of the mean lifetime for spatial de-orientation of upper Stark states after passing into field-free space. The addition of homogeneous field plates facilitated the determination of the minimum electric field strength required to retain spatial integrity for oriented beams. These measurements were needed to move on to an investigation of cross beam studies of electron-oriented molecule collisions in which fast switching electric fields were used to ensure field free conditions during electron interactions with oriented molecular beam pulses. This work showed that both the ionization cross-section and the ion products formed are orientation dependent and that as the ionizing electron beam energy is reduced the orientation effect disappears as the de Broglie wavelength of the electrons exceeds the dimensions of the target molecule. Current work is focused on the experimental and theoretical calculations of positive and negative ion collisions with spatially oriented molecules.

In addition to the molecular beam work, an instrument for the measurement of absolute total electron impact ionization cross-sections was designed and constructed in the mid-1990s that has since produced over half of all the values reported in the literature and most of those for molecules with more than 4 atoms. Measurements for several series of organic molecules (alcohols, esters, halides, cyanides and hydrocarbons) have been used to test theoretical models of electron impact ionization and have shown that the molecular polarization volume for a molecule can be reliably deduced from the maximum ionization cross-section.

Associate Professor Greg Russell works on radical polymerization kinetics. A long-standing problem in this area is that of *chain-length-dependent termination* (CLDT). One of the first chemical reactions that students learn about is that of radical-radical recombination. Because this is a near barrierless reaction, it is diffusion controlled in rate in the liquid phase. As one would intuitively expect, the diffusion of large polymer molecules is slower than that of small ones. Therefore, it is self-evident that the rate coefficient for termination in radical polymerization (RP) must vary with the size of the macro-radicals involved. Greg has been at the forefront of efforts to bring CLDT out into the open and to show that RP kinetics can only be properly understood if it is taken into account. He has developed fast computational algorithms for solving RP kinetic equations that include CLDT, and he has shown that the analytic equations from a special case of CLDT are widely applicable. The knowledge has been applied to a broad spectrum of experimental data, and has cleared up mysteries that previously were a roadblock to both accurate modeling and detailed understanding of RP systems. A particular highlight was the proposal of a new model for CLDT that, in a classic example of experiment-theory synergy, quickly found verification via a novel, EPR-based technique for measuring termination rate coefficients. A large number of monomers subsequently have been found to show this so-called composite-model behaviour. All this work was recently summarized (see: Barner-Kowollik, C.; Russell, G.T. *Prog. Polym. Sci*. **2009**, *34*, 1211-1259).

Other Specialist Spectroscopy

Dr. Rod Claridge moved EPR research from Physics to Chemistry at the university. By 1986 he was well established with his Varian E12 spectrometer and a series of successful investigations on radical ion properties and thermodynamics of ion pairing and radicals in organic single crystals were completed. Equipment was developed for one of the first EPR studies of matrix isolated radicals.

The EPR instrument was modified for single crystal studies with the intention of examining materials of technological importance. Collaboration with Dr Craig Tennant and his colleagues (from the then Physics Division of DSIR) began a study of Fe^{3+} in single crystal scheelite, calcium tungstate, which led to the development of new theory for use of Higher Spin Terms in the Spin Hamiltonian, a somewhat controversial topic. Craig retired from DSIR in 1993 and moved to Christchurch to join in studies of transient defect centres in Zircon, zirconium silicate. The next 17 years were very productive with graduate students gaining vast experience from Craig's theoretical knowledge and his practical skills in handling transient species. He also introduced Mössbauer spectroscopy for studying the site symmetries of Fe^{2+} in single crystals of ferrous ammonium sulfate hexahydrate and ferrous chloride tetrahydrate.

Professor Bryce Williamson was appointed in 1986 and has conducted research using magneto-optical spectroscopic techniques. Initially, the equipment appropriate to his research was unavailable, so he spent most of his time doing theoretical work, commuting to Paul Schatz' lab at the University of Virginia to do the necessary experiments. Most of that work involved the spectroscopy of metalloporphyrinoids doped into argon matrices at temperatures below 10 K. After a couple of years, Bryce received a UGC grant to purchase a superconducting magneto-cryostat and build a spectrophotometer. It was based on an old JASCO circular dichrograph, and could simultaneously measure magnetic circular dichroism (MCD) and absorption spectra. Subsequent work on ferricyanide represented the first measurements of MCD spectra at Canterbury.

Bryce has built a radically new type of matrix-isolation *injection* system and used it to work on metallophthalocyanines doped in argon. Students investigated spin-orbit coupling (SOC) and vibronic (Jahn-Teller; JT) effects by measuring absorption, MCD and hole-burning spectra. Other work was principally on diatomic hydrides (XH, X = C, N, O) doped in argon. In order to cope with the narrow transition line widths in his spectra, a new spectrometer was designed and constructed based on a 0.75-m Jarrell-Ash monochromator and it remains his principal research instrument.

The porphyrinoid theme was continued in the late 1990s and a new spectrometer was built to permit emission analogues of MCD to be used in a detailed study of the vibronic structure in the Q band of metallophthalocyanines in argon. An extensive generalised theory of the MCD and absorption spectra of uniaxial systems undergoing simultaneous SOC and JT effects was subsequently developed. In the early 2000s, diatomic-hydride research was developed. Measurements of the absorption and MCD of heavier species in argon and heavier noble gases required development of a dynamic theory to interpret the spectra.

This century has seen a local collaboration, with Craig Tennant and the late Cuth Wilkins, involving the spectroscopic characterisation on NZ jades. Internationally, there has been work with Spanish research groups headed by Jaume Veciana and Javier Tejada, both in Barcelona, using the temperature and magnetic field dependences of MCD to investigate hysteresis phenomena in chiral single-molecule magnets. A more applied collaboration, involving the US company Remspec Corporation, has investigated the use of fibre-optic-infrared reflection-absorption spectroscopy and chemometric methods to indentify and quantify trace amounts of pharmaceuticals on various surfaces. Recent work, with Professor Alison Downard's group, has been on the functionalization and characterization of surfaces modified with thin organic films.

Analytical Chemistry

Interest in this area waned, worldwide, prior to 1986, but it has waxed since, largely because a variety of novel and sensitive instruments have facilitated measurements with direct bearing on environmental and medical matters.

Dr. Jack Fergusson carried out environmental work on many metals and materials such as dust, aerosols, sediments, Fe-Mn nodules, tree cores, cockles, and hair and teeth. The aim was to study the environmental processing of the metals. A study of low level lead in dentine was carried out to estimate the effect of lead on children. Professor Kip Powell has been active in the Analytical Division of IUPAC for many years. He established a clean room to very high international standards and has an active interest in soil science.

Dr. Sally Gaw specialises in interdisciplinary research on the environmental fate and behaviour of contaminants, in aquatic and terrestrial environments. She is investigating the environmental fate of a wide range of contaminants including trace elements and emerging organic contaminants. This is important as it enables environmental hazards and potential remedial strategies to be identified. This knowledge underpins research in environmental toxicology and public health, as well as environmental policy.

Currently, contaminant discharges from Scott Base in Antarctica, characterization of emerging contaminants in domestic wastewater and cyanobacteria in Canterbury waterways are under investigation.

Highlights since Sally started at UC have included the purchase and installation of both a GC-MS and an ICP-MS, key to environmental chemistry research, and they have significantly enhanced her research capabilities significantly.

Inorganic Chemistry

The strength of inorganic chemistry at UC began with Dr. Cuth Wilkins in the 1950s. Dr. Jack Fergusson studied transition metal chemistry, in the preparation, structural and spectral properties (NQR, NMR, IR and UV-visible) of the halogeno complexes of metals including technetium, rhenium, ruthenium, osmium, rhodium and iridium. The late Dr. Gordon Rodley brought his original and innovative mind to bear on the convoluted structures of the DNA double helix and other origins of life biochemical topics, while Professor Don House led a long-term investigation into the synthesis and characterization of transition metals complexed with multidentate ligands.

Prof Vickie McKee was the first female permanent staff member of chemistry and is now Professor of Inorganic Chemistry at Loughborough in the UK. Her interests remain primarily focused on synthetic and structural aspects of coordination chemistry, with particular emphasis on the use of geometric factors to control metal-metal interactions and other properties in bi- or polymetallic systems. These find potential applications in fields ranging from bioinorganic chemistry to surface and solid state chemistry. Dr. Jan Wikaira's two areas of interest are investigating the magnetic properties of tetrahalocuprate complexes and transition metal macrocyclic chemistry; she also runs the X-ray crystallography facility.

Dr. Vladimir Golovko's research and teaching interests are in the area of inorganic and materials chemistry with applications in catalysis and nanotechnology. His work takes him in rather diverse directions – from carbon nanotube growth to fabrication of catalysts (from designer support materials to active ingredients - metal nanoparticles) and running catalytic testing using three different approaches. His laboratory is well connected to researchers within the university, NZ, and internationally, and is attracting a significant number of talented students. Dr. Owen Curnow works on ionic liquids while Dr. Paul Kruger is synthesizing new ligands and using them in assembling novel oligimers and other aggregates with many different metals.

Computer Impact

Like everywhere, the past 25 years has seen the exponential increase in computing power, and decrease in price with everyone now having a 1986 supercomputer on their office desk. Of course, chemical research has benefited. In addition to the advent of sophisticated professional quality software, the spectroscopic investigations alluded to above have benefited, but the two areas of research most affected have been computational chemistry and X-ray crystal structure analysis.

Dr Robert Maclagan has exploited whatever facilities he could access. These now include the university's Blue Fern supercomputer for calculations that aid experimentalists, particularly those working in the broad area of gas-phase chemical physics. Calculations have aided the identification of molecular ions by evaluating appearance potentials or proton affinities. Electro affinities, radiation energy profiles and gas phase ion motilities have been calculated; also the interaction of water with compensatory solutes and the properties of quartz when a silicon atom is replaced by aluminium and protons or Li^+ ions are present.

X-ray crystal structure analysis entered the Department through Professor Bruce Penfold. Bruce had been instrumental in acquiring the first ever computer on any NZ university campus when *Chemistry in New Zealand* was in its 50th year and he acquired the world's best software for analysing X-ray data. Combining this with microprocessor controlled diffractometers and, latterly, area detectors, Professor Ward Robinson provided a first class data service to the rest of the country and to many overseas laboratories, principally throughout Asia. Indeed, he was appointed for a term as President of the Asian Crystallographic Association from his teaching missions around countries in that area. The laboratory output has increased as a result of one structure in three days to three structures in one day. All aspects of this approach to crystal and molecular structure analysis have been replicated at former customer campuses by crystallographers trained at the Canterbury laboratory.

Chemical Education

There have been several significant contributions to education. Dr. Jack Fergusson founded the monthly magazine *CHEM NZ* (now *ChemEd NZ*), which has international circulation. School curriculum reviews have involved Departmental representatives and several teachers have spent time teaching first-year classes in the university. Extensive school visiting programs, initiated by Drs. Mckee and Steel, have extended beyond chemistry into the Science Outreach Programme largely through the initiatives of Dr. Richard Hartshorn. The initial goals were to promote the study of chemistry, and science more generally, to Year 11 pupils. Now, the programme covers all of the subjects in the College of Science and a great deal of time is spent helping teachers through workshops, *e.g.* a radioactivity workshop in collaboration with Rutherford's Den. The student presentations that were the exciting and novel backbone of the early years now seem rather mundane, but that is a measure of how technology has advanced in a decade, and of how the audience has changed. Scholarship Days and fora for Science HoDs are regular and popular activities. Dr. Robert Maclagan has been heavily involved in training the NZ Chemistry Olympiads teams with very gratifying success amongst the medalists.

Awards and Appointments

The last 25 years have seen Canterbury chemists gaining plenty of recognition for their research and teaching contributions: some in the form of DSc degrees from overseas universities (Phillips, Powell and Harland), others

Christchurch Polytechnic Institute of Technology

from UC to its own graduates – Professors Warren Roper and Robin Clark, both FRS – and to Dr. Robin Mann who completed a term as University Chancellor after a distinguished career in business. A number of the staff have been appointed Adjunct Professors in prominent overseas universities.

Many Canterbury chemists have been elected FRSNZ, some have received top national awards, and others international awards from their professional bodies. There have been several Easterfield medallists of the NZIC and four Presidents of the Institute have come from the Branch since 1986. Some of our colleagues have served on commissions of International Scientific Unions and some as leaders of international specialist interest organizations. There have been extensive contributions to important databases, particularly in marine natural products (Munro and Blunt), equilibrium constants (Powell), and thermodynamic and EPR data (Claridge).

The importance of academic visitations to the Department, both outgoing and incoming, cannot be over-emphasized. In particular, Canterbury has enormous ongoing benefits from the will of John Angus Erskine, a contemporary of Ernest Rutherford. Over the last 25 years, the Erskine Fund has allowed over 70 overseas academics to visit and share their expertise with both their academic colleagues and students in chemistry here. The Erskine Fund has also financed almost 30 trips by departmental academics to lecture and exchange research ideas overseas.

Several greatly respected people are no longer with us but deserve special mention because of their massive contributions to chemistry in the region, as well as nationally, namely: Professors Jack Vaughan, Cuth Wilkins, Stan Siemen, Drs. Jack Austin, Walter Metcalf, Gordon Rodley, and Messrs. John Pollard and Denis Hogan.

At Christchurch Polytechnic Institute of Technology (CPIT)

The 1980s saw CPIT teaching chemistry as one of the electives in the NZ Certificate of Science (NZCS). Moreover, introductory chemistry courses were also taught to students planning careers in nursing or horticulture. Since then, programmes and courses have changed to meet the demands and needs of employers, students and the government; however chemistry remains a core subject within our qualifications.

In those days, chemistry courses were taught within the Department of Science and Computing. Chemistry staff then included Dave Leuthwaite, John Cretney, Joy Causer and Dr. Selwyn Maister, who was Departmental Head for some of the time. Various part-time chemistry tutors included Mary Cretney, Jan Maister, Jan Ross, Jocelyn Douglas and Jan Wikaira.

The department moved into its current building, S Block, in 1990, which provides the chemists with better workspaces and fume hoods, and brings them into the same building as all of their scientific colleagues. Prior to this happening, science classrooms were located in different parts of the campus. The Seven Oaks horticultural site was also developed in the early 1990s and later a winery was included for students' course work on wine chemistry. A Science Advisory Committee was established so that the science courses have industry input.

The 1990s also saw greater interaction with local secondary schools, from creation of a Year 11 Chemistry Competition. Initially run in collaboration with secondary schools, CPIT staff took over this annual competition in 1996 and later expanded the scope to include competitions for Years 10–13 Science. The competitions focus on practical skills and theory with students preparing buffers, calibrating equipment, and performing qualitative functional group analyses. They continue to be extremely popular, with a capacity crowd of 25 teams always achieved, typically involving students from about 15 different schools from as far afield as Kaikoura and Timaru. Some schools always support the competitions, whereas others have come and gone a little, as pressure within the school and the priorities of individual teachers have changed.

1993 saw the creation of a Diploma in Laboratory Technology to provide science graduates with the opportunity to develop further practical skills in subjects including chemistry. This move into graduate education was also accompanied by plans to develop a research culture. In 1994, Dr Barbara Dolamore was employed full-time as a biochemistry and biology tutor, while 1995 saw Dr. David Hawke join the staff. He has made important contributions to the nascent *research culture* with his expertise in environmental chemistry, as well as his contributions to the teaching environment. A rearrangement of CPIT structure in 1966 saw the creation of the School of Science and, a year later, the NZCS was replaced with the National Diploma in Science (NDS). This change required much work for the staff in the redesign of teaching materials and assessments, and in adapting to the arguably more constrictive philosophy of Unit Standards.

In 1998, CPIT students were offered the opportunity to complete the Bachelor of Applied Science of Auckland Institute of Technology by studying additional Level 6 and 7 courses with us. These included environmental chemistry and natural products chemistry. The new degree proved to be extremely popular with students. In 1999, analytical chemist, Joe Keller, was employed to set up the Analytical and Consulting Services group to provide scientific services for industry while, in 2000, Dr. Michael Edmonds joined the staff as teacher of organic, natural products and general chemistry, and to do research in the area of synthetic organic chemistry, collaborating with Associate Professor Andrew Abell at Canterbury University.

As the research culture in the institution developed in the early 2000s, research outputs increased and external funding was sought. Success came in 2006, an impressive year in which staff were involved in three separate Marsden grants. David Hawke became an associate investigator working on DNA and stable isotopes to study moa remains with Richard Holdaway. Likewise, Michael Edmonds was an associate investigator working on novel peptide structures with Andrew Abell at CU, and Keith Baronian was a principal investigator working with Alison Downard at UC on nanobiosystems. In the same year Barbara Dolamore received a CPIT Foundation Grant to study the environmental effects of the toxic cyanobacteria in the toxic blooms on Lake Forsyth.

The end of 2008 saw the retirement of Joy Causer, a valuable member of staff, both with her teaching of chemistry and her role as Faculty Academic Co-ordinator. The science staff began work on CPIT's own Bachelor of Applied Science (laboratory technology) degree in 2009 to replace the collaborative AIT (now AUT - Auckland University Technology) degree taught for the preceding decade. The CPIT degree became available to students in 2010, the year that saw the September 4th earthquake and subsequent aftershocks. These disrupted teaching only for two weeks thanks to the diligent work of the Health and Safety staff and technicians, and to precautionary features in the laboratories; very little damage was done (five pieces of glassware broken in the chemistry laboratories).

As we begin 2011, chemistry courses still remain an important part of the now School of Applied Sciences and Allied Health. Courses provide nursing students with the knowledge to make sense of pharmacology, and science degree students with the skills to work as laboratory technicians and research assistants in a wide variety of laboratories.

Chemistry Division DSIR and ESR

Twenty five years ago ESR existed as part of the Department of Scientific and Industrial Research, or DSIR. However, in 1992 it was reconstituted as a Crown Research Institute (CRI) and rebranded as the Institute of Environmental Science and Research (ESR) Ltd., which was required be financially viable and pay its own way. Acquiring a mission statement of: *Protecting people and their environment though science*, ESR became the country's foremost provider of forensic and other scientific services.

A wide variety of analyses have been carried out at ESR over the past 25 years. The forensic group has examined clandestine methamphetamine laboratories and dealt with the fallout from the 9/11 attacks and the subsequent security paranoia centred around any and all white powders. The food laboratory has been involved in the testing of soy sauces for carcinogenic chloropropanols, measuring levels of toxic acrylamide in potato chips, checking imported spices for cancer-causing colours, and developing methods to assay foodstuffs and food packaging for the new toxin *du jour*, melamine. Each emerging analytical challenge presented its own unique analytical difficulties, highlighting one of the most profound changes at ESR over the last two and a half decades: that our analytical capability has expanded in a breath-taking manner.

Part of this rapid evolution has incorporated the mass spectrometry capability into GC and HPLC equipment, the sensitivity and specificity of which opened new vistas of possibility, leading, for example, to a GCMS project fingerprinting faecal source contamination in water by measuring faecal sterols. The recent purchase of a Liquid Chromatograph Mass Spectrometer (LC-MS/MS/MS) is being used to test foodstuffs for gluten with the aim of extending the technique to encompass a wide array of food allergens in a single analysis.

The ESR's laboratory systems employed to monitor NZ diets in the form of the *Total Diet Survey* assess exposure to chemical contaminants in food and has been exported to Fiji. The resultig Fijian Total Diet Survey was the first of its kind carried out in the South Pacific. Collaborations with the Food Safety Authority in Australia and Europe, in the form of the MoniQA (Monitoring and Quality Assurance in the Food Supply Chain) organisation continue to expand. The globalisation of ESR's food market imposes quality obligations on our exports and presents on-going health risks from abroad. Indeed, the problems of deliberate or accidental adulteration of imported products and increasingly acute consumer concerns have resulted in food forensics becoming a major growth area.

Note added by the editor: The CU and CPIT campuses were severely impacted upon by the Feb. 22 Christchurch earthquake; the university chemistry building remained unoccupied for several weeks while CPIT, itself essentially unscathed, fell within the city 'no go' zone.