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IN NEW ZEALAND

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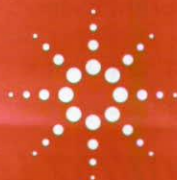
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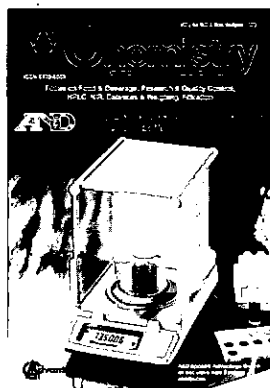
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LETTER TO THE EDITOR

Dear Editor,

REALLY IMPORTANT NEW ZEALANDERS

Before the end of 1999 many publications listed 100 New Zealanders worthy of note. They were brilliantly successful in illustrating what we are at last beginning to realise: we have paid far too much attention to sportsmen, sportswomen, musicians, singers, entertainers, politicians, writers, artists and financiers; and not enough to scientists and technologists. I do not deny that we should admire the chosen, but where there are not even ten scientists, technicians, engineers, medical men (or women) in anyone's 100 names, something is wrong. The future of our country depends far more on the latter group than on most of those chosen in lists.

The disgraceful description of RUTHERFORD ("Split the atom") in many lists shows a pathetic ignorance of what he and his team actually achieved. We should regard him as a modern Newton. Rutherford's classic remark "Gentleman, we haven't much money so we've got to think", has obviously been taken to heart by our politicians in as much as nearly all the funding of research is on a three-year basis, a totally inadequate time scale to encourage new graduates to start a research project.

One of Rutherford's colleagues, SIR ERNEST MARSDEN, came to New Zealand after a few years with him and established the DSIR.

Major omissions in many lists include PICKERING and his space work in the USA, and SIR ANGUS TAIT, the electronic manufacturer who was the subject of a recent article in the *Listener*. What they did not say was that the combined export value of three Christchurch electronic factories is greater than the value of Kiwifruit exports. In software development our success is such that they compare favourably to the much-vaunted exports of wine. Unfortunately it is difficult to name anyone in the software industry because of the lack of attention paid to the participants by the media.

In some scientific fields there are so many brilliant workers that it is possible to name only a few in a short note like this. For example, in the medical field:

PROFESSOR BRUCE CAIN, working on leukaemia in children; PROFESSOR BILL DENNY, a brilliant chemist who has synthesised some remarkable anti-cancer compounds, now being tested in the USA; DR PETER FITZGERALD, who has studied chromosomal abnormalities in leukaemia, and DR TONY REEVES, researching kidney tumours in children.

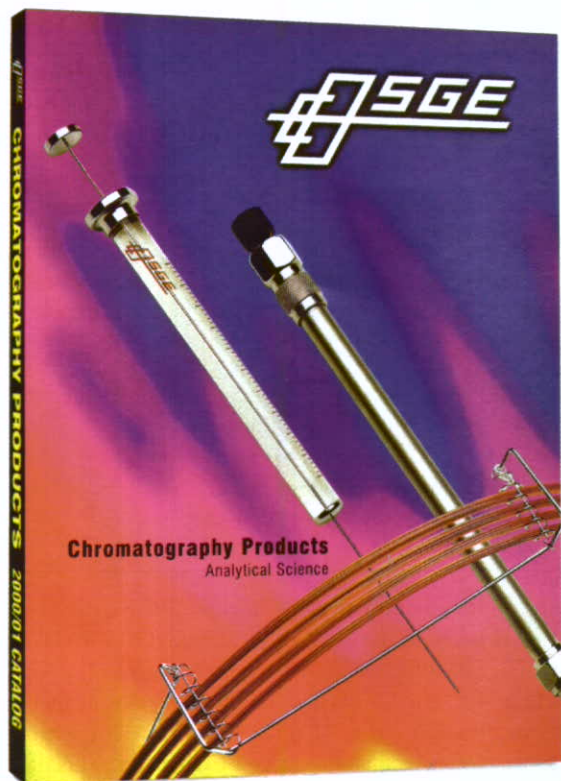
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NZ SCIENCE SCENE

PROMOTION FUND HELPS PUT RUTHERFORD IN SPOTLIGHT

A grant from the 1999/2000 Science and Technology Promotion Contestable Fund awards announced in November 1999, will fund development of an original script, costumes, props, and director's notes for RUTHERFORD: The Story of a Kiwi Genius. An earlier grant of \$80,000 from the Science and Technology Promotion Contestable Fund funded development to a stage where sponsors could invest in the development and touring of the exhibition.

The theatre programme will focus on "the personality behind the science," and link closely with a touring national exhibition on this towering figure in New Zealand science. The exhibition project is the brainchild of the Association of Science and Technology Centres of New Zealand (ASTC NZ), and has attracted major sponsorship from the University of Canterbury and Tait Electronics.

Project manager Jude Benson commented that "his humble beginnings, perseverance, team spirit and strong character all serve as an example of what constitutes a great individual, as well as a brilliant scientist".

The exhibit will visit at least seven science centres and museums from July 2000 to July 2002, including Te Papa and Auckland War Memorial Museum.

There has also been interest expressed by Canada, USA and Australia to feature the exhibition.

The Science and Technology Promotion Contestable Fund has been made available by the Government to promote positive values towards science, mathematics, social sciences and technology. Some 55 applications totalling \$23,112,199 were received for the \$400,000 of funding available in 1999/2000.

BUILDING TALENT FOR THE FUTURE

The future of New Zealand's science and technology community is in good hands if the contestants in the 1999 Genesis Energy National Science & Technology Fair are anything to go by.

The 31 entrants from Forms One to Seven were chosen from 23 regional fairs held throughout New Zealand. Entries included an examination of the fractal properties of leaves to assist in future planting and forest management, testing children to see how age varies the ability to clearly recollect events and its implications for the courtroom, and 12 year old Lisa Penderon's prize-winning trial of flashing warning lights on the sides of school buses.

Debbie Chan from the Royal Society noted that although there was the same number of entries as last year, there was a far higher level of technology-orientated projects - about a third of all entries. Royal Society Education Officer Peter Spratt adds that the younger technical entries that won prizes were both from primary level. "I think that reflects the introduction of the new technology curriculum and the way that primary schools have incorporated it into their programmes."

Regional science fairs first began in New Zealand some 30 years ago, and when the fairs became a national event seven years later the Royal Society was invited to support and co-ordinate them. The national fair is organised by the Royal Society, the New Zealand Association of Science Educators and the Kiwanis service club.

PUTTING NEW ZEALAND ON THE RS&T MAP

Global economic, technological, social and environmental changes are changing the role of RS&T in New Zealand's interactions with the rest of the world. Globalisation provides great opportunities for New Zealand,

perhaps more than for most countries, as long as we act to capitalise on them. A successful national innovation system is essential to this, but it must link and align with the complex international networks of the modern global knowledge age in order to work.

This is reflected in a change in focus for MoRST's international activities.

Previous strategies saw investment in R&D as the only role for Government, and strongly stressed the formation of direct international scientific links for their own sake, with most interactions being between science providers in each country. Within the contemporary innovation policy framework, more emphasis is placed on creating a richer variety of international partnerships and networks for our RS&T system, and increasing understanding and awareness of global challenges and opportunities. MoRST's international activities have three objectives:

- ensure the Government's mainstream RS&T investments help us capitalise on global advances in RS&T;
- create an environment conducive to international linkages and partnerships; and
- develop more understanding of the role of RS&T in the global knowledge economy and the implications of this for New Zealand.

The international strategy provides a good framework for MoRST's international activities. Recent examples include the development of three S&T initiatives following the high profile visit of the President of the Republic of Korea, enhancing relationships at senior official level and encouraging the formation of partnerships within the broad innovation networks established with Japan and the United States.

The strategy will mean more focussed efforts for priority countries, increased use of the MoRST website, and an innovation focus involving a greater

range of people. A summary of the strategy will be available via the MoRST website in the near future.

ESR CLIENTS BENEFIT FROM SALE OF ESR ANALYTICAL

The sale of ESR Analytical to AgriQuality NZ is part of a business strategy that will allow ESR to focus on its core research and science services business.

“The result of our business strategy will be an ESR completely focussed on delivering client outcomes in the areas of environmental health and forensic science,” said ESR Chief Executive, Dr John Hay.

“Concentrating on ESR’s core business will allow us to invest in capability in line with our clients needs,” he said.

“ESR wants to continue to make gains in developing science solutions for our key clients and expanding research to underpin this activity is essential.”

ESR intends to work closely with AgriQuality, with ESR research programmes continuing to make use of their complementary analytical expertise. However Dr Hay believes the scope of the relationship goes beyond just the provision of analytical services by AgriQuality and could extend to ESR providing technology transfer, new product development and development of research projects.

ESR’s analytical laboratories at Gracefield were sold to Auckland-based SOE AgriQuality NZ Ltd on February 1 this year. Dr Hay says that laboratory clients will continue to receive a high quality specialist environmental analytical service and that the move to a State-Owned Enterprise will ensure stability and ongoing reinvestment.

Chief Executive of AgriQuality, John Morgan, says the purchase of ESR Analytical is a natural extension of his organisation’s core business activity in testing, analysis, verification and certification, extensive network of testing and analytical laboratories throughout New Zealand.

Dr Hay noted that “ESR continues to retain the considerable analytical expertise which is needed to support

our research and specialist services in communicable disease, water quality, food safety, risk assessment and forensic examination”.

A THINK TANK FOR THE KNOWLEDGE ECONOMY

A new council of seven people is being set up to provide top-level strategic advice to the Government on science and innovation, Minister of Research, Science and Technology, Pete Hodgson announced recently.

Establishing the Science and Innovation Advisory Council (SIAC) was proposed in Labour’s pre-election policy and identified by Prime Minister Helen Clark as an item for action in the Government’s first 100 days.

The council will report directly to Miss Clark, creating a stream of advice on research, technology and innovation at the highest level of Government.

“I know scientists and innovators are excited about this,” Mr Hodgson said. “For years they were sidelined by a disinterested National Government. They watched unhappily as public and private sector support for research languished and many of New Zealand’s finest minds drifted overseas. Their ideas for tackling these problems have gone untapped. This Government is inviting Cinderella to the ball”.

Mr Hodgson said the Government was not simply looking for senior scientists to fill the council seats.

“I expect the SIAC members to come from diverse areas including the academic and science communities, business, the Maori community and the general public. The main qualifications are vision, energy and ideas for gearing up science and innovation in New Zealand. Science and innovation are vital in the shift to a high-skill, high-wage economy, so we’re looking for wisdom and far-sightedness.

“The Council will consult with the community and advise the Prime Minister on issues such as building understanding of science, encouraging businesses to invest in research and development, and creating wealth from innovation. It will ensure Government policy is related directly

to stuff that works in the community,” Mr Hodgson said.

The Government is now seeking nominations for members of the Council, which should meet for the first time by June. Initial appointments will be for two years. The council will have a modest budget covering remuneration, overheads and funds for commissioning specialist advice. The exact sum is being finalised in the Budget process.

The call for nominations will be advertised in major papers and nominations will close on April 5th. Nomination forms are available on the Internet at www.siac.govt.nz or from SIAC, P O Box 2401, Wellington.

Terms of Reference for the Science and Innovation Advisory Council

Purpose

The purpose of the Science and Innovation Advisory Council is to: increase the public status and recognition of scientists, science and innovation;

- promote a long-term, strategic direction for research, science and technology;
- build private-sector commitment to new science and technology policy directions; and
- enable co-ordination of Government science and innovation policies and community activities at the highest level.

The Council will be the Prime Minister’s Advisory Council. The Prime Minister has delegated responsibility for the day-to-day operations of SIAC to the Minister of Research, Science and Technology.

Mode of Operation

Effective research and innovation requires partnership between the Government and the community. It will have:

- a consultation role in which it discusses science and innovation issues of concern to the Government with interested groups in the community; and
- an advice role in which it synthesises feedback from the community and its own analysis of issues to provide

advice on policies and actions for Government.

The Prime Minister, or the Minister of Research, Science and Technology acting on her behalf, will set broad directions for the Council's work, in consultation with the Council.

The Council will not routinely publish the advice its gives to Government. However, the Government and the Council may, from time to time, agree to publish papers produced by the Council.

The Council will develop methods for consulting with the community through regular meetings with individuals and groups, hui with Maori organisations, internet forums, surveys, conferences, or other suitable means.

The Council will be supported by a secretariat provided through the Ministry of Research, Science and Technology. The Council will direct the work of the secretariat through its chairperson or a member deputised to carry out this task.

The Official Information Act 1982, the Privacy Act 1993, and the Ombudsmen Act 1975 will apply to the operations of the Council. SIAC is established by the Prime Minister to assist and advise her. Information held by SIAC will therefore be deemed to be information held by the Prime Minister for the purposes of the Official Information Act 1982.

Membership

The Council will consist of seven members, including a chairperson

selected by the Prime Minister. The Council may choose to elect a deputy chairperson from within its membership.

Members will be appointed by the Prime Minister for a term of two years. This term may be extended by mutual agreement.

Members will receive fees and allowances in accordance with Government guidelines.

Meetings

The Council will meet quarterly with the Prime Minister. It will provide summaries of its findings and proposals for further work at these meetings.

The Council will also hold working meetings as and when it determines. The Minister of Research, Science and Technology may attend these meetings to brief the Council and discuss work plans.

NEW ZEALAND SEED FUND TO COMMERCIALISE UNIVERSITY RESEARCH

Auckland UniServices, the commercial arm of the University of Auckland, has started New Zealand's first seed capital fund putting around \$15 million into the kitty.

The New Zealand Seed Fund was launched on March 6 and UniServices will now approach American and British investors.

The fund will invest in research originating from local universities and crown research institutes, who will be able to seek finance for their research from a fund dedicated to commercialising their work.

In announcing the fund, UniServices' chief executive, Dr John Kernohan, said "I think that is slowly dawning on New Zealand that the rest of the Western world is moving ahead very fast while the bulk of New Zealand's activity is still commodities-based. There is a realisation now that we have to move on."

The seed fund is to be managed by Ulysses Group, founded by Jerry Balter, an American investment banker with experience in raising money for US healthcare and medical companies. The advisory board will be chaired by Telecom New Zealand Chairman Roderick Deane. In one of its first investments, the fund will be looking at staking NeuronZ, a company setup to research the central nervous system.

Dr Kernohan said other projects the fund will consider include EPTTCO, a joint venture between UniServices and three British research companies working on cancer therapy, and a medical devices company.

A feature of investment in the seed stage of companies is that only a very few make money. US experience shows that of every 15 companies attracting seed investment, only two to three will be highly successful, giving investors returns beyond their average investment profiles.



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The Government's Vision For Science and Technology

*A Speech By Hon. Pete Hodgson, Minister For Research, Science And Technology
The Otago Institute Of The Royal Society Public Lecture Series, Hutton Theatre, Otago Museum, Dunedin
Friday 17 March 2000*

It is a pleasure to have been invited "back home" to give my first extended speech in the Research, Science and Technology portfolio.

It is an exciting portfolio, one that I held in opposition when I first entered Parliament nearly 10 years ago. Back then I seized the opportunity to quietly tour New Zealand for a year visiting research sites, talking to scientists and inevitably getting into debates on science policy. I am a veterinarian and failed amateur marine researcher myself so the big words have never bothered me. Nor has scientific method, scientific uncertainty or scientific debate. I thrive on it.

Science policy is a different matter. It's hard. It has a logic and basis which is ambiguous, contradictory and changing. Its economic underpinning is fairly robust, at least by the standards of economics, but understanding the innovation system or the details of technology transfer, or intellectual property, or "learning by doing", or how information becomes knowledge much less wisdom is pretty much in the eye of the beholder.

So much so that after a year I went to my leader and protested that I loved my portfolio, but I couldn't understand it. Mike Moore replied, "If ever you can't understand something you must write a book on it". I left his room feeling confused, thought about it for week or two and over the following three months did just that. It was, and remains, an unpublished mess. But it helped me immensely to sort through the threads of academic thinking on science policy.

I became comfortable with the topic then inspired by it. I still am.

In recent years the importance of R&D has become well understood amongst my colleagues. As a group we are alert to its importance. We are alert to it because we are starting to describe our nation as in need of transformation.

I want to use this opportunity to outline our Government's vision for science and technology. I assure you that this Government wants to be actively involved in the transformation of the nation's economy.

That's a bold aim. Transformation is not a word to be used lightly, but tinkering will not do.

Transformation means moving New Zealand beyond its traditional dependence on the primary industries for the generation of wealth. We are extremely good at primary production and processing. It is a vital part of our future and we continue to post remarkable productivity increases. But it's not enough. The knowledge economy is already a cliché, but the basic premise is sound nonetheless: wealth is increasingly taking the form of knowledge rather than stuff.

So what is this Government's vision for science and technology? Let me take a couple of minutes to paint you a picture.

It's 2010 and New Zealand's investment in research and development is at an all time high. Government investment has finally reached 0.8% of GDP and investment by the private sector has more than tripled from its level of 0.34% at the beginning of the decade.

We have successfully defended the Americas Cup another three times. Our expertise in marine technology has reached such a level that many nations are now contracting our research organisations to get access to some of the technologies that have been developed.

Our New Zealand researchers and technologists are strongly connected into the global community. We have overcome the limitations of our small research base by building a number of strategic bilateral relationships with key players.

An eminent New Zealand microbiologist has just been announced as the winner of the Nobel Prize for Science. She was awarded this for the ground-breaking research that resulted in the creation of an anti-cancer agent. This agent was derived from one of our unique native flora species.

As a result of the initial breakthrough, which happened needless to say at University of Otago's Innovation Centre, international biotechnology companies are competing to relocate their research facilities to Dunedin – now a recognised global cluster point for medical biotechnology.

As a result of these and many other achievements by New Zealand scientists, technologists and innovators, science and technology have been embraced as the engines of health, wealth and prosperity by New Zealanders. We have, at last, developed a culture that values and rewards innovation.

To make this vision a reality the Government needs to take action. We need to become a leader, a facilitator, a broker, a partner and an investor in the innovation system.

In this speech I want to outline three areas where the Government's priorities lie and expand on them. Then I wish to dwell on three issues of the day that are topical and important components of the work plan we have to turn that vision into reality. Those three issues are the Royal Commission, the Biodiversity Strategy and the new Science and Innovation Advisory Council.

But first the issue of priorities.

My main job is to lift our public investment in research and development to 0.8% of GDP by 2010. We hope to be the Government for much of that time so you are welcome to monitor our progress carefully. There are three areas I want to address as investment priorities.

First, we need greater levels of private sector involvement in research and development. In this area I intend to encourage partnerships between researchers and the private sector by supporting the work of Technology New Zealand and by converting the results of academic and industrial research into value added export opportunities.

Secondly, I want to unleash the creativity and imagination of researchers by better supporting New Zealand's basic research base. This is currently funded through the Marsden and New Economy Research Funds. Building our international linkages will also be vital if we want to access the ever-growing global pool of knowledge.

Thirdly, I want to ensure that the range of activities undertaken in the strategic research area is maintained and in some areas increased, and to signal some changes which I hope will help us achieve our vision.

The first area that I mentioned in my outline is the need to encourage the private sector to invest greater amounts in research and development.

There is no ducking the fact that overall, New Zealand's total R&D expenditure as a percentage of gross domestic product is only half the average for countries in the Organisation for Economic Co-operation and Development.

The Government will do its part to improve this by restoring the target of raising public funding of R&D to 0.8% of GDP by 2010. Getting public funding back on track to this goal should send a powerful leadership signal to the private sector.

Private sector investment is very low by international terms, about one quarter or on a good day one third of the Western world average.

To give business a more conducive environment for investment we have some specific measures in mind, such as investigating R&D tax issues, reviewing the cost to small business of protecting intellectual property and, perhaps most immediately, strengthening Technology New Zealand.

The Government also proposes to establish a small business research fund, open new venture capital avenues, examine barriers in accessing development finance, examine issues around capacity building and on it goes. These issues that I mention fleetingly are about economic development, industry development, regional development, small business policy and policy concerning Trade New Zealand. They are all part of the drive to transform the New Zealand economy, and they are portfolio areas that I am involved with.

They are not to do with R&D *per se*, but they are so closely related that I will wander across the boundaries a bit as I go.

My Government is determined to support business investment in R&D, rather than just complaining about the lack of it.

Part of this process is about acknowledging the businesses that are already out there and doing it. Here's an example.

I re-acquainted myself last Saturday with a Dunedin-based company, Swing Thru International Ltd. Swing Thru is a

company that is lifting the lid on a new container handling system whose revolutionary technology has drawn interest from around the world.

The innovative technology used by Swing Thru allows shipping containers to be loaded from either side of the host vehicle. The idea began five years ago when company founder, Ross Simpson, was challenged by the transport industry to devise an improved method of moving containers.

This project received support from the Technology New Zealand scheme. Without this support Swing Thru would likely not be in the enviable position that they are in today.

Technology New Zealand needs more support from Government. Expenditure in this scheme in past years has increased and credit needs to go to the previous Government for that. But it has not increased significantly and this Government is committed to seeing that happen.

Government involvement is not just simply about pouring money into the system. There is a need to help firms to make connections with overseas markets, with universities and CRIs and with other firms with similar or complementary interests. That's why we talk about the development of regional clusters.

That's why on Monday the Government announced an incubator support programme, designed to oil the wheels of the many incubator or innovation centre initiatives now springing up around the country, including the innovation centre across the road.

The second area I mentioned in my outline is the need to expand New Zealand's knowledge base. A critical part of this processes is to build a solid science and technology human capital resource. Science is much more about human capital than financial capital.

The sciences no longer automatically attract our best young people as they move through the education system. Nor does New Zealand hold a strong enough attraction for the brightest of our scientists, who leave in ever-increasing numbers for better positions overseas. But there is nothing inevitable about either of these facts. There are things the Government can and will do.

Increasing the recruitment and retention of talent for science must begin with the education system. In schools we aim to increase the number of teachers of mathematics, science and technology by offering bonded scholarships for these teachers. In the tertiary sector we will be negotiating adjustments to the funding model to cultivate centres of scientific and technological excellence. We will also use scholarships to attract and retain postgraduates in research areas where there are skill shortages.

Scientists need to know that the Government recognises the importance of basic research as the serendipitous source of the truly new. It underpins the integrity and progress of society. Our approach to tertiary education acknowledges the universities' vital role, with a continued commitment to funding research as part of teaching.

The New Economy Research Fund unleashes the creativity of scientists to do some out-of-the box thinking about how tomorrow's wealth will be created differently from today's.

It will generate new ideas as the basis for new industries and for R&D intensive industries emerging from existing sectors. The potential for creative leaps is exciting. The inaugural round of funding was announced two weeks ago today.

Successful projects included research to explore vaccines to prevent Alzheimer's disease and asthma; research focused on creating the next generation of communications technologies; research exploring opportunities for smaller, smarter electronics; and innovative electronic-based learning techniques. This Fund is a step in the right direction but with only \$11 million dollars of new money going into this fund it is at the smaller end of the scale.

I think the most significant result from the recent bidding process was the sheer number of bids that were received. The Foundation for Research, Science and Technology received more than 200 applications for funding from the New Economy Research Fund, requesting some \$100 million. With just \$11 million available it would appear that there are many good ideas that will not get funded. My Government is committed to increasing the New Economy Research Fund over time.

The Marsden Fund supports the curiosity of creative individuals who want to understand why and how things work in our natural, physical, social or cultural world. One example of a recent Marsden sponsored breakthrough is the work that was done by a team of Auckland-based researchers. These scientists are taking us a step closer towards confirming the existence of a mystery homing sense in rainbow trout. Another example is the new findings from a pioneering early learning research project at the University of Otago. This research is challenging many fundamental assumptions about the way infant learning and memory develops. This Government is committed to growing the Marsden Fund over time. This type of curiosity-driven non-strategic research is a vital part of our overall set of science portfolio investments.

The emerging global economy provides perhaps the greatest opportunity for New Zealand to tap into the global knowledge base. We shouldn't lose sight of the fact that we currently only carry out around 0.13% of the total global investment in science and technology. That means that there's 99.87% that we don't do!

In order to gain access to this global knowledge base we need to build our networks and develop collaboration opportunities. Overall we need to improve the ability of our scientists and technologists to tap into the global knowledge base.

In order to build an inclusive, innovative economy we need to make a commitment to building a strong knowledge base. We also need to commit to developing the human capital needed to drive this knowledge base. And we need to grow our international networks. My Government is committed to increasing investment in these areas. Watch these spaces over the next three years.

The third area that I mentioned in my outline is strategic research. This is the most important part of the Government's investment, for the simple reason that it is the largest. Several comments are pertinent.

For starters the Foresight Project, for all its perceived and actual shortcomings, has delivered a potentially significant redirection of research, particularly in the Crown Research Institutes. This is the process by which existing research has been redirected into the New Economy Research Fund category for future years. In summary, and perhaps simplistically, strategic researchers have responded very positively to the challenge to find research opportunities which may involve basic research skills but which nonetheless are directed from the outset towards a specific commercial or knowledge outcome.

Currently strategic research is poorly evaluated. The quality of the research is not in question but quite what, for all these hundreds of millions of dollars, is the taxpayer buying? Fear not – we are not about to subject New Zealand science to a crude cost/benefit analysis. The bean counters have not been let out of their cage. But evaluation of the strategic outcome for New Zealand rather than just the scientific outcome of this very significant investment needs to be improved.

We need to address that.

I want to touch briefly on the issue of social research, because I shan't have a chance to elsewhere. This is a difficult area for me, and I think for all of us. The three problems are insufficient academic depth, insufficient public engagement and insufficient co-ordination. The three problems are of course inter-related. They are however resolvable. From my end I have an obligation to produce systems that allow for researchers to better co-ordinate their efforts, be it operational research within the silos of departments of state, academic research in universities or social research now being more actively contemplated by industry, especially primary industry. I don't yet know how to do that. If you do, let me know. Be it the aetiology of poverty, issues surrounding the sociology of the digital divide or a co-ordinated response to youth suicide there is work to be done in co-ordinating our nation's effort.

I believe that if we can have a better co-ordinated approach to social research we can look forward to resolution of academic depth and insufficient public engagement. Why, for example, is no-one talking about a science strategy on marijuana policy options or the social effects of plantation forestry?

So that's once over lightly on investment priorities. I have placed emphasis on using public investment to increase private investment, on ensuring that our basic research base is rendered adequate, and on ensuring that the integrity of our strategic effort is maintained and better evaluated.

I want to now turn to three issues of immediate priority that you will be aware of, or should be made aware of. These are the Royal Commission, the Biodiversity Strategy and the Science Innovation Advisory Council.

The Royal Commission on genetic modification will kick off soon and the reason we are having it is two-fold. The first reason is that the progress of science has outstripped the progress of values definition, cultural consideration or the debate on ethics. The second reason is that, because of the first reason, the public at large do not trust aspects of the technology and consumers are asserting their sovereignty stridently.

It is utterly vital that our nation manages this debate in an honest and tolerant manner. There are issues that are well defined, and issues that are ill defined that need to be addressed. If they are addressed in a reasoned and reasonable way then the outcome, whatever it is, can be decided by us as a society, peaceably.

No-one has the franchise on wisdom in this debate.

Everyone knows that genetic engineering has a place in our society and everyone knows that, like any other technology, it has its societal limits. We need to find them. I think it is time to remind ourselves of the term "appropriate technology".

Let me give you two examples to illustrate the sort of decisions we need to weigh up. In both cases the issue is perceived risk versus potential benefits.

The first is the field trials of GM canola crops to this country. In recent years we have seen a number of applications for field trials of GM canola. Canola is not an important crop in New Zealand and is one of the more risky species to grow, with pollen that has the potential to be spread by wind and bees. It can cross with weedy relatives and has small seeds that are viable in the ground for up to five years. This type of GM trial is one that offers New Zealand little opportunity and a degree of risk. We have to ask ourselves as a nation, do we want such genetic engineering technology in New Zealand?

On the other hand there are genetic engineering technologies that offer New Zealand high economic and medical benefits, with zero or low risk. The production of human pharmaceutical proteins is an important and growing biotechnology industry. PPL Therapeutics has developed a transgenic sheep with a human gene that produces a valuable pharmaceutical product, human alpha-1 antitrypsin (hAAT), in their milk. This product has important medical benefits and is being developed and clinically trialled in the Waikato region for the treatment of cystic fibrosis. There are also significant downstream opportunities for applying this technology to other applications should this trial prove successful.

We will come, I hope quietly and reasonably, to a worthwhile and legitimate decision on this issue in the near future.

The second issue I want to touch on is biodiversity. Our biodiversity strategy will significantly strengthen, and partly redirect, our environmental science capability. Science strongly underpins policy in these areas.

No science: no strategy.

Of course our nation's environmental science is already in good shape and makes the development of a biodiversity strategy relatively straightforward. But there are gaps. In particular I see these as gaps in state of the environment reporting, in marine science, and gaps in biosecurity issues on the land and in the water.

Our strategy seeks to address those gaps and a few others as well. It is currently the subject of budget negotiations so I shall refrain from giving further detail. However detail is likely to emerge well before the budget in June.

The third and final contemporary issue I announced on Monday. It is the establishment of the Science and Innovation Advisory Council.

The idea of the council met with a great deal of enthusiasm during the election campaign. The door has been closed for so long that there is obvious relief at its opening. We have chosen the door to the Prime Minister's office for the simple reason that it is the surest route to results.

The inclusion of "innovation" in the council's title is significant. We do not seek a committee of eminent scientists. Instead we seek original and creative thinkers, people with the ability to draw together all the elements that combine to create innovation in New Zealand and identify how these can be best applied to create a future that benefits all. People with vision. People who are wise. If those people happen to be eminent scientists, well and good. Indeed if our eminent scientists do not have amongst their ranks people with the qualities we seek I would be very surprised indeed. I look forward to receiving a whole bunch of excellent nominations.

Now it is time for concluding remarks

I have two.

The first is that you, as scientists, have an obligation to liaise.

The second is that I, as Minister, have an obligation to promote.

Your liaison should be with commercial interests, with international peers, with other New Zealand research institutions, and with the public.

My promotion should be with New Zealand industry, with other Governments, towards a more co-operative framework between New Zealand research institutions, and with the public.

Why all this liaison and promotion? Because interactivity is the prize. And because interactivity is the future. If there is any scientist left in this country who believes that science funding exists for them, personally, and not for the knowledge they create and its appropriate transfer to the business community, the policy community or the public would they kindly go outside and retire.

If ever a responsible Minister, present or future, is caught dealing with this portfolio in a bored or flaccid manner, kindly arrange for their personal defeat at the next election.

Remember the idea of an innovation system, and see yourselves as active interactive players in such a system. Please never forget that. Only by building and nurturing a multiplicity of links will we develop the fabric of a society that values innovation and science to the extent that it should.

I am honoured to be the Minister for Research, Science and Technology. I am lucky to represent this particular electorate and the intellectual horsepower within it. I am lucky too to be part of a Government that wants New Zealand to be "on to it" – a lot.

Thank you.

Patent Proze

by Jane Calvert and Greg Lynch

CROWN USE OF A PATENTED INVENTION

Did you know that the New Zealand Government has a special exemption from the exclusive right of a patent owner to use the invention of that patent? The New Zealand Patents Act 1953 (the Act) has specific provisions defining this exemption. These provisions are known as "Crown Use" provisions.

The Act stipulates that any Government department may "make, use, exercise, and vend" any patented invention for the services of the Crown. This means that a Government department can take advantage of the invention knowing it cannot be sued for patent infringement by the owner of the patent. This also applies to any person who has authorisation in writing from a Government department. In addition, the provisions relate to an invention for which a patent application has been filed but the patent not yet granted.

An interesting question these days is what is a "Government department"? The Act defines "Government Department" as "any Department or instrument of the Executive Government of New Zealand". That is a rather broad definition. One wonders whether the definition would include Government bodies such as Pharmac, state-owned enterprises such as the energy generation companies recently spawned from ECNZ, crown research institutes, or even universities. To our knowledge this point has not been tested in New Zealand but it does seem possible that a Government owned entity could argue that it is entitled under the Crown use

provisions to take advantage of another's patented invention. However, patent owners need not be alarmed. A "Government department" can only exercise this power in certain circumstances.

Firstly, a Government department cannot claim the right to use a patented invention exclusively. That is, the Government department cannot prevent the use of the invention by the owner of the patent or any other person such as a licensee.

Before a Government department can exercise its right to use a patented invention, it must take all reasonable steps to obtain the consent of the owner of the patent to use the invention on reasonable terms and conditions. Only if such consent is not given within a reasonable period of time can the Government department then exercise its right. However, a Government department is not required to seek consent if use of the invention would appear to the department to avoid prejudice to the security or defence of New Zealand or in relation to states of national emergency or national civil defence emergency.

In the exercise of its right, the Government department is required to pay remuneration to the owner of the patent as may be agreed between them. If necessary, the amount of remuneration can be determined by the courts if no agreement can be reached.

The right of the Government department is limited to the supply of the patented invention predominantly in New

Zealand, as opposed to any other country. However, an exception to this arises where the invention is used, under a bilateral agreement or arrangement, for the supply to the Government of another country of articles required for the defence of that country.

The Government department must keep the owner of the patent informed of its use of the invention, unless the security or defence of New Zealand would be prejudiced.

Similar Crown use provisions are found in the patent legislation of many countries. It is not difficult to see that these provisions could be important for matters relating to defence, civil emergency, and national security. One can also envisage inventions important for public health reasons (for example, epidemics) being the subject of the Crown exercising its right of use.

To our knowledge, the Crown use provisions of New Zealand's patent legislation have not been invoked. Perhaps that is a reflection of New Zealand having a relatively free market economy and being comparatively free of major national security and civil defence issues to date.

A reminder: If you have any queries regarding patents, or indeed any form of intellectual property, please direct them to:

Patent Proze
Baldwin Shelston Waters
P O Box 852, Wellington
Email: email@bswip.co.nz
Internet: www.bswip.co.nz



Jane Calvert

Jane Calvert and Greg Lynch are both employed in the patent department of Baldwin Shelston Waters, Patent and Trademark Attorneys and Solicitors, where they specialise in chemistry patents. Jane joined the firm after completing a PhD in Chemistry at the University of Canterbury in 1994. Greg also joined the firm in 1994 after three years research at Industrial Research Limited in Wellington. Following completion of a PhD in chemistry at the University of Otago in 1989, he spent a two year period as a post-doctoral researcher at Oxford in the United Kingdom.



Greg Lynch

Flash of Inspiration Wins Nobel Prize for Chemistry

By David Bradley, Science Writer, <http://www.camsoft.com/elemental/>

Chemist Ahmed Zewail (shown below) of the California Institute of Technology (Caltech) was the recipient of the 1999 Nobel prize for chemistry for a flash of inspiration that is revolutionising our understanding of chemical reactions. Using brief bursts of light from lasers, he developed a way of taking 'snapshots' of individual molecules as they change during a chemical reaction.

Modern lasers can produce a very short burst of light, lasting a few femtoseconds i.e. a million-billionth of a second. Like a fast camera flash that freezes a dancer in motion, the laser beam can illuminate a molecule as it is transformed from one shape and structure to another during a chemical reaction - its transition state. This transition state, which exists between the reactant and the product, lasts for only femtoseconds, so observing it before it disappears was, until Zewail's experiments, almost impossible. Being able to observe the state is helping chemists find out exactly how particular reactions work and allowing them to predict the outcome of other related reactions as well as the complex interactions of, for example, a drug molecule with a biological receptor.

The earliest attempt to look at reactions as they happen was by H Hartridge and F J Roughton in the 1920s. They used a spectrophotometer to observe what happens when two compounds are mixed and saw chemical reactions taking place in a thousandth of a second. In the 1960s, Ronald Norrish and George Porter came up with the idea of using a flash-lamp to freeze the reactions - the shorter the flash, the more transient the reactions they could see. They observed chemistry on the millisecond and microsecond timescales - a thousand times shorter than that possible in the 1920s. Porter and Norrish shared the 1967 Nobel prize with the German chemist Manfred Eigen, who

used heat and pressure shock methods to trigger a reaction and observe 'almost' the instant at which it was happening (Eigen was also working at the milli- to micro-second timescale).

During the early 1980s, Dudley Hershbach, Yuan Lee and John Polanyi had improved the ability to observe chemical reactions down to the picosecond scale using vacuum collision experiments - for this work they received the 1986 Nobel prize for chemistry. With shorter and shorter timescales, chemists began to reveal the intermediate chemical species in reactions - not, the transition states, they were still too fleeting, but the structures either side that lasted just long enough for them to record. Once chemists had reached the picoscale, they only needed to take one step further to reach the femto timescale. The femtosecond (10^{-15} s) represents the frequency at which molecules vibrate, without which there would be no interaction and no chemical change. If chemists could watch molecular vibrations they would have reached the limit of observation.

Lasers make light work

Zewail realised that to observe molecules at this level his flashlamp would have to be very fast, a pulsing laser that flashes once every femtosecond, he reasoned, would do the job. For their simplest experiment, Zewail and his colleagues chose a unimolecular reaction, i.e. where a single substance changes into another without the involvement of a second chemical, and formed a molecular beam in a vacuum chamber. By blasting this beam with a 'pump pulse' of laser light they excited the molecules and triggered a change. Then, by applying a weaker, 'probe pulse' from a laser lasting a few femtoseconds - at a frequency to coincide with the absorption frequency of the suspected transition state of the substance

- Zewail and his team obtained a characteristic spectrum from the light emitted by the transition state. They had frozen the reaction.

The chemists compared the characteristic spectrum with the theoretical pattern obtained by using the methods of last year's Nobel chemists John Pople and Walter Kohn (*Educ. Chem.*, 1999, 36 (1), 7) who provided them with the means to predict molecular structure and so their characteristic spectra. Zewail's first unimolecular reaction - the one that started the whole femtochemistry field - was the dissociation of iodine cyanide (ICN), which takes just 200 femtoseconds. His results were published in 1987 in the *Journal of Physical Chemistry* and showed the transition state just as the carbon-iodine bond in the molecule is about to break to form the cyano radical and an iodine atom.

Zewail and his colleagues then moved on to bimolecular reactions, which involve two interacting chemical species. They studied the reaction of hydrogen with carbon dioxide, which produces carbon monoxide and hydroxy radicals. Zewail's flash revealed that the reaction passes through a transitional HOCO molecule, which exists fleetingly for a mere picosecond (1000 fs). His team also began to look at a puzzle that had occupied chemical minds for some time - i.e. would two seemingly identical bonds in a molecule break simultaneously in, for instance, a dissociation reaction. For the dissociation of tetrafluorodiiodoethane it turns out that the 'equivalent' C-I bonds do not break at the same time - there is a delay of 200 fs following the splitting of the first.

Since Zewail's pioneering studies in the 1980s and 1990s, many other research teams have begun to use femtochemistry to look at diverse reactions - watching them happen in real-time.



CONFERENCES & SEMINARS

3-5 April 2000

GreenTech 2000 - Sustainable Raw Materials

Venue: Utrecht, The Netherlands
Contact: Europoint bv, P O Box 822
NL-3700 AV Zeist, The Netherlands
Tel: (+31-30)-6933489
Fax: (+31-30)-6917394
Email: info@europoint-bv.com
Website: www.europoint-bv.com

4-10 April 2000

10th International Conference on High Temperature Materials Chemistry

Venue: Aachen, Germany
Contact: Professor K Hilpert
Forschungszentrum Julich GmbH
Institut für Werkstoffe der Energietechnik
52425 Julich, Germany
Tel: (+49-2461)-613280
Fax: (+49-2461)-613699
Email: k.hilpert@fz-juelich.de

11-14 April 2000

Food Asia 2000

Venue: Singapore
Contact: Eurofair
Tel: (+64-9)-3094447
Fax: (+64-9)-3098707
Email: trade.solutions@eurofair.co.nz

25-28 April 2000

11th International Global Warming Conference

Venue: Boston, Massachusetts, USA
Contact: World Resource Review
22W381 75th Street, Naperville
IL 60565-9245, USA
Tel: (+1-630)-9101551
Fax: (+1-630)-9101561
Website: www.globalwarming.net

14-17 May 2000

Foresight and Precaution - Risk Analysis and Safety

Venue: Edinburgh, United Kingdom
Contact: The Safety and Reliability Society
Clayton House, 59 Piccadilly
Manchester M1 2AQ, United Kingdom
Tel: (+44-161)-2287824
Fax: (+44-161)-2366977
Email: secretary@sars.u-net.com
Website: www.sars.u-net.com

14-18 May 2000

PBA 2000, 11th International Symposium on Pharmaceutical and Biomedical Analysis

Venue: Basel, Switzerland
Contact: PBA 2000, Convention Centre Basel
P O Box, Messeplatz 21
CH-4021 Basel, Switzerland
Tel: (+41-61)-6862828
Fax: (+41-61)-6862185

Email: congress@messebasel.ch

Website: www.congress.ch/pba

21-25 May 2000

10th International IUPAC Symposium on Mycotoxins and Phytotoxins

Venue: Sao Paulo, Brazil
Contact: Dr Myrna Sabino, Instituto Adolfa Lutz
AV Dr Arnaldo 355
Sao Paulo, Brazil, 01246-902
Fax: (+455-11)-8533505
Email: myrna@sti.com.br

3-7 June 2000

First International Conference on the Biology, Chemistry and Therapeutic Applications of Nitric Oxide

Venue: San Francisco, USA
Contact: KREBS Convention Management Services
657 Carolina Street, San Francisco
CA 94107-2725, USA
Tel: (+1-415)-9207000
Fax: (+1-415)-9207001

14-18 June 2000

Challenges for Science and Engineering in the 21st Century

Venue: Stockholm, Sweden
Contact: Dr John Peet
Department of Chemical & Process
Engineering, University of Canterbury
Private Bag 4800
Christchurch, New Zealand
Tel: (+64-3)-3642538
Fax: (+64-3)-3642063
Email: j.peet@cape.canterbury.ac.nz
Website: www.cape.canterbury.ac.nz/people/njp/njp.htm

26-28 June 2000

Pharma R&D Directions 2000

Venue: Barcelona, Spain
Contact: Tracy Moring, Marketing Manager
ECPI, QAiC Worldwide
Second Floor, 100 Hatton Garden
London EC1N 8NX, United Kingdom
Tel: (+44-171)-8275977
Fax: (+44-171)-2421508
Email: ecpi@aic-uk.com
Website: www.ecpi-online.com

1-5 July 2000

13th International Conference on Organic Synthesis

Venue: Warsaw, Poland
Contact: Professor M Chmielewski
Institute of Organic Chemistry
Kasprzaka 44, 01-224 Warsaw 42
P O Box 58, Poland
Tel: (+48-22)-6318788
Fax: (+48-22)-6326681
Email: ichos@ichf.edu.pl

CONFERENCES & SEMINARS

3-6 July 2000

University of Waikato/Amersham Pharmacia Biotech Protein Purification Course

Venue: Hamilton, New Zealand
Contact: R McGowan
Centre for Continuing Education
University of Waikato, Private Bag 3105
Hamilton, New Zealand
Email: rmcgowan@waikato.ac.nz
Website: www.mape.waikato.ac.nz/courses/522.htm

9-14 July 2000

34th International Conference on Coordination Chemistry

Venue: Edinburgh, Scotland, United Kingdom
Contact: Professor P Tasker, Chairman
Dr John F Gibson, Secretary
The Royal Society of Chemistry
Burlington House, London W1V 0BN
England, United Kingdom
Tel: (+44-171)-4403321
Fax: (+44-171)-7341227
Email: gibsonj@rsc.org

9-12 July 2000

Chemeca 2000: Opportunities and Challenges for the Resource and Processing Industries

Venue: Perth, Western Australia
Contact: Conference Secretariat, Chemeca 2000
C/O Congress West Pty Ltd, P O Box 1248
West Perth, WA 6872, Australia

9-14 July 2000

38th International Symposium on Macromolecules

Venue: Warsaw, Poland
Contact: Professor Stanislaw Penczek
Polish Academy of Sciences
ul. Sienkiewicza 112, 90363 Lodz, Poland
Tel: (+48-42)-6819815
Fax: (+48-42)-6847126
Email: speczek@bilbo.cbmm.lodz.pl

17-20 July 2000

40th Microsymposium on Polymers In Medicine

Venue: Prague, Czech Republic
Contact: Dr Jaromir Lukas
Institute of Macromolecular Chemistry
Academy of Sciences of the Czech
Republic, Heyovskeho na. 2
162 06 Praha 6, Czech Republic
Tel: (+420-2)-360341
Fax: (+420-2)-367981
Email: sympo@imc.cas.cz

6-11 August 2000

16th IUPAC Conference on Chemical Thermodynamics

Venue: Halifax, Nova Scotia, Canada
Contact: Dr Peter G Kusalik

Department of Chemistry
Dalhousie University, Halifax
Nova Scotia B3H 4J3, Canada
Tel: (+1-902)-4943627
Fax: (+1-902)-4941310
Email: kusalik@is.dal.ca

6-11 August 2000

7th International Symposium on Polymer Electrolytes

Venue: Noosa, Queensland, Australia
Contact: Dr Astrid Nordmann
Centre for Advanced Materials Technology
Monash University, Wellington Road
Clayton, VIC 3168, Australia
Tel: (+61-3)-99055791
Fax: (+61-3)-99054998
Email: ispe7@eng.monash.edu.au
Website: www.chem.monash.edu.au/electrolytes/ispe7

14-18 August 2000

12th International Conference on Thermal Analysis and Calorimetry

Venue: Copenhagen, Denmark
Contact: Dr O Toft Sorensen
Risoe National Laboratory
Tel: (+45-4)-6775800
Fax: (+45-4)-6775758
Email: o.toft.sorensen@risoe.dk

20-25 August 2000

XIIIth International Congress on Rheology

Venue: Cambridge, England, United Kingdom
Contact: Dr D M Binding
Tel: (+45-1970)-622777
Email: rheology2000@aber.ac.uk

1 September 2000

22nd International Symposium on the Chemistry of Natural Products

Venue: Sao Paulo, Brazil
Contact: Dr M Fatima das G F da Silva
Universidade Federal de Sao Carlos
Depto. de Quimica
Via Washington Luiz km 235
CP676, Sao Carlos, Brazil
Tel: (+55-16)-2748208
Fax: (+55-16)-2748350
Email: dmfs@power.ufscar.br

3-8 September 2000

11th International Biotechnology Symposium

Contact: Professor G Kreysa
DECHEMA eV C/O 11th IBS
Theodor-Heuss-Allee 25
60486 Frankfurt/Main, Germany
Tel: (+49-69)-7564205
Fax: (+49-69)-7564201
Email: info@dechema.de

CONFERENCES & SEMINARS

3-8 September 2000

ICHC 2000, XIth International Congress of Histochemistry and Cytochemistry

Venue: York, England, United Kingdom
Contact: Royal Microscopical Society
37/38 St Clements
Oxford OX4 1AJ, United Kingdom
Tel: (+44-1865)-248768
Fax: (+44-1865)-791237
Email: info@rms.org.uk

Website: www.rms.org.uk

10-15 September 2000

XXth International Conference on Polyphenols

Venue: Freising-Weihestephan, Germany
Contact: Professor Dr G Forkmann
Chair of Floriculture and Horticultural
Plant Breeding
Technical University Munich, D-85350
Freising-Weihestephan, Germany
Fax: (+49-81)-61713886
Email: d.treutter@lrz.tum.de

11-14 September 2000

21st International Federation of The Societies of Cosmetic Chemists

Venue: Berlin, Germany
Contact: DGK Secretariat, Konrad-Zirkel-Str 22
D-97769 Bad Bruckenu, Germany
Tel: (+49-9)-7414323
Fax: (+49-9)-7413934
Email: dgk.ev@t-online.de

19-22 September 2000

5th International Chemical Industry Fair

Venue: Beijing, China

7-10 October 2000

NZIFST/MIRINZ Joint Conference 2000: Horizons MM! - Designing Foods That Consumers Will Choose.

This conference will run concurrently with Xpo's Food Tech 2000, Pack Tech 2000 and the Massey Food Awards

Contact: Julie Watson, Swift NZ Ltd
P O Box 27056, Mt Roskill, Auckland
Tel: (+64-9)-6256169
Fax: (+64-9)-6256655
Email: jwatson@im.aust.com

8-10 November 2000

2nd International Symposium on Food Packaging - Ensuring the Safety and Quality of Food

Venue: Vienna, Austria
Contact: Dr L Contor, ILSI Europe
83, Avenue E. Mounier, Box 6
B-1200, Brussels, Belgium
Tel: (+32-2)-7620044
Fax: (+32-2)-7710014
Email: laura@ilsieurope.be

19-22 November 2000

Corrosion & Prevention 2000

Venue: Hyatt Hotel, Auckland, New Zealand
Contact: Corrosion Prevention Centre
P O Box 2340, Mount Waverley
VIC 3149, Australia
Tel: (+61-3)-98095266
Fax: (+61-3)-98095344
Email: corrprev@internex.com.au

3-8 December 2000

Soil 2000: 2nd Joint New Zealand and Australian Soil Science Societies Conference

Venue: Lincoln University, Canterbury
New Zealand
Contact: Helen Shrewsbury
P O Box 84, Lincoln University
Christchurch, New Zealand
Tel: (+64-3)-3252811 xtn 8955
Fax: (+64-3)-3253840
Email: shrewsbh@lincoln.ac.nz

9-13 December 2000

Poly Millennium 2000

Venue: Hilton Waikoloa Village, Waikoloa, Hawaii
Contact: William H Daly, Department of Chemistry,
Louisiana State University
Email: bill.daly@chem.lsu.edu

14-19 December 2000

Pacificchem 2000

Venue: Waikiki, Honolulu, Hawaii
Contact: Professor B Halton
Department of Chemistry
Victoria University of Wellington
P O Box 600, Wellington, New Zealand
Fax: (+64-4)-4955241
Email: brian.halton@vuw.ac.nz

19-20 January 2001

Chem Expo India 2001

Venue: Mumbai, India

19-21 June 2001

10th Loss Prevention and Safety Promotion in the Process Industries

Venue: Stockholm, Sweden

26 August - 1 September 2001

XXXIV International Congress of Physiological Sciences "From Molecule to Malody"

Venue: Christchurch, New Zealand
Contact: The Conference Company
P O Box 90040, Auckland, New Zealand
Tel: (+64-9)-3601240
Fax: (+64-9)-3601242
Email: info@tcc.co.nz

Improving Tertiary Chemistry Teaching Implications of Science Education Research for Classroom Practice

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Tertiary chemistry teachers are considered experts in their fields; indeed lecturers are usually appointed on the basis of their research record or potential. In spite of this an important part of staff duties in modern universities involves teaching, a task in which many academics have little experience or training. This is in stark contrast with their secondary school counterparts who commonly undergo extensive teacher training and in New Zealand are currently required to gain teacher registration before appointment. An important part of teacher training involves understanding how students learn, that is how they develop understanding and assimilate concepts into their cognitive structure. There has been a tremendous amount of research into the teaching and learning of science in recent years but it is likely that few tertiary level academics are familiar with this vast body of literature. The purpose of this article is to bring to the attention of tertiary chemistry teachers some of the findings of this research. We hope that this will help tertiary chemistry teachers to reflect on their teaching practice and to consider the teaching approach described here. In particular, as tertiary educators, with a particular interest in chemistry education, we were interested in expressing the potential importance of the constructivist paradigm for classroom practice. Here we advocate a constructivist approach to tertiary chemistry teaching and draw on evidence from the chemical education literature to support this view. Consequently, here we describe relevant reports of research and reflect on the implications this research holds for tertiary chemistry educators.

Changing Views of Scientific Thought

The twentieth century has witnessed a major shift in scientific thinking. Drastic changes in the ideas of modern physics started to undermine the prevailing empiricist belief that science could make absolutist claims, in other words, that once knowledge is acquired it can be described in absolutist terms such as true or proven. Work by Karl Popper (1959) raised questions about the possibility of ever proving or confirming knowledge. This led to the proposal that knowledge was not discovered but was instead the result of construction by the human mind. Unlike empiricism, which claimed that observation came before theory, *constructivism* presupposes that theory precedes observation and that observations can be selected and conducted only through theoretical expectations. Therefore, our own constructed theories determine how we perceive the world (Nussbaum, 1989).

A similar paradigm shift has taken place in psychology. The decades following the 1920s had been dominated by behaviourism, a school of thought which emphasised the passivity of the mind, with information from the environment providing an input which is directly transmitted to, and accumulated by, the learner (Gilbert & Watts, 1983). This had resulted in what is called the cultural transmissive approach (Pope & Gilbert, 1983) or conduit model (Tobin, Briscoe, & Holman, 1990) which became dominant in Western education. The most extreme advocates of this approach contended that absolute truth could be accumulated bit by bit, subject by subject, thus implying that knowledge is piped from the full container of the teacher's head to the empty vessels of the students' heads.

Teaching based on behaviourist thinking placed little or no emphasis on the student's own conceptions or active participation and as Yager (1991) suggested it placed a low premium on learning with understanding.

"If the goal is to get students to replicate a certain behaviour, this method works well; but if understanding, synthesis, eventual application, and the ability to use information in a new situation is our goal in education, a behaviourist approach is not successful. Because there is no place in the model for understanding, it is not surprising that behaviourist training rarely produces it." (p. 54)

During the 1960s and 1970s new cognitive theories began to emerge which challenged the behaviourist view and regarded knowledge as being produced by transactions between a person and the environment. An emphasis was thus placed upon the active person reaching out to make sense of events by engaging in the construction and interpretation of individual experiences (Pope & Gilbert, 1983). This resulted in the formation of the so-called constructivist paradigm (Guba & Lincoln, 1994).

The Development of a Constructivist Teaching Approach

The development of a more interactive mode of teaching and learning can be traced to educators such as Dewey (1916). However, Nussbaum (1989) contends that it was a combination of a greater awareness of the paradigm shift in the philosophy of science, along with the new theories in cognitive psychology which ultimately led to the major drive within science education for a new approach to

teaching, one that would perceive students as active thinkers who construct personal meaning that could in turn help them form conceptual frameworks. According to Tobin, Butler, Kahle and Fraser (1990), this constructivist view of learning is defined as the acquisition of knowledge by individuals through a process of construction that occurs as sensory data are given meaning in terms of prior knowledge. Learning is always an interpretive process and always involves individual constructions. Thus, from a constructivist philosophy, to learn science implies direct experience with science as a process of knowledge generation in which prior knowledge is elaborated and changed on the basis of fresh meaning negotiated with peers and teachers.

This belief, that learners are purposive, constructing knowledge through social interaction and experiences with the physical environment, was a radical shift from the behaviourist view of learning which had put the learner in a passive role as an absorber of information (Driver & Bell, 1986), or as coming to science lessons with a blank mind which can be filled with the teacher's science (Gilbert, Osborne, & Fensham, 1982). It acknowledged that students bring to their school learning in science ideas, expectations and beliefs concerning natural phenomena which they have developed to make sense of their own past experiences. Furthermore, these ideas could differ from the currently accepted scientific view, and from the intended learning outcome (Driver, 1981). The systematic attempt to recognise students' ideas, referred to by such terms as worldviews, alternative frameworks, or children's science, and to build upon them for instructional strategies, led to the constructivist approach, which was the application of constructivism to education.

Thus for some time the slogan of the constructivist movement has been that students actively construct their own knowledge (Bereiter, 1994), and according to Nussbaum (1989) all versions of the constructivist approach in teaching require that both the teacher and the curricular activities help the students actively to construct their own meaning of the materials under study. However, this may be an oversimplification as within the constructivist position there are now a number of differing traditions, resulting in a range of accounts of how knowledge construction takes place (Driver, Asoko, Leach, Mortimer, & Scott, 1994; Good, Wandersee, & St Julien, 1993).

A constructivist view of learning has influenced classroom practice and curriculum development in secondary schools throughout the world (Bell, 1991; Bell, Jones & Carr, 1995, 1996). However, it is generally believed that the constructivist paradigm has had comparatively little impact on teaching and learning at the tertiary level (Pope & Gilbert, 1983; Sanger & Greenbowe, 1996; Tobin, Briscoe, & Holman, 1990).

Difficulties Encountered in Tertiary Chemistry Teaching

An analysis of the research reports in the chemical education literature highlighted two broad areas of interest

in the teaching and learning of chemistry at the tertiary level; low levels of cognitive development or limited prior knowledge, and the prevalence of alternative conceptions. In addition to these two fundamental areas, we identified two derivative areas of interest; poor problem-solving ability, and difficulty in relating chemistry to real-world situations. We discuss the literature under these general themes, although clearly they are inter-related.

Cognitive Development and Prior Knowledge

Widespread concern has been expressed about the low level of cognitive development observed in many tertiary chemistry students, particularly at the entrant level (Barrow, 1994; Brooks *et al.*, 1978; Finster, 1989; Herron, 1975). It appears that this problem is also highly prevalent and, for example, Herron (1978) reported that up to 50% of his tertiary chemistry students may be operating at the concrete-formal level. Some authors suggested that this may mean that it is appropriate to design courses which exclude formal-operational thought (e.g., Beistel, 1975; Goodstein & Howe, 1978), a position opposed by others (e.g., Herron, 1975, 1978).

Some researchers believe that not only are many tertiary entrant students at a low level of cognitive development, but there has been a downward trend in cognitive ability for first-year chemistry students over time. Rheingold (1994) returned to teaching junior classes after a prolonged absence and reported:

"After many years of teaching graduate and upper-level undergraduate courses, I recently returned to teaching one of our less challenging freshman courses, one semester each year. I found the students distinctly less able than when I last taught them." (p. 580)

It is clear from the literature that authors recognise that an appreciation of the prior knowledge of their students and a knowledge of the students' level of cognitive development is important for effective instruction (Goodstein & Howe, 1978; Herron, 1978). As Beistel (1975) argues "the student cannot hope to grasp formal concepts such as acidity or electrochemical potential unless he (*sic*) is formal operational" (p. 151).

Finster (1989, 1991) described the application of an elaborate model for intellectual development proposed by William Perry for advancing cognitive development. Perry proposed that students advance through a series of stages or positions of intellectual ability. Students begin with *dualism*—characterised by a simplistic right-wrong view of concepts, to *multiplicity*—characterised by an appreciation of a diversity of valid views to *relativism*—in which students realise that knowledge is contextual and relative. This model is different from that proposed by Piaget (Flavell, 1963; Novak, 1978) in that intellectual development does not occur by spontaneous maturation, but by specific instructional strategies and learning experiences. Finster suggests that in order to move students along the scheme, that is, raise their level of cognitive development, instruction must focus on higher-level skills

such as those enhanced by a constructivist teaching approach.

Thus to help a dualistic student (position 2) move to multiplistic thinking (position 3), one must challenge the bipolar nature of dualistic thinking by presenting multiplistic perspectives of an issue and letting them (*sic*) reconcile the inadequacy of the dualist position. (Finster, 1991, p.752)

Thus according to Finster (1991) students must confront conceptual conflict and be involved in resolving this conflict themselves, that is, they must play a more active part in the learning process.

There seems to be a wide-spread perception amongst authors that chemistry is a subject many students find difficult (Carter & Brickhouse, 1987). It should be noted, however, that there is comparatively little survey or quantitative research on which to base this assumption—many authors drawing on anecdotal data, and personal experience (e.g., Kirkwood & Symington, 1996; Nakhleh, 1992). Barrow (1994) sums up the thinking of many tertiary chemistry educators.

“The introduction-to-chemistry courses given in schools, colleges, and universities have always, at least back to the time when I took the course, been difficult. I was a good student, but I was puzzled completely by the subject. Even basic ideas, like those of chemical formulas (*sic*) and chemical equations, made little sense to me. Now when I read through the first few chapters of any of the new popular general chemistry texts, I can relive the bewilderment that I experienced as a student many decades ago.” (p. 874)

Student limitations have been attributed to lack of mathematical skills (Banerjee, 1995; Herron, 1975; Kogut, 1996; Ver Beek & Louters, 1991) and low ability in fundamentals skills such as reading (e.g., Rheingold, 1994; Stanislawski, 1990). VanOrden (1987, 1990) suggests that language skills are important not only for effective communication, but also for learning chemical concepts. She devised a program of “critical-thinking writing assignments” (p. 583) to give students practice in “simulated real-life chemistry” (p. 583). VanOrden found that this application of chemical ideas and concepts to real-world problems resulted in a higher degree of understanding as evaluated by examinations and interviews.

Tertiary Chemistry Students' Alternative Conceptions

Considerable concern has been expressed with the high incidence, and remarkable tenacity, of alternative conceptions at the tertiary level (Bodner, 1991; Herron, 1975, 1978; Kogut, 1996; Nakhleh, 1992). In some of the reports, one can sense the frustration of many educators as they struggle to correct student alternative conceptions. Although there are a number of subjects that students traditionally find difficult, for example, physical chemistry concepts such as thermodynamics and electrochemistry (Banerjee, 1995; Banerjee & Power, 1991), most authors

seemed more concerned at the prevalence of student alternative conceptions for what they perceived to be rather simple concepts (e.g., Herron, 1978; Kogut, 1996). For example, Herron (1975, p. 146) reported that “fewer than 50% of the students seemed to comprehend that it was Cl that was in table salt and not Cl₂, or that there was a difference between the two”.

There is general recognition that alternative conceptions are related to prior learning experiences, although as mentioned previously, some authors suggest that the presence of alternative conceptions may be related to the students' level of cognitive development (Craig, 1972; Herron, 1975, 1978). One factor may be the large amount of factual material that students are expected to memorise when developing a cognitive structure for a complex body of knowledge like chemistry (Barrow, 1994), and Nakhleh (1992) suggests there is often confusion in the use of everyday language and scientific terminology.

Craig (1972, p. 809) suggests that identification of alternative conceptions is beneficial for instructors “in the study of chemistry too, incorrect answers would give the teacher important feedback, not only on how his[/her] students think, but also on his[/her] teaching, and on the text used”.

It is interesting, but perhaps not surprising, to note that tertiary physics educators report that they also confront similar difficulties to their chemistry counterparts, that is, prevalent alternative conceptions, and difficulty with mathematical manipulation (e.g., Maloney, 1990; Tobin & Roth, 1996; Viiri, 1996).

Developing Problem-Solving Ability in Tertiary Chemistry Students

Another area of research interest for tertiary chemistry educators has been in attempts to develop effective problem-solving skills for students (Beall, 1994; Bowen & Bodner, 1991; Kogut, 1996; Nurrenbern & Pickering, 1987; VanOrden, 1987; Zoller, 1987). Poor performance in problem-solving exercises has been attributed to a number of factors, the most common being a lack of mathematical ability (Gorin, 1991).

Sanger and Greenbowe (1996) maintain that part of this problem is that many tertiary educators are objectivist in outlook and this is reflected in their teaching approach.

Here, then, is the crux of the problem. Most college chemistry instructors are not aware of nor do they subscribe to the constructivist philosophy of teaching and learning. Most college chemistry instructors believe that there is an objective reality and that chemists can describe, measure, and work with reality using the tools that chemistry concepts and principles provide. (p. 533)

Interestingly, some researchers have suggested that the scientific method is inherently constructivist in nature (e.g., Bodner, 1986, 1991). They add the qualification that in order for the constructivist approach to mimic the scientific method, the constructs devised by students must ‘work’,

that is, they must be consistent with known data and experimental observation. According to Bodner (1986):

“The constructivist model raises an important question, ‘If individuals construct their own knowledge, how can groups of people appear to share common knowledge?’ The key to answering this question is remembering that knowledge must ‘fit’ reality. Construction is a process in which knowledge is both built and continually *tested* [original emphasis]. Individuals are not free to construct any knowledge, their knowledge must be viable, it must ‘work’.” (p.875)

Even if there is disagreement within the wider community of tertiary chemistry educators about objectivism and constructivism, amongst chemical education researchers at least, there is consensus that traditional transmissive instruction is not an effective means of developing good problem-solving skills (e.g., Bowen & Bodner, 1991; Kogut, 1996; Sanger & Greenbowe, 1996).

Millar (1989) suggests that much of science at the introductory level is seen to be unrelated to problem solving and instead consists of factual material. This, Millar contends, has important implications for instruction.

“For good, understandable pedagogical reasons, constructivist science educationalists...acknowledge that science as a school subject poses a formidable challenge to the teacher in maintaining the involvement of many pupils simply because the science covered at school is, almost entirely, a consensually agreed body of knowledge. There is, therefore a limited value in children taking away from science lessons ideas that diverge radically from the accepted ones. This means that science can come to look like the transmission of a body of knowledge that cannot be challenged by the learner, and whose learning leaves little scope for the creative involvement of the learner.” (p. 590)

The fact that there has been little change to the subject matter of basic chemistry taught at the tertiary entrant level in many institutions suggests that this view may be a factor in the continued use of a transmissive teaching approach.

Relating Chemistry to Real-World Experiences

Many authors have suggested that teaching chemistry should serve more than the narrow goal of the production of professional scientists and that it must address chemistry in the real world. This view has been championed by the Science-Technology-Society (STS) and Chemistry in the Community (ChemCom) approach at secondary school level (Bybee, 1987). Studies of this objective in relation to tertiary science education have focused on the issue of prior learning, and how well this prepares students for tertiary education (e.g., Sanger & Greenbowe, 1996). An advantage of this view of the role for science education is that it may help students understand the wider role that scientists have in society. Schibeci (1986) found evidence that many tertiary students, as well as the wider community, consider scientists to be somewhat eccentric or abnormal “frequently portrayed as obsessive and socially

maladjusted” (p. 140) or even “elderly white males who were often insane or evil” (p. 140). Thus, teaching from a constructivist perspective, and relating chemistry to more real-world experiences may have important implications for how students view scientists and science careers.

Implications of Science Education Research for Tertiary Chemistry Teachers

The chemical education literature has revealed that researchers uncovered a number of difficulties encountered when teaching chemistry at the tertiary level. Difficulties include; lower than expected cognitive development, limited prior knowledge, wide-spread student alternative conceptions, and a lack of understanding of the relationship between chemistry and the real world. There is evidence that instructors believe conventional direct instruction teaching methods are relatively ineffective in promoting good problem-solving skills, raising the level of cognitive development and correcting student alternative conceptions.

Significantly, the research has revealed that tertiary chemistry educators perceive that, despite some logistical difficulties, there are significant benefits in teaching chemistry from a constructivist perspective. However, before a shift to a constructivist teaching approach can occur a number of issues must be confronted. Careful examination of course content must occur, students’ misgivings about alternative instructional strategies must be addressed, but arguably most difficult of all, misgivings of teachers about alternative instructional methodologies must be overcome. Understanding chemistry, like physics, represents a significant challenge for many students. University educators can no longer rely on expertise and in-depth knowledge of subject matter in order to teach effectively. It is essential that they draw on recent advances in psychology and pedagogy to promote more effective teaching. The commitment of the teaching institutions and their staff, accompanied by adequate training will be essential if the tertiary education sector is to embrace a constructivist view of learning in the same way their secondary school counterparts have in recent times.

Teaching Chemistry from a Constructivist Perspective of Learning

According to Scott, Asoko, Driver, and Emberton (1994) “there is no unique method or instructional route for teaching a particular topic from a constructivist perspective” (p. 218) and there are a number of pedagogical models reported in the literature (e.g., Fensham, 1994; Carr, *et al.*, 1994; Taylor & Lucas, 1997). Nonetheless, there are several features that are common practice for constructivist-informed teachers; *elicitation of prior knowledge, collaborative group work, a change in role for the teacher and teaching in context by the use of familiar models or analogies.*

The alternative conceptions literature has established that learners bring their own well-formed views on many scientific matters to the classroom, many of which are in conflict with the scientific view (Solomon, 1983).

Furthermore, research has revealed the remarkable tenacity of alternative conceptions even after remedial instruction. There is now a large literature indicating that elicitation of prior knowledge is essential in the detection and correction of alternative conceptions in chemistry and science (e.g., Osborne & Gilbert 1980; Summers, 1992; Tasker, 1980). Consequently, constructivist teaching necessitates elicitation of students prior knowledge and there are a variety of techniques for probing understanding, such as, concept mapping, predict-observe-explain, and interviews-about-events and interviews-about-instances (White & Gunstone, 1992). In doing so, teachers' focus should be on gaining an understanding of how students have arrived at their views, going beyond an immediate judgement of right or wrong ideas (Driver, 1989).

Much has been written about the value of collaborative group work in science education. According to Hatano and Inagaki (1987) group work seems to support the construction of individual knowledge of the members. This is particularly true when students are required to explain or defend their viewpoints as they are more likely to construct a deeper understanding because they have to evaluate, integrate and elaborate their existing knowledge. In addition, the social setting makes the enterprise of comprehension more meaningful. Linn and Burbules (1993) also believe that most arguments for group learning are usually buttressed by the claim that students learning together co-construct more powerful understandings than they could construct alone.

In practical terms a constructivist-based teaching approach necessitates a significantly different role for the teacher in the learning process. The traditional role of the teacher is that of a transmitter of knowledge (Hand & Vance, 1995). Tertiary educators perhaps even more than their secondary school counterparts are perceived to be experts and commonly teach by a transmissive or conduit approach (Pope & Gilbert, 1983; Tobin, Briscoe, & Holman, 1990). In contrast, the role of a teacher in a constructivist classroom is very different and is much more hands-off. The teacher in a constructivist classroom behaves more like a facilitator who teaches by negotiation rather than imposition (Bodner, 1986; Hand & Vance, 1995). Initially this change of role may be an uncomfortable one for many teachers, especially those in tertiary education. Hand and Vance (1995) identify three new pedagogical skills that a constructivist teacher should learn; negotiation, facilitation of group work, and thinking on your feet. The latter skill is likely familiar for many teachers in tertiary education; the former skills maybe less familiar. The principal challenge is for the tertiary teacher to maintain a hands-off approach, however tempting it may be to leap in and correct students when they are 'wrong'. Clearly the three new pedagogical skills are closely linked and Hand and Vance recommend caution in introduction of a constructivist teaching approach, as time is needed for both parties to come to terms with their new roles.

Contemporary science has been criticised as being confusing and intimidating for students from a variety of cultural backgrounds (Ogawa, 1995; Shan, 1990). By building on student's own experiences and existing ideas,

the use of models and analogies, represent a powerful tool in the armoury of the constructivist teacher (Duit, 1991). As well as rendering science more familiar, analogies are an effective means of producing conceptual change of alternative conceptions (see, e.g., Clement, 1987; Glynn, Duit, & Thiele, 1995; Zeitoun, 1984). One of the major advantages of using analogies to effect conceptual change is that this approach is potentially less detrimental to learners' confidence than conceptual conflict models which may demean students' views (Stavy, 1991). The use of analogies does possess certain constraints, for example, in some instances there are no suitable analogies available, and students may take the analogy too literally, or may remember the analogy and not the conception under study, hence caution is required in their use (see, Treagust, 1993).

Interestingly, Sanger and Greenbowe also suggest that there is little purpose in altering instructional strategies without an appropriate adjustment to assessment techniques "therefore, studies are warranted using traditional assessment techniques such as standardised exams as one measure of achievement, as well as non-traditional assessment techniques" (p. 535).

Difficulties Encountered Teaching Tertiary Chemistry From a Constructivist View of Learning

If the research reports described here suggest that teaching chemistry at the tertiary level using a constructivist approach has many advantages, it is interesting to consider why this approach has not been embraced by the wider tertiary teaching community? As mentioned previously, it is likely that lack of knowledge of constructivism is a significant factor. However, a number of authors have indicated that teaching chemistry by a constructivist approach contains some difficulties (Coll, 1997; Davis *et al.*, 1993; Kogut, 1996).

One of the most common difficulties encountered is increased demand on staff time, for example, in planning of lessons, and provision of new assessment procedures (Kogut, 1996). It has also been reported that students and staff are initially uneasy about the new approach and are uncomfortable about participating in group activity or class discussion (Coll, 1997; Varco-Shea, Darlington & Turnbull, 1996). Other authors have pointed out that teaching tertiary chemistry using a constructivist approach inevitably means that less content will be covered (Barrow, 1994). This difficulty has also been reported for teachers upon implementation of teaching from a constructivist perspective at the secondary school level (e.g., Confrey, 1990; Driver & Oldham, 1986; Hand, Lovejoy & Balaam, 1991). Whether this is in fact a disadvantage or not is a debatable point (Barrow, 1994). Nonetheless, it is likely that it would be off-putting for many tertiary chemistry educators to significantly reduce the content of their courses, although as Eylon and Linn (1988) suggest the concomitant improvement in the quality of understanding provides tangible benefit.

It is evident that the implementation of a constructivist-based teaching program at the tertiary level would be no simple task. As well as careful scrutiny of their course

work, it is likely that tertiary educators would require some pre-service and in-service training. First, educators need to be made aware of the constructivist paradigm and the advantages found in the secondary school system elucidated (e.g. Bell *et al.*, 1995, 1996). Interaction with other tertiary-level instructors who already have experience with teaching from a constructivist perspective may help to facilitate this process (Coll, 1997). Second, instructors need to be made aware of the specific teaching methodology involved in teaching from a constructivist perspective. The infrastructure in terms of facilities and staff expertise for such training likely exists already in many tertiary institutions, as it does, for example, at the institutions of the authors involved in this article. What may be lacking is commitment from the senior management towards staff development with regard to teacher training and subsequent commitment of the educators themselves. The latter would likely come if the institutions' management show the commitment in the first instance.

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The Dawning Of The Millennium Solar Project

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“Scientists catch first rays of Millennium dawn” was the statement on the front page of the *Evening Standard* on Saturday, 1st January 2000. This was an intriguing statement given that dawn at the Tararua Wind Farm that morning never appeared to take place; the mist was so thick that we could only see one of the forty eight wind turbines. When the *Evening Standard* reporter rang me up on New Year’s Day to discuss the Millennium Solar Project (MSP) ‘Capture the Rays’ event, I told her that we never saw the sun. Her response was that she had already written up the event as a success and would not be able to withdraw the story. However, she would write what really happened for the Monday edition!

After 18 months of consistent dealing with the media as an event organiser, nothing surprises me any more. As a scientist (and an idealist), of course, such disregard for purveying the truth seems almost criminal. My father used to quote the expression “Believe half of what you see, and none of what you read!” Even in science I have come to believe in that wisdom. If we had seen the dawn sunrise, ‘captured the first ray of sunlight’, and declared the MSP a success, the stories would still have been half-truths. So what was the truth?

On 30th December, seven internationally recognised scientists and their families flew into Palmerston North to celebrate the dawning of 2000. That was an achievement in itself, but to have three of them speak at a champagne morning symposium, “Energising the New Millennium”, on New Year’s Eve at The Coachman Hotel, was great. Dr Igor Skyrabin, Technical Manager of Sustainable Technologies Australia Limited (STA), spoke about the

new titania solar cells, on behalf of Professor Michael Grätzel, the Swiss inventor of the cells. Professor Martin Green, world-leading silicon solar cell researcher and 1999 Australian of the Year, highlighted the future of silicon solar cells, and Professor Andrew Holmes, Cambridge co-inventor of plastic light emitting diodes, entertained the audience of thirty with light-emitting demonstrations and scientific anecdotes. Those that attended thoroughly enjoyed the symposium, particularly the champagne and canapes half-way through. Unfortunately, I never had a chance to enjoy such fruits of my labour as we were still putting last minute touches to the Dawn event.

The next MSP Millennium event was the MSP dinner again at The Coachman. Among the twenty seven guests were Professor and Mrs McWha, Councillor and Mrs Stewart, and Professor and Mrs Robinson, the Deputy Vice Chancellor of the University of Wollongong. Following dinner, the guests enjoyed the entertainment at an unusually quiet Coachman or wandered into the square to ‘taste’ millennium entertainment Palmerston North style. It seemed that I ate my dinner standing up, sorting out the minor crises of the moment or out in the garden trying to will away the gathering clouds and occasional raindrop.

Most of my millennium memories will be of the bizarre, not the least standing in the middle of Fitzherbert Avenue with my mother, five children and MSP guests, drinking champagne and heralding in the new year, while watching fireworks. Prior to that, I had been driving around Hokowhitu looking for the lost family fox terrier. One hour later I was standing in someone’s garden, talking to the house owner through the toilet door, trying to get hold

of a beam projector. Don't ever ask me why! But with that beam projector in hand, the last item necessary for the Dawn Event, I raced up to the wind farm to join my fellow organisers.

The previous week, I must have driven up to the wind farm ten times. At 2.00 am on New Year's Day, I almost got lost; you could barely see the fences at the side of the road, the fog was so thick. For two hours, my fellow MSP organisers from Wollongong and I sat in the wind farm pavilion, trying to decide whether we could hold the event on the stage in our Stonehenge-type arena that we had created outside under one of the turbines. Not only was the visibility terrible (we could barely see the arena 50 yards from the building) and the likelihood of a sunrise remote, but there was just too much water around to safely use our equipment. In the end we compromised, the theatrical part of the event would be in the pavilion and the technical events partially done on the arena stage outside.

An hour later at 5 am, following a flurry of activity both inside and out, our fifty guests arrived by mini-bus. For the next 40 minutes, they were 'entertained' by speeches from yours truly, my fellow organiser Gordon Wallace, the Mayor, the Vice Chancellor and the DVC of Wollongong, the televised sunrise from the Chathams, a collage of original dance, music and video, and a 'smart window' technical presentation by Igor Skyrabin from STA.

Just prior to the anticipated sunrise at 5.52 am, the audience and the TV1 and TV3 crews moved outside into ghostly dawn light and they assembled in front of the stage in the arena. The mist created an ethereal atmosphere that added to the drama of the moment. As our 'estimated' moment of sunrise came, an olympic-style flaming torch was electrically lit, although not from the large titania solar cell suspended above the back of the stage. The torch promptly went out, due to the damp atmosphere, leaving me scrambling for matches, and apologies. We then electrically set off a very large scale thermite reaction that produced molten iron. Again the weather prevented us from casting this iron into an 'icon' of the event. As the last shower of thermite reaction sparks died away, I held up the flaming torch and six members of the Manawatu Marathon Clinic to stage collected it and began the run to the public in the Square in Palmerston North.

I thought that I was getting too old to stay up all night, but after 23 hours I felt good. After a couple of quick interviews, I left everyone else to clean up and raced off in my car to act as support crew for the runners. The torch could only burn for 20 minutes before it needed more kerosene, so for almost 3 hours, I drove at 10 km per hour, stopping every 15 to 20 minutes to refuel or restore the torch. After that, my age did begin to tell. Nonetheless, we got the flaming torch to The Coachman for breakfast at 9:15 am and then into the Square at 10 am to set off the 2000 balloons at the champagne breakfast there. As the flame burnt through the strings that held down the balloons and they all rose into the air at once, Robyn Winter, co-organiser of the Square events, cried on my shoulder in relief.

With the MSP Millennium events over and a chance to think again, it hit me how many others had contributed to the project, particularly members of the Institute of Fundamental Sciences, Massey University. In particular, Steve Denby brilliantly made the flaming torch, Barry Evans calmly saw us through some crazy moments of stage design, Peter Lewis designed and built the electronic controller we tried so hard to destroy and Ester Blandford often ran around finding chemicals and equipment. Others members of the secretarial and administrative staff contributed and I would like to thank everyone for all their hard work and creativity. Finally, my thanks to David Parry for the support of the Institute of Fundamental Sciences, Massey University.

Were the MSP Millennium Events a success? The best answer to that is a very loud but reserved 'YES'. Like all good research projects, we did not achieve everything that we set out to achieve, but we sure had a great deal of fun trying, we learnt a lot and we got a significant amount of media coverage in the process. Although we failed to 'catch the first ray of sunshine of the new millennium', that just gives us the opportunity to be really scientifically accurate. You see truth does win out!

See you at 5.42 am at the Trustpower Tararua wind farm on January 1st, 2001!!!!

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The IUPAC Prize for Young Chemists has been established to encourage outstanding young research scientists at the beginning of their careers. The prize will be given for the most outstanding PhD thesis in the general area of the chemical sciences, as described in a 1000 word essay.

IUPAC will award up to four prizes annually. Each prize will consist of US\$1000 cash and travel expenses to the next IUPAC Congress. In keeping with IUPAC's status as a global organisation, efforts will be made to ensure fair geographic distribution of prizes. Prizes will be presented biennially at the IUPAC Congress (next congress is to be held in Brisbane, Australia from 1 to 6 July, 2001). Each awardee will be invited to present a talk on his/her research and to participate in a plenary award session.

Applications will be judged by a committee of eminent scientists appointed by the President of IUPAC.

Complete information, including application forms is available on the IUPAC website. The URL is:
<http://www.iupac.org/news/prize.html>



The selection of symposia for Pacifichem 2000 has been completed and a full listing can be found on the Pacifichem web site. Chemists and biochemists are given their final reminder that the **last date for receipt of abstracts in Washington, DC, for oral and poster presentation at Pacifichem 2000, is 14 April 2000.**

Abstract forms are available directly on the internet but if graphics are to be included a hard copy must be submitted. Hard copies are available from Professor B Halton, School of Chemical & Physical Sciences, Victoria University, P O Box 600, Wellington (e-mail: brian.halton@vuw.ac.nz). The Pacifichem web access to abstract forms is:

<http://www.acs.org/meetings/pacific2000/>

Advance registration will be available only after July 1, 2000, and details for this, the accommodations, and pre- and post-congress tours will be publicised in *Chemistry in New Zealand* in the July/August 2000 issue. The registrations fees are (late on-site registration in parentheses):

NZIC Member US\$340 (US\$410)
Non-Member US\$420 (US\$505)
Full-time Student US\$75 (US\$90)
Guest of Registrant US\$50 (US\$50).

Abstracts must be in received Washington by 14 April 2000.

Full details of the Congress including the updated programme listings are available from the web site that can be accessed easily from the Pacifichem listing on the ACS meetings site at:

<http://www.acs.org/meetings/pacific2000>

The Congress opens on the morning of Thursday December 14 and concludes at noon on Tuesday, December 19. A direct noon-time flight from New Zealand on Thursday December 14 will arrive in Honolulu late in the evening of December 13, while a return on a December 19 night flight (maybe just after midnight) will arrive in Auckland on the morning of Thursday December 21. We hope to see many of you at Pacifichem 2000.

Surface Coatings Association
New Zealand Inc.

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INSTITUTE OF
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forest research
creating wood based solutions

Symposium Emulsions & Adhesives

A symposium on aspects of emulsion chemistry and emulsion adhesives will be held on Monday 17th April, 2000 at The University of Auckland.

This is a joint session of the Surface Coatings Association of New Zealand, The New Zealand Institute of Chemistry Polymers Group, Forest Research and The University of Auckland Polymers and Coatings Science Group.

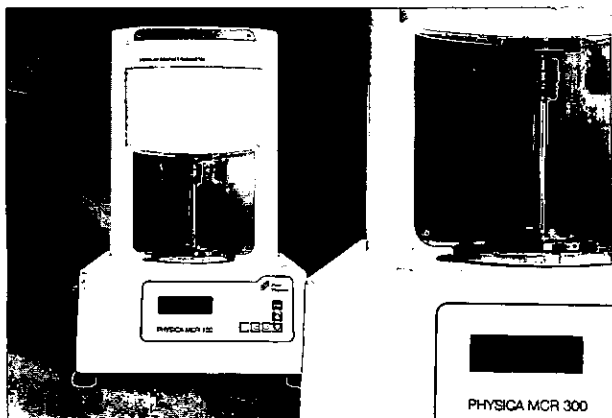
Topics Include :

1. Keynote Address by Professor Bob Gilbert, Key Centre for Polymer Colloids, Sydney University
2. Synthesis and Characterisation of Core Shell Latices
3. Measurement of Emulsion Particle Size. Methods Compared
4. Development of a research emulsion reactor
5. Modelling Emulsion Kinetics
6. Cross-Linking Emulsion Adhesives
7. Thermomechanical and Conventional Testing of Wood Adhesive Joints
8. Bench Mark Properties of Wood Adhesive Chemistries
9. Theoretical and Practical Aspects of the Glass Transition
10. Research Partnerships in Emulsions Research

Contact: Alan Eastale
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Department of Chemistry
University of Auckland
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Auckland

PHYSICA PRESENTS A NEW RHEOMETER LINE AT ACHEMA 2000



Physica Messtechnik GmbH is presenting its new rheometer line at the Achema in hall 6.3 H13-H14. Central to display is the MCR 300 modular compact rheometer, first unveiled by Physica less than a year ago, and its new companion the MCR 150. The MCR 300 is the first rheometer in its price range to provide controlled shear stress (CSS) and controlled shear rate (CSR) measurements as well as oscillatory tests, says Paar.

The MCR 300 owes its versatility and accuracy to its permanent-magnet synchronous drive. Already well-known from Physica's UDS 200 rheometer, this type of drive is only available from Physica and is said to be vastly superior to conventional drag-cup motors. For the MCR 300 the drive has been further improved and built into a compact and robust casing. The result is a rheometer that combines high-quality measurements with outstanding ease of use and a flexibility that allows it to tackle a wide range of measuring tasks.

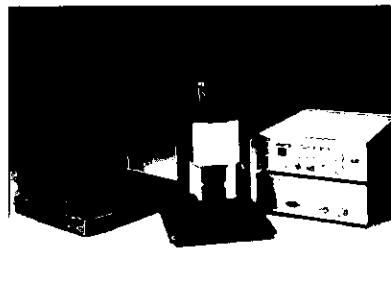
Encouraging sales of the MCR 300 have prompted Physica to develop another new rheometer. Unlike the MCR 300, the new MCR 150 has a ball-bearing motor making it especially suitable for use in quality control.

Also on show at Achema are some new accessories for the MCR series. The TEK-IMC immobilisation cell is used in the development of colours for paper coating, by characterising their immobilisation kinetics and water retention. By simulating process conditions exactly, the TEC-IMC allows users to optimise coating formulations and improve quality control.

For characterising asphalt, Physica has developed a special asphalt chamber for the MCR series as well as a dedicated asphalt rheometer, the DSR 200. Both systems use temperature-controlled Peltier elements for heating and cooling the sample, eliminating the conventional water bath and cutting the time required for temperature equilibration. Push-button automatic calibration has replaced time-consuming manual calibration.

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MMS NIR - A STURDY SPECTRAL SENSOR FOR PROCESS ANALYSIS IN THE NEAR-INFRARED RANGE

The new MMS NIR sensor upgrades the Carl Zeiss series of MMS spectral sensors for the near-infrared range. This opens up a multitude of optimisation possibilities for production processes, e.g. in the fields of petrochemistry and food analysis. Featuring a compact and sturdy design, the sensor is highly flexible and very reasonably priced in comparison to earlier systems. Its remarkable reliability and accuracy set a new milestone in process analysis technology. It is now possible to perform reliable in-process and shop-floor measurements, e.g. humidity or molecular analyses.

Like the MMS 1, the NIR spectral sensors consist of a solid quartz body to which a fibre shape converter and a InGaAs diode array are permanently connected, and which also directly carries the immovable imaging flat field grating. This technology yields extremely high reproducibility with respect to both the wavelengths and intensity information. The image-corrected and NIR-blazed grating, the large aperture and the shape converting technique results in high light intensity.

The module can be equipped with different diode arrays, depending on the spectral range requirements. The most budget-priced solution an uncooled standard InGaAs array with 128 pixels covers the range from 0.9 to 1.7 μm . Using a cooled "extended" InGaAs array, the spectrum can be determined from 0.9 to 2.4 μm . Pixel dispersion totals approximately 6 nm, resulting in a spectral resolution of better than 20 nm. This makes the spectrometer module ideal for the identification of OH-like absorption bands. The wavelength reproducibility is better than 1 nm.

The integrated preamplifier provides simple control and selection of the sensor modules. Light is coupled via a fibre bundle equipped with an SMA connector.

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NOVEL DETERMINATION OF MOISTURE CONTENT UNDER HALOGEN LIGHT FROM METTLER-TOLEDO



For the first time the moisture content can be determined in substances with a compact instrument which uses halogen light and links drying and weighing with each

other in a completely new process. After intensive development work, Mettler-Toledo AG has developed the 'Halogen Moisture Analyser' which drastically reduces the time needed for determination of the moisture content of liquid, powders, pastes and organic or inorganic substances in the food, chemical and pharmaceutical sectors.

The analyser provides dependable measurements with a readability of 0.01% in the range 0.5% to 99%, as well as a repeatability of 0.2% to 0.02%, dependent on the substance. A striking feature is the sample chamber, which can be controlled at a keystroke and is reminiscent of a CD player; it accommodates the sample in an aluminium pan, automatically transports it to the instrument interior where drying starts immediately.

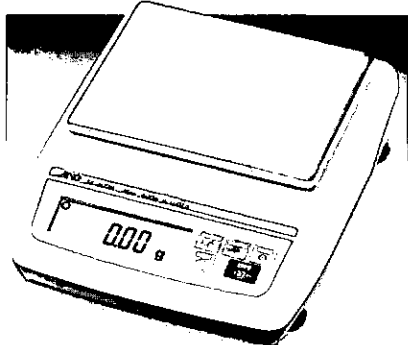
The HR73 model is particularly distinguished by its universal application and can store the drying procedures for up to 20 different types of substances in its database, as well as manage a separate measured value journal and measured value statistics for each type. The adjustment of the balance and dryer ensures that exactly the same measured value is obtained anywhere in the world under a wide range of environmental conditions.

The HG53 model has been designed for routine determinations. A printer can be integrated in both models if desired to record the instrument settings, work steps and results with time and date. Via the LocalCAN RS232 data interface the results can also be sent to an attached PC. The design, the screen with easily understandable symbols and the easy to clean keypad with its plastic protection are ergonomically constructed that both highly trained and semi-skilled staff can work reliably and quickly.

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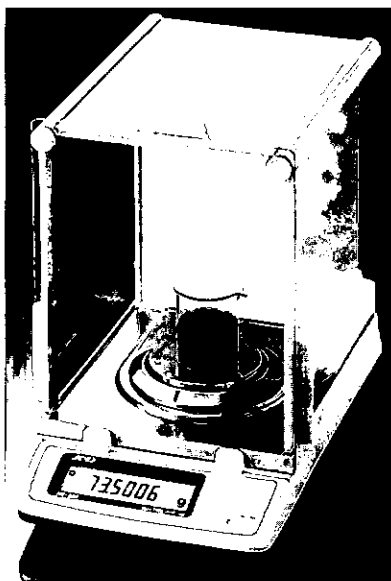
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Phone: (09) 3610500, Fax: (09) 3610665
Email: davidm@advantagegroup.co.nz
circle number 29 on the reader reply card

ECONOMICALLY PRICED BALANCE



The A&D HR Series analytical balance provides precision weighing to 0.01 mg at an affordable price. The balance features a large, easily accessible weighing chamber, which provides an excellent environment for weighing operations.

A clear, easy to read, LCD display ensures a minimum of operator error when transferring weight data to hard copy. This feature can be further enhanced with the addition of the AD8121 printer option, which provides automatic hard copy at the touch of a button or when a weight reading becomes stable.

The HR300 has a capacity of 310 g with a resolution of 0.1 mg, while the HR202 features a dual range with a resolution of 0.01 mg to 42 g and then 0.1 mg to full capacity of 210 g. All models of the HR analytical balance feature multiple weighing units including carat, ounce, momme and tael, which makes them ideal for weighing jewellery, pearls or other forms of valuable product.

A rechargeable battery option is available for the HR200 analytical balance which gives the opportunity to weigh either in the laboratory or out on site. This handy feature makes the HR200 one of the most flexible balances currently available.

Selectable digit filtering can be used to match the balance performance to the chosen environment. If the environment is hostile it is still possible to obtain a steady reading by the use of filtering.

The HR series can be interfaced to a computer for the input of tare weights, tracking of readings etc. and all models include GLP software to allow inclusion of calibration data into quality systems.

The HR series of analytical balances is available exclusively through Advantage Group's approved dealer network.

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THE OHAUS SCOUT BALANCE

Scout's durable construction and simple, two-button operation make it a favourite of classrooms and laboratories alike. And with features like a high-contrast display, large stainless steel weighing surface and auto shut-off, it's no wonder the ergonomically-designed Scout is the market leader.

- Affordable, superior performance from a market leader
- Large, high-contrast LCD display
- Large weighing pan and simple, two button operation
- Multiple weighing units and parts counting
- Battery operation or AC adaptor operation
- Easy span and linearity calibration
- Integral security bracket
- Weigh below hook

Optional Accessories:
Security device, calibration masses, scoops.

Contact: Global Science & Technology Limited
P O Box 101253, NSMC, Auckland
Phone: (09) 4435867, Fax: (09) 4447314
Freephone: 0800 734100
Email: global@globalscience.co.nz
circle number 31 on the reader reply card

NEW OHAUS NAVIGATOR BALANCE

Big enough to handle large loads, yet small enough to carry, the new Navigator balance gives laboratory users - and those who work in other demanding environments - the freedom to bring the laboratory to the field without sacrificing performance.

BALANCES & WEIGHING

Navigator's text messages and prompts guide users through set-up and operating functions. Navigator offers 16 weighing units and four functions - for quality control, percent weighing, animal weighing, and more. The balance can provide a documented audit trail at the touch of a button.

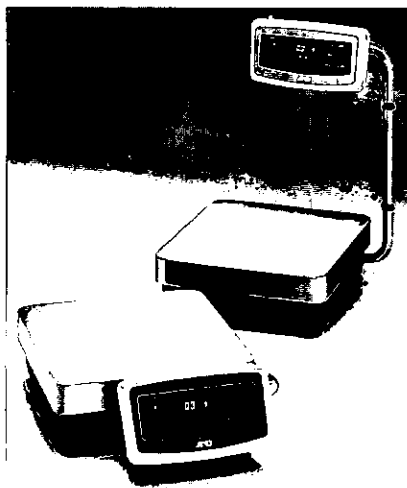
Other features include:

- Simple one-button operation for basic weighing and dedicated single-function buttons for setup and menu operations;
- Sealed one-piece keypad with wipe-clean styling;
- A programmable auto shut-off feature and RS232 power shut-off to conserve battery life;
- Environmental settings to filter vibrations and stability levels;
- An integral weigh below hook for below balance weighing applications.

Ohaus' Navigator is available in capacities ranging from 210 g x 0.01 g to 8100 g x 0.5 g.

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A&D INDUSTRIAL BALANCES



A&D's HP series of industrial precision balances are specifically designed for the factory floor. These rugged balances are both dust- and moisture-resistant (IP-65) and are suitable for a wide variety of weighing and mixing requirements.

The balances feature high weighing capacities of up to 100 kg (101 kg x 1 g) and an accuracy to 0.1 g (31 kg x 0.1 g). This makes them ideal for ingredient mixing, especially where small additives are being added to a larger base material. The innovative swinging arm display enables an operator to set the balance up to suit either weighing or filling operations. With the display in the elevated position

an operator can easily view the display whilst filling a container and can more easily judge the weight.

The HP series also feature a large stainless steel weighing pan to accommodate big containers. The weighing mechanism is overload protected to handle industrial environments.

The HP series software incorporates a handy over/under display. An operator can use this feature by setting high and low weight or count values to more accurately control checkweighing operations. This feature can be further enhanced with an optional output card to fully control the weighing operation and reduce the incidence of over/under filling.

The HP series can be fitted with an optional underhook for measurement of density and the weighing of magnetic materials.

The A&D HP series of industrial balances is available exclusively through Advantage Group's approved dealer network.

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OHAUS SETS NEW STANDARD WITH EXPLORER & VOYAGER ERGONOMIC BALANCES

After extensive field research - asking tough questions and getting hard answers - Ohaus Corporation has taken what it learned and created a new generation of balances that is setting the standard in balance design. Ohaus' Explorer and Voyager balances are as practical as they are innovative. Users can select either analytical or toploading balances with the capacity, readability, calibration, features and functions that meet their specific needs - from basic weighing to sophisticated applications.

The basic-featured Explorer, offers a custom LDC display and user-friendly functions - parts counting, animal weighing, percent, GLP, time and date. This dependable workhorse balance is available with or without internal calibration and has a host of convenience features, including two large tare keys, simple one-key/one-function buttons and cursor keys for easy menu navigation.

Also available with or without internal calibration, Ohaus' Voyager balance offers a host of advanced capabilities. Users can access up to eleven different applications, including density determination, formulation and differential weighing, with a touch of a button.

Balances in the Voyager, series are designed to offer enhanced performance features like AutoCal and "user-

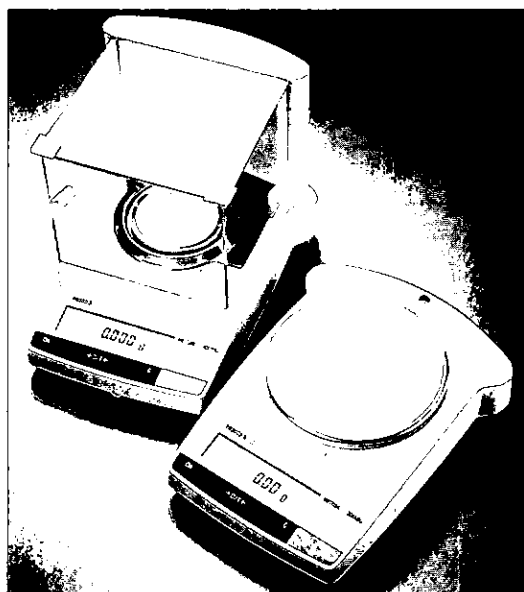
BALANCES & WEIGHING

NEW
PRODUCTS

friendly" functions, including a Custom Menu and Applications Library. Both Explorer, and Voyager, are ergonomically designed with adjustable levelling systems, with the level bubble at the front of the balance for easy access. The balances are available with capacities ranging from 62 g x 0.1 mg to 32 kg x 0.1 g.

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METTLER-TOLEDO'S NEW BASIC LEVEL BALANCE LINES (AB-S AND PB-S)

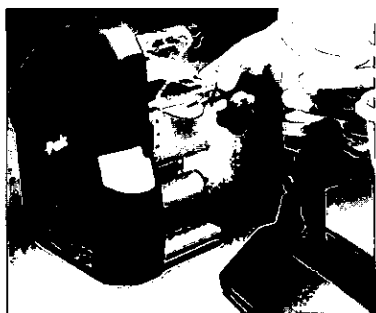


The pressure to cut costs in the laboratory is particularly high when only simple weighing operations need to be performed at the workplace, and then rarely in large numbers. With the new "Basic Level" balance lines (AB-S and PB-S) from Mettler-Toledo GmbH, this requirement has been addressed by deliberately keeping their technical features simple. Their quality design gives them a long service life: the new generation of MonoBloc weighing cells ensures reliability and accurate measuring for many years to come. The one-piece balance housing is an all-metal construction, but high quality materials are also used for all other components. Particular attention has been given to ease of cleaning. There are no edges, corners, grooves or holes where dirt can collect. The large surfaces can be washed down quickly and easily. A replaceable in-use cover fits over the complete instrument for additional protection when working with substances that are liable to drip, or when used by inexperienced personnel. But, whether experienced in weighing or not, the user is helped at every stage of the weighing process by the clear digital display and the large, sensitive operator key using modern touch key technology. On the other hand, applications programs have been omitted. An RS interface is available as an inexpensive option for connecting to a printer for GLP reports or to a PC. The ranges of balances now available comprise various analytical and precision models with a readability (depending on the model) between 0.1 mg and 0.1 g. All details and technical data are given in Mettler Toledo's newly published laboratory catalogue.

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FILTRATION

MILLIPORE - MICROFIL FILTRATION SYSTEM WITH EZ-PAK MEMBRANES



Making MF easy and convenient!

Millipore's unique EZ-Pak Membrane Dispenser delivers single sterile membranes, eliminating the time and contamination risk from handling membranes and

packaging. The dispenser is loaded with a cartridge holding 150 sterile, individually packaged membranes. By pressing a lever, a single membrane is automatically unwrapped and can be picked up with forceps and placed into a conventional filter holder or on the Microfil station's filter support. The Microfil funnels feature a "push fit" seal without clamps or O-rings, ensuring leak free operation and uniform microorganism recoveries. Pour the sample into the funnel and filter by applying vacuum. When complete, pressing a lever on the Microfil system breaks the vacuum and the membrane is lifted for convenient removal with forceps. Transfer the membrane to a media-filled Petri dish or pad for incubation.

Contact: Biolab Scientific Ltd
244 Bush Road, Albany, Auckland
Phone: (09) 9806767, Fax: (09) 9806788
Website: www.biolab.co.nz
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FILTRATION

CONVENIENT LOW COST VACUUM FILTRATION

The Alltech Vacuum Station is a hassle-free and more importantly maintenance-free benchtop vacuum station ideal for filtration or solid phase extraction. Built-in software controls the vacuum set point avoiding fiddly valve adjustments. Use the Vacuum Station for degassing, gel drying, aspiration, vacuum blotting and bulk solvent filtration with our 47 mm vacuum filter funnel.

This dependable filter funnel is durable, well balanced and autoclavable at a price well below the breakable and top

heavy ground glass joint and clamp filtration apparatus you're used to. And it screws onto any GL-45 top bottle commonly available in most laboratories as 'Schott' bottles, or solvent bottles. 1 and 2 litre funnels are available, Tygon vacuum tubing and our popular membrane filters are also available at low prices.

Contact: Alltech Associates Inc.
P O Box 100352, NSMC, Auckland
Phone: (09) 4443230, Fax: (09) 4442399
Freephone: 0800 652766
circle number 37 on the reader reply card

HPLC/IC

METROHM 761 COMPACT IC HALF THE SIZE - HALF THE PRICE - BUT FULL POWER

A revolution in Ion Chromatography, with and without suppressor, is realised with the introduction of the new Metrohm 761 Ion Chromatography system. The compact design, using a minimum of bench space, low detection limits, price/performance ratio, and user-friendly communication with a PC, will convince new users in many analytical laboratories to make the move into Ion Chromatography now.

All the IC components are integrated in the housing of the 761 Compact IC:

The injection valve - for individual injections or for use with a sample changer.

The double piston pump - extremely low pulsation with a flow range from 0.2 to 2.5 mL/min and a maximum pressure of 25 MPa (250 bar).

The pulsation damper - protects your column against damage.

The thermally- and electrically-shielded column chamber for anion columns with or without suppression, separation columns for cations or organic acids.

The Metrohm Suppressor Module.

The two-channel peristaltic pump for regeneration of the Metrohm Suppressor Module.

The thermostatted high performance conductivity detector.

The high-resolution AD converter.

Two sample changer systems, for either 128 sample vials with a volume of 700 μ L each (750 IC Autosampler) or 127 sample vials with a volume of 11 mL each (766 IC Sample Processor) allow automatic processing of large numbers of samples.

The eluent and storage containers for regeneration can be easily accommodated in the eluent organiser on top of the 761 Compact IC. All components which come into contact with eluent and sample are metal-free. The rear panel has the connections for the detector block, the cable to the RS 232 interface of your computer and the interface for the freely-definable remote lines.

Your PC does not need any extra hardware. 20 MB free hard disk space, a Pentium processor or higher and 64 MB RAM with Windows 95 or NT and a standard communications interface are sufficient. The combined control and integration software is included in the system. The parameters for more than 300 applications are pre-stored in the system. The hardware and the software comply with the requirements of GLP. Update and upgrade is available on-line from the Internet. Detailed information is available at www.metrohm.ch

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Email: nt@mep-instruments.co.nz
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TRAP CARTRIDGES



Michrom BioResources, Inc. introduces a complete line of trap cartridges designed for concentration, desalting, detergent removal and protein removal from samples prior to analysis by HPLC, LC/MS, MALDI-MS, Edman sequencing and/or amino acid analysis. Michrom's trap cartridges are packed with application-specific packing materials for use with small molecules, peptides, proteins, and poly nucleotides. The traps can be used individually or in series to cleanup samples manually, online using a HPLC injector or automatically with an HPLC

autosampler. These application-specific trap cartridges come in three sizes with sample capacities varying from 2 µg to 200 µg, and sample recovery >90% at levels as low as 10 femtomoles. Michrom has designed several holders for the trap cartridges, including a Rheodyne HPLC injector kit, a Valco HPLC injector kit, and a manual kit for sample elution in as little as 1 µL volume.

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1945 Industrial Drive, Auburn, CA 95603, USA.
Tel: (+1-530) 8886498, Fax: (+1-530) 8888295
Email: michrommkt@psyber.com
circle number 39 on the reader reply card

SHIMADZU VP DISCOVERY SYSTEM

Shimadzu Scientific Instruments has introduced a totally automated HPLC system designed to increase throughput and facilitate high volume analysis requirements in the various stages of the pharmaceutical development process. This unique HPLC system features onboard intelligence to enable pharmaceutical scientists to submit samples on a first come, first served queue basis and to tend to other tasks while analysis is automatically performed. E-mail notification is provided when analysis is complete.

The Shimadzu VP Discovery System provides a great deal of versatility and scalability to allow effective operation in a wide range of drug discovery and development as well as QA/QC applications. The open architecture of the hardware and software offers the capability to meet diverse productivity requirements from analytical to preparative scale.

Contact: Shimadzu New Zealand Ltd
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Bruce Fraser, Ph: (03) 5456016
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DIRECT SAMPLING FROM COOLED DEEP-WELL TITRE PLATES

Shimadzu Scientific Instruments, now offers new Peltier-cooled rack options for the SIL-10AVP robotic autosampler that enable direct sampling from deep-well titre plates. Accommodating single or dual deep-well titre plates, these cooled racks allow thermolabile samples to be held at a reduced temperature while awaiting analysis. Chromatographic analysis is streamlined by allowing samples to be injected directly from titre plates without transferring to vials, thereby increasing sample throughput while minimising sample preparation time and transfer errors. These features are particularly useful in pharmaceutical research, combinatorial chemistry, and other applications where high throughput autosampling is desired.

The SIL-10AVP compact stand-alone autosampler is an integral component of Shimadzu's VP Series HPLC; however, it can be interfaced with any manufacturer's HPLC system. It performs automatic sample pre-treatment including dilution and standard addition, and provides high precision injection from 0.1 to 500 µL with excellent reproducibility and linearity. Its needle-in-flow-path design virtually eliminates carry-over. Validation functions are built in to facilitate GLP compliance.

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OTHER NEW PRODUCTS

IMPROVED NALGENE ACETONE RTK SAFETY WASH BOTTLE PROVIDES ENHANCED CHEMICAL RESISTANCE, ELIMINATES RISK OF SOLVENT LEAKAGE, IMPROVES DISPENSING

Nalge Nunc International announces the availability of an improved 500 mL Nalgene Acetone RTK Safety Wash Bottle, manufactured of LDPE (low density polyethylene) by an improved process that provides LDPE with enhanced chemical resistance. The improved bottle also features a non-metallic self-vent that reduces "sputter", keeping the contents in the bottle and eliminating the risk of solvent leakage. Improved manufacturing also provides a softer texture that improves ease of dispensing by making the bottle easier to squeeze.

The improved Nalgene Acetone RTK Safety Wash Bottle is featured in a new assortment containing one of each:

Nalgene RTK Safety Wash Bottles for isopropanol, methanol, sodium hypochlorite (bleach) and distilled water.

The improved 500 mL Nalgene Acetone RTK Safety Wash Bottle is available as Nalge Nunc International catalogue number 2425-0501.

Contact: NNI Documentation Centre
Sevenoaks, TN 14 5XA, United Kingdom
Fax: (+44-1732)-453166
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VARIAN AND QUESTAR BASELINE INDUSTRIES, PARTNER TO PRODUCE TIME-SAVING ONLINE GAS MEASUREMENT TOOLS

Varian and Questar Baseline Industries have introduced online gas measurement systems that deliver near real-time

OTHER NEW PRODUCTS

analysis of complex gas streams. These revolutionary products are high-performance process monitoring instruments marrying the speed and sensitivity of Varian's Micro GC with the time-tested measurement capabilities of Baseline's Real-Time Applications Management System (RAMS).

"By joining the best features of the Micro GC with RAMS, we've created a breakthrough instrument that delivers unsurpassed gas measurement," said Bob Forsberg, President of Questar Baseline Industries. "This integrated solution finally allows our customers to make time-critical adjustments to their industrial process monitoring."

"We developed this gas measurement system based on customer requests for fast, accurate online analysis," said Garry Rogerson, Varian Inc., Vice President, analytical instruments. "Incorporating our Micro GC into Baseline's products allows users to obtain quantitative measurements from remote locations in seconds, rather than minutes."

Rogerson explained that the collaboration between Varian and Baseline is a customer-focused effort to combine complementary technologies to produce high-performance instrumentation.

Baseline's Forsberg also noted that the Micro GC's vast applications library will allow the company to penetrate new markets that can benefit from continuous online monitoring.

These products give users a means to distribute measurements with standard communication protocols for WAN, LAN, direct modem, or Internet connectivity. The instruments are also ideal for process gas stream monitoring in the petrochemical or refining industries, natural gas pipelines or gas gathering locations, and for many other applications requiring remote measurements.

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A.i. Scientific (NZ) Ltd
P O Box 35579, Browns Bay, Auckland
Phone: (09) 4781351, Fax: (09) 4781360
Email: aiscinz@ihug.co.nz
circle number 43 on the reader reply card

pH BUFFER SOLUTIONS GUARANTEED 5 YEARS

Hamilton Duracal pH buffer solutions are certified traceable to NIST standards. They are guaranteed stable for 5 years. The CALPACK dosing bottle allows sensor calibration in the bottle without contamination of the bulk buffer. The unique CALPACK reservoir on top of the bottle is graduated, and filled by squeezing the bottle. No separate reservoir is required for calibration, and only as much buffer as is needed to cover the electrode tip is used at one time, and when finished just tip the bottle to pour it away. No more buffer contamination, no more wasted

buffer. And a 5 year guarantee. Duracal buffer solutions are in stock at Alltech.

Contact: Alltech Associates Inc.
P O Box 100352, NSMC, Auckland
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NEW PERKIN ELMER OPTIMA 4000 DV SERIES OES DELIVERS THE PERFORMANCE REQUIRED TO MAXIMISE ICP PRODUCTIVITY

The new Optima 4000 Inductively Coupled Plasma (ICP) series from Perkin Elmer Instruments has the fundamental design performance required to improve method development and provide accurate and reliable answers. The instrument's powerful Segmented-array Charge-coupled Device (SCD) detector simultaneously measures all analyte wavelengths and background correction points, providing unmatched precision and accuracy while significantly reducing analysis time. Automatic dual viewing (DV) ensures the lowest detection limits and the widest working ranges. WinLab32, the Optima 4000's 32-bit Windows software, provides the tools needed to analyse samples, report and archive data, and ensure regulatory compliance.

The Optima 4000 series is different by design. Based on the highly successful Optima 3000, the new system combines proven technology with innovative enhancements, resulting in a reliable system that provides high sample throughput. The dual-detector option of the Optima 4000 series maximises light throughput and resolution for both the UV and visible wavelengths. The high resolution optical system provides fewer line interferences, making method development easier and faster, with better results.

Computer-controlled gas flows and mass flow of the nebuliser gas ensure day-to-day reproducibility. To eliminate interferences caused by the cooler regions in the plasma gas, the Optima 4000 ICP uses a unique compressed air shear gas system to remove the cool tail plume of the plasma. This provides a maintenance-free, reliable solution compared with other methods that use expensive argon gas and are prone to clogging.

WinLab32 software provides advanced capabilities and flexible control to boost productivity. It contains tools for both basic operation and advanced work, adapting well to multi-user environments. The WinLab32 software, based on Windows NT, also contains extensive security features, such as password-controlled access to software functions. To ensure regulatory compliance, the WinLab32 software offers multiple user-defined quality control (QC) standards, as well as a selection of calibration procedures. Programmable start-up and shut-down modes reduce cost

OTHER NEW PRODUCTS

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of ownership and improve productivity. Advanced features, such as simultaneous background correction, Inter-Element Correction (IEC), and Multi-component Spectral Fitting (MSF), significantly enhance analytical performance and minimise potential interferences.

Contact: NZ Scientific Ltd
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GC/MS IN CLINICAL CHEMISTRY

Shimadzu Scientific Instruments has announced the availability of a textbook on the use of GC/MS for various clinical chemistry applications. GC/MS In Clinical Chemistry enables the reader to gain a basic understanding of the fundamental principles of the technique, its application to the analysis of drugs and the determination of exposure to environmentally hazardous substances in the workplace.

Available from Shimadzu or Wiley-VCH Publishing, GC/MS In Clinical Chemistry is mainly written for the analyst but is equally suited for teaching purposes. In addition to a comprehensive overview of the theory of GC/MS, the book also describes efficient methods of sample preparation and applies the technique to epidemiology and pharmacology.

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HIGH SPEED GC - THE SHIMADZU GC-17AV3

The Shimadzu GC-17AV3 can be easily configured with standard options to perform high-speed GC analysis. Utilising narrow bore capillary columns or multi-cap columns and hydrogen as the carrier gas, the GC-17AV3 with the variable speed AOC-20 autoinjection system, CLASS-VP software and high pressure, high flow AFC can dramatically reduce analysis run time without sacrificing performance.

The AOC-20 autosampler, with 150 x 1.5 mL vial or 96 x 4 mL vial capacity can provide ideal sample injection rates for HSGC. It enables OCI, Split/Splitless injection, and PTC/LVI on the same system. Precision for repetitive injections on the AOC-20 is less than 2% RSD. CLASS-VP software provides sampling frequencies up to 60 Hz for consistent data integrity.

High Speed GC can be used in a wide range of applications including BTEX, explosives, fatty acid methyl esters and petrochemicals. The system also improves the analysis of high molecular weight compounds. Once configured for HSGC, the GC-17AV3 can also be used for traditional analysis.

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HIGH SENSITIVITY, HIGH SPEED GC/MS FROM SHIMADZU

The new Shimadzu GCMS-QP5050A provides the highest sensitivity available for the low-level detection of compounds in complex matrices. It features an extended mass range of 900 daltons and low noise conversion dynode and offers electron ionisation as well as positive and negative ionisation modes.

Sensitivity for the GCMS-QP5050A exceeds 50:1 S/N for 100 pg of methyl stearate and 200:1 S/N for 100 pg of methyl hexachlorobenzene. Scan speeds of up to 6750 amu/sec with up to 50 scans per second are possible. Commercial library searchable structures permit rapid identification of unknowns.

The GCMS-QP5050A offers a comprehensive array of sample injection accessories to enable convenient and efficient analysis of a wide range of sample types. Sample introduction accessories include a high reproducibility liquid autoinjector, direct insertion probe, pyrolyser, as well as purge and trap and headspace samplers.

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OI ANALYTICAL INTRODUCES THE MODEL 4632M HEADSPACE AUTOSAMPLER

OI Analytical, have introduced the new Model 4632M Headspace Autosampler. The Model 4632M is automated and designed to fit onto almost any gas chromatograph containing a vertical injector. Its heated sample loop/valve via a needle directly injects into the inlet to maximise accuracy and reproducibility, thus eliminating sample pathway "cold spot" active sites, band broadening, and sample loss associated with transfer lines. The Model 4632M features a 32-position tray, 6-place thermal equilibration oven and a magnetic gripper for accurate and reliable vial transfer.

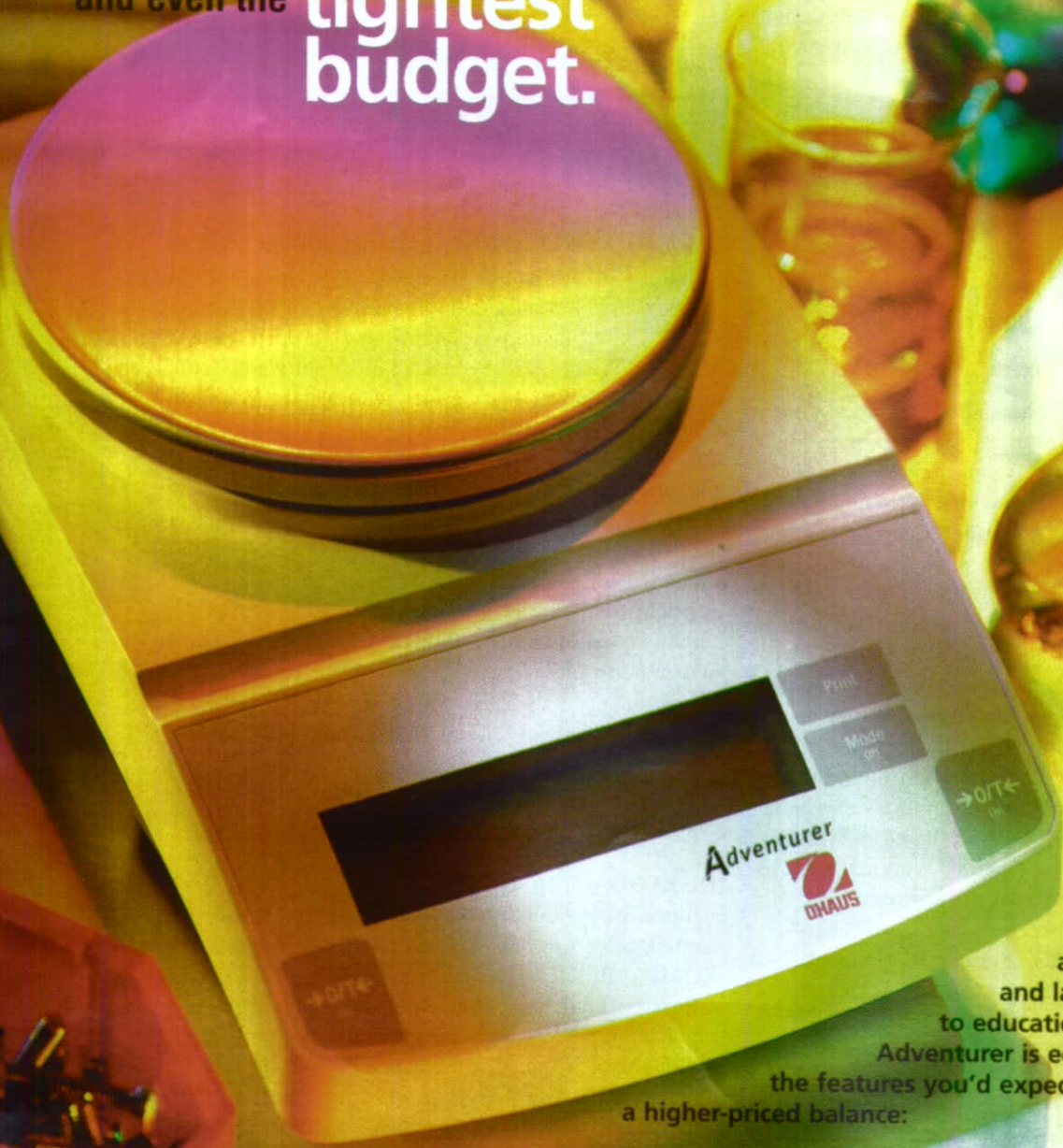
Contact: Shimadzu New Zealand Ltd
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REVOLUTIONARY NEW PERKIN ELMER OPTIMA 2000 DV SCANNING CCD ICP SYSTEM OFFERS INCREASED TIME SAVINGS AND PERFORMANCE

The new Optima 2000 DV Inductively Coupled Plasma (ICP) system from Perkin Elmer Instruments delivers the increased flexibility, superior performance, and enhanced reliability previously available only in high-end

The Ohaus Adventurer™

Finally, a balance that can stand up to
the most **grueling** R&D projects,
the most **demanding** shipping department,
the **toughest** science class...
and even the **tightest**
budget.



For a versatile balance that's ready to take on the world, you'll love the spirit of the new Ohaus Adventurer™

Perfect for a wide range of applications— from industrial and lab work

to education, and more—

Adventurer is equipped with

the features you'd expect only in

a higher-priced balance:

- Incredibly easy-to-use three-button operation
- Standard RS232 interface
- Multiple weighing units, including parts counting
- Simple calibration
- Large LCD display
- Ergonomic leveling system

Add it all up and the Ohaus Adventurer delivers a truly great combination—the features to handle any job *and* the exceptional value to fit any budget.



Toll Free:
0800 734 100
Fax:
(09) 4447314



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OTHER NEW PRODUCTS

simultaneous systems. The instrument's unique scanning Charge-Coupled Device (CCD) significantly reduces analysis time for research and quality assurance laboratories by measuring the wavelength range around the emission line of interest simultaneously. Automatic dual viewing (DV) ensures the lowest detection limits and the widest working ranges. WinLab 32, the Optima 2000's 32-bit Windows software, provides the tools needed to analyse samples, report and archive data, and ensure regulatory compliance.

The Optima 2000's custom-designed solid-state detector, solid-state RF power supply, and sealed optical system reduce operating costs and ensure that the instrument is available when needed. In addition, the solid-state design makes the power supply exceptionally compact, saving valuable laboratory bench space.

Computer-controlled gas flows and mass flow of the nebuliser gas ensure day-to-day reproducibility. To eliminate interferences caused by the cooler regions in the plasma gas, the Optima 2000 ICP system uses a unique compressed air shear gas system to remove the cool tail plume of the plasma. This provides a maintenance-free, reliable system as compared to other methods that use expensive argon gas and are prone to clogging.

The Optima 2000 system continually references a neon background making it faster and more precise than conventional systems that rely on mercury references between reads. Dynamic Wavelength Stabilisation (DWS) allows direct on-peak measurement that eliminates the need for peak searches and ensures long-term stability.

The unique optical system and the exceptional stability of the Optima 2000 instrument allow the WinLab32 software to include tools previously available only in high-end simultaneous ICP-OES instruments. Simultaneous background correction, Inter-Element Correction (IEC), and Multi-component Spectral Fitting (MSF) significantly enhance analytical performance and minimise potential interferences. The WinLab32 software, based on Windows NT, also contains extensive security features, such as password-controlled access to software functions. To ensure regulatory compliance, the Win32 software offers multiple user-defined quality control (QC) standards, as well as a selection of calibration procedures.

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NEW OPTION FOR THE OI MODEL 5380 PFPD

OI Analytical has introduced a software addition to its Pulsed Flame Photometric Detector (PFPD) product line. The new PFPDView software program enables operators to reprocess an entire chromatographic run under different

PFPD operational parameters. This program provides the operator with easier and improved optimisation of the PFPD, post run analysis capabilities, and expanded dual gate capabilities. The PFPD is used for pesticide, petrochemical, air monitoring, pharmaceutical, sulfur, and phosphorous compound detection applications.

Contact: Shimadzu New Zealand Ltd
Chris Nipper, Ph: (09) 8367752 or
Bruce Fraser, Ph: (03) 5456016
Fax: (09) 8367757, Email: sales@shimadzu.co.nz
circle number 51 on the reader reply card

THE NEW LOOK KOMPACT SERIES OF KRATOS MALDI-TOF INSTRUMENTS

Kratos has created a series of MALDI TOF mass spectrometers to meet all your bioanalytical needs without costing the earth. Kratos use the latest technology to give you versatile mass analysers at an extremely competitive price.

The new KOMPACT MALDI range continues the traditions of the Kratos benchtop style, incorporating Pulsed Extraction and a multiple sample stage as standard. The PC-based instrument control system operates using Microsoft Windows 95, 98 and NT based software. Getting results have never been easier with a number of new automatic data acquisition features.

The linear MALDI systems in the product range are the KOMPACT ALPHA and KOMPACT PROBE, which are ideal for rapid routine analysis of a wide range of samples. Designed for scientists requiring ease of use and wide application (for the analysis of proteins, peptides, carbohydrates, oligonucleotides as well as a diverse range of synthetic molecules) they are ideal for multi-user environments within academia. KOMPACT PROBE incorporates an extended flight tube for increased resolution and mass accuracy. The software for both systems enables the user to analyse multiple samples automatically.

The KOMPACT DISCOVERY and KOMPACT SEQ offer additional functionality that enables structural analysis of biomolecules such as peptides and carbohydrates. The KOMPACT DISCOVERY includes all the tools for reflectron analysis - Post Source Decay (PSD) data acquisition, precursor ion selection and new software for the automatic acquisition and labelling of PSD data. The KOMPACT SEQ provides all the benefits of the KOMPACT DISCOVERY, whilst including the higher performance in linear mode of the extended flight tube.

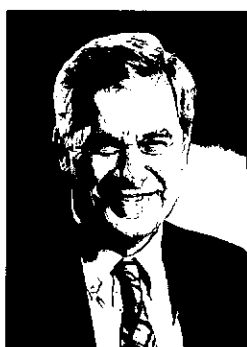
Contact: Shimadzu New Zealand Ltd
Chris Nipper, Ph: (09) 8367752 or
Bruce Fraser, Ph: (03) 5456016
Fax: (09) 8367757, Email: sales@shimadzu.co.nz
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NEW ZEALAND INSTITUTE OF CHEMISTRY



NZIC COUNCIL NEWS

NZIC NOMINATES NEIL MILESTONE FOR RSNZ COUNCIL



Neil Milestone

The NZIC has nominated Neil Milestone FNZIC as the Physical Sciences and Technologies representative on the Council of the Royal Society of New Zealand.

Neil is a Distinguished Scientist at IRL, leading the Applied Inorganic Chemistry team. He has taken an active role in the advancement of chemistry serving on the Wellington branch of the NZIC in several positions including Branch Chairman. An elected member of the RSNZ Council for the last few years, he convenes the Science & Technology medals panel as well as chairing the Executive Committee of Council.

Neil says that he has enjoyed his term and that he is "just getting into the role". He feels that with the changes promised by the new Government he could accomplish a lot with a another 2 year term - and the NZIC Council agrees.

If you are a RSNZ member please support Neil when the voting forms are distributed in April.

NOMINATIONS FOR HONORARY TREASURER

Rob Whitney has indicated that he will resign soon as Honorary Treasurer. Rob has served for 2 years as Treasurer preceded by a term as President and the Council thanks him for all his hard work.

The Treasurer will have the following qualities:

- be familiar with the concept of accrual accounting;
- be MS Excel competent and can prepare a budget;
- will monitor performance against that budget;
- will manage the financial services provided by the Virtual Secretariat;

- can facilitate communications (e.g. use the cc button on his or her e-mail);
- has enough sense and experience to make decisions in the best interest of the NZIC.

Rob will be available to assist the new Treasurer.

Nominations are called for the position of Honorary Treasurer. Nominations can be made by branches or by six members and must be received by the Honorary General Secretary by the end of April 2000.

BRANCH NEWS

MANAWATU

Snippets

- * Planning for the 2001 NZIC Conference to be hosted in the Manawatu is underway with Dr Mike Boland of NZDRI (and former Manawatu NZIC chair) chairing the organising committee. A handful of people have already volunteered to work on the committee with Mike.
- * Associate Professor Dave Harding from the Institute of Fundamental Science at Massey University has taken over the management of the Manawatu NZIC Education Trust.

News From Massey University

By Professor Andrew Brodie

The six million dollar reconstruction of the Chemistry Laboratories has started this summer and should be completed for Semester 1 in 2001. This will cause quite a bit of disruption over this year, especially in Semester 2, but it will be worth it the long run. The chemists are also enjoying using their new 400 MHz NMR instrument which was installed last year.

Professor Andrew Brodie has stepped down as head of chemistry at Massey University. Associate Professor Roger Reeves has taken over the position in the meantime.

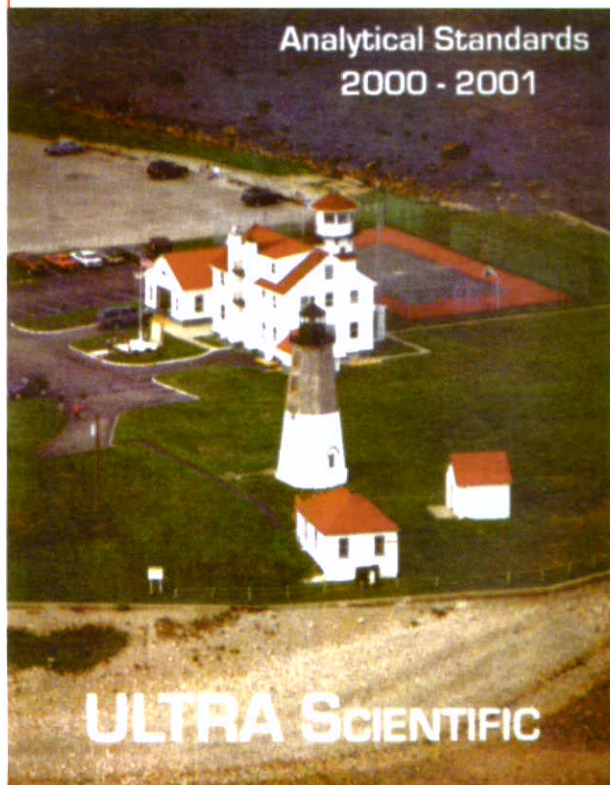
Associate Professor Roger Reeves has been credited with discovering a rare and endangered Australian shrub near Rockhampton. The two metre shrub was found by Roger back in 1989 but only recently have botanical experts given the unknown shrub an identity and a name - *Bursaria reevesii*, in honour of Roger. He found the shrub while searching the Queensland bush for plants that accumulate nickel from the serpentine soils.

Dr Tony Wright has recently been elected as President of The Science Centre Inc. in Palmerston North. Tony is also heavily involved in assisting to organise SCICON, the national conference for science teachers, being held at Massey University this July.

Alltech

0800 255 832

Analytical Standards
2000 - 2001



Ultra Scientific's (USA) new 352 page analytical standards catalogue represents ULTRA's largest and most comprehensive catalogue ever, with over 6000 organic and inorganic standards designed to meet the latest revisions of state, federal and international regulatory methods.

All ULTRA standards are manufactured under ULTRA's ISO 9001 registered quality system and validated by ULTRA's ISO Guide 25 accredited laboratory. Featured in the catalogue are a full line of WS/WP organic and inorganic proficiency test (PT) samples produced and verified under ULTRA's National Institute of Standards & Technology (NIST)/National Voluntary Laboratory Accreditation Program (NVLAP) accredited proficiency program.

circle number 5 on the reader reply card

Ross Edwards, who has just finished his PhD under the supervision of Associate Professor Geoff Jameson and Professor Ted Baker, has been awarded the Hatherton Award by the Royal Society of New Zealand. This award is for the best scientific paper by a student registered for a PhD degree in New Zealand.

Dr Craig Depree has left Massey University to take up a post-doctoral fellowship at the University of Otago with Dr Sally Brooker. While at Massey, Craig worked with Associate Professor Eric Ainscough and Professor Andrew Brodie and made a significant contribution to their polyphosphazene project.

Dr Simon Brown spent several weeks this summer chasing penguins at Cape Bird in Antarctica. The reason for his trip was to try to begin to understand how the penguins' biochemistry copes with the Antarctic environment. A small device attached to the birds was used to collect data.

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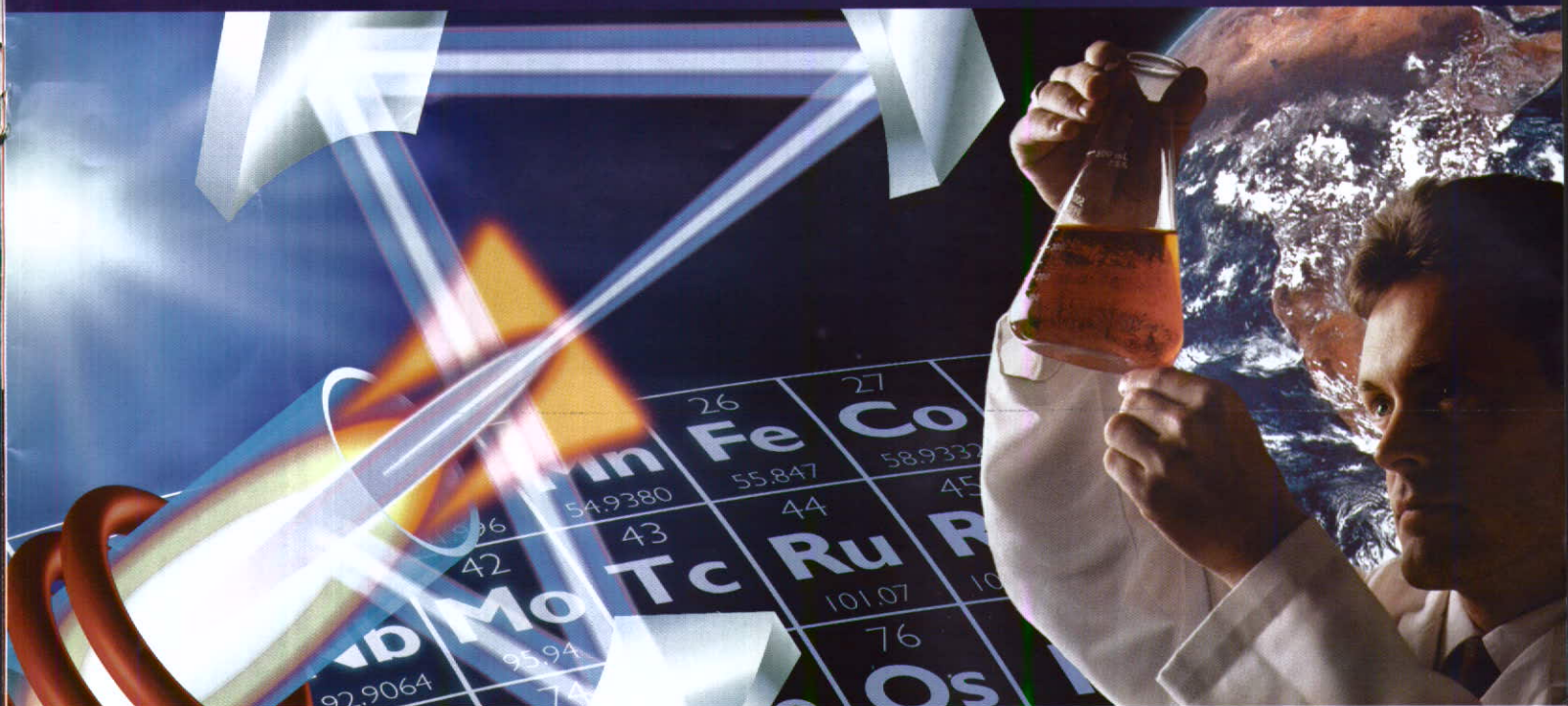
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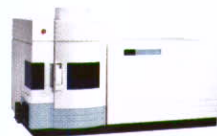
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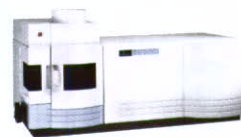
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Both the Optima 2000 DV and the Optima 4000 DV series utilize PerkinElmer's robust WinLab32™ software, which means you get features, flexibility and ease of use that are still unequalled.

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The VP Series HPLC is the smart solution for high volume pharmaceutical QC and R&D laboratories. Intelligent automation features enable high sample throughput with complete control from sample pretreatment through analysis and detection. System reliability is enhanced by greater durability of pump seals and pistons, longer lasting lamps as well as constant self-monitoring of system components.



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at 0800 735 725 today

circle number 2 on the reader reply card

Rheology

Rheolab MC 1

The Rheolab MC 1 is a rotational rheometer based on the Searle principle. It features a direct DC motor drive and optical encoder which provides excellent speed regulation, dynamic range and transient response. These features enable the Rheolab MC 1 to provide superior performance in comparison with rheometers using gear driven (indirect) or stepper motor drives. The unique design of the Rheolab MC 1 enables precise measurement of fluid viscosity over the widest range of conditions available today in a portable rheometer.

The user may perform measurements using either controlled shear stress (CSS) or controlled shear rate (CSR), generally a feature only available in the most sophisticated research rheometers. Controlled shear operation enables the user to make precise measurements of yield point and perform creep experiments as well.



Foam Stability

FTS Head Retention

A new development by Anton Paar allows objective determination of the beer foam retention under practice-oriented conditions. This unit can also be employed to test the stability of industrial foams.

The measuring principle

An optical scan of the foam height and the liquid height is performed.

Temperature

MKT 25 & MKT 100

0,001°C - Portable & Affordable

Temperature measurement with an uncertainty of 0,001°C used to be complex, space demanding and expensive. The MKT Millikelvin Thermometer – the result of two decades of intensive research and development – is the first portable instrument that takes full advantage of the utmost accuracy and precision of Platinum Resistance Thermometers (PRT). The MKT measures the temperature of high precision PRTs with an uncertainty of less than 0,001°C. Temperature is displayed in °C, °F or Kelvin.

Zeta Potential

EKA Electro Kinetic Analyzer

The EKA Electro Kinetic Analyzer is a versatile instrument for measuring the Zeta Potential of all types of macroscopic samples with virtually any shape. A variety of several different measuring cells are available to accommodate fibers, tissues, foils, granules, sheets, discs, powders...



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- Titrators
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WA 6008
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Viscosity

AMVn Automated Microviscometer

The new AMVn based on the approved and acknowledged rolling ball / falling ball principle according to DIN 53015 and ISO/DIS 12058 packed in a user friendly and easy to use design. The variable inclination angle of the measurement capillary allows variation of shear stress and shear rate and the built-in Peltier thermostat saves substantial lab space.



Features and Benefits

- Peltier temperature control
- Extremely small sample size - 500 μ l (150 μ l with low volume measurement system)
- Can be combined with Automatic Sample Changers, Anton Paar Density Meters and / or Sound Velocity Analyzers (simultaneous determination of viscosity, density and sound velocity possible)

Applications

- Wort and beer (beverages)
- Polymer solutions
- Lubricants

- Inks
- Biological Fluids
- Pharmaceuticals
- Coatings
- Brine solution

KF 20 Falling Ball Viscometer

The KF 20 Falling Ball Viscometer is used to measure the dynamic viscosity of Newtonian fluids with high precision.

The measuring tube is surrounded by a glass tube through which the temperature control liquid flows. This ensures reliable and exact temperature control.

The KF 20 corresponds to the falling ball viscometer specified in the DIN 53015 and ISO 12058 standards and allows authorised calibration.



DCR Viscoelasticity and Density Analyzer

The DCR – Dynamic Capillary Rheometer combined with a density meter represents a unique system for frequency and strain controlled oscillatory shear measurement.

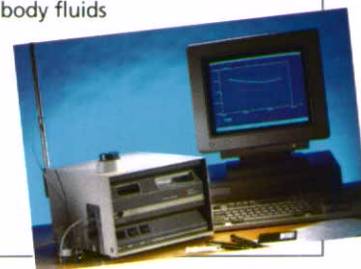
Applications

- Determination of the viscoelastic properties of polymer solutions, suspensions and

surfactants

- Rheological characterization of whole blood and plasma
- Determination of the aggregation behaviour and flexibility of red blood cells
- Therapy monitoring of heart disease and circulatory problems
- Studies of the influence of pharmaceuticals on the viscoelasticity of whole blood

- Determination of true density and density related values
- Quality control in food, beverage and pharmaceutical industries
- Rheological studies of artificial body fluids



Rheology

Physica MCR300 Rheometer

Physica MCR300 Rheometer – a revolutionary rheometer that combines accuracy and flexibility with small size and cost

All performance features available in modern rheometry are offered at a fraction of the investment costs by the Physica MCR 300 research rheometer. It is compact and easy to use, but still has the flexibility to solve all applications from simple viscosity measurements to the most complex and advanced R&D rheometry.

Test protocols such as frequency, amplitude, temperature and time sweeps, flow curves, creep/recovery, yield stress, step strain, post-shear relaxation, and superimposed flow/oscillation are possible in extremely wide dynamic ranges of torque and normal force.

A rigid air-bearing together with the unique EC motor provide

unmatched transient response, and enable true controlled strain and controlled stress modes.



Every combination of controlled strain and controlled stress tests both in rotation and oscillation can

be mixed to create user-defined experiments.

Standard features are automatic gap setting, thermal gap correction, and normal force controlled gap setting and testing. The low torque performance is significantly boosted by user-adjustable air bearing calibration.

The new Physica MCR300 is the first rheometer featuring a Peltier regulated temperature controller for concentric cylinders (pat. pending), offering new dimensions in heating/cooling rates for concentric cylinders.

The new, easy-to-use software makes testing, analysing and documentation fast and efficient. In addition, high-pressure cells, a full range of temperature control units and customised measuring systems are designed to meet all needs of applications.

Anton Paar

Density and Concentration of Liquids

DMA 35N

The DMA35N – portability and power, all in one small package! The new DMA35N handheld digital density meter defines the state-of-the-art of portable density measurement. Designed for use in the most demanding industrial environments, the DMA35N gives you the density, specific gravity, or % concentration of your sample. Simply press the lever on the built-in pump and within seconds, the results are shown on the large, bright display.

► Now also available as intrinsically safe EX model.



Applications

- Incoming raw materials
- Field and Plant Floor Measurements
- Battery acid concentration
- Pharmaceutical
- Wort
- Grapejuice
- Fuels and oils

DMA 4500/5000

Anton Paar's reputation to build the density meters with the highest accuracy, durability and reliability is continued in the launch of the new 4 and 5 decimal place density meters DMA 4500 and DMA 5000 respectively. These latest units contain the most exact temperature control available in their class.

Features

- Automatic viscosity correction
- Patented reference oscillator for drift-free measurement
- Automatic API conversion
- Adjustment history stored in instrument (ISO requirement)
- Measuring range 0 to 3 g/cm³
- Accuracy:
DMA 4500 - 5 x 10⁻⁵ g/cm³
DMA 5000 - 5 x 10⁻⁶ g/cm³

Sample Changers

For higher sample throughput the DMA 4500 / DMA 5000 connect to two different kinds of sample changers.

SP-1m: A single key stroke, and the SP-1m automatically fills samples from the sample tray into the measuring cell of the density meter. Previous sample is displaced by the new sample, no cleaning between the samples is required.

SP3-m: The SP3-m automatically fills samples from a tray into the measuring cell of a DMA 4500 / 5000, cleans the cell with two liquids, and dries it before the next measurement.



DSA Density and Sound Analyzer

The concept of measuring 2 physical properties for the determination of concentration in 3-component liquids, or for product characterization is not new. Modern technology now combines sound velocity and density measurement in the DSA, opening new fields in concentration analysis.

Applications

- Beer analysis – % alcohol, % real extract, OE
- Soft Drink analysis – actual and fresh Brix
- Sulfuric acid – 0 to 114.5% H₂SO₄
- Formaldehyde, methanol, water mixtures

Sample Digestion – Microwave & Conventional Heating

Multiwave

The versatile microwave sample preparation platform

High performance sample decomposition, leaching, drying and evaporation of solutions can be flexibly performed in the MULTI-WAVE microwave system.

Ultimate reaction vessel specifications, process control, vessel cooling and documentation features provide for superior and reliable results.

Leading technology and a wide range of applications make the MULTI-WAVE the efficient link between samples and spectrometer.



HPA-S High Pressure Asher

The ultimate digestion system

The HPA-S High Pressure Asher is an instrument for quick and complete wet chemical decomposition of the most organic and inorganic samples with acids (HNO₃, H₂SO₄, HF) in closed vessels made of quartz or glassy carbon under high pressure (up to 130 bar) and high temperature (up to 320°C).

The HPA-S is the new version of the hundredfold approved HPA which offers highest decomposi-

tion power and is named in many publications as the reference method. It is our top-of-the-line instrument for daily routine work in the decomposition laboratory, providing improved efficiency.



Trace Analysis with Voltammetry

746 VA Trace Analyzer

746 VA Trace Analyzer – your key to trace analysis

The VA Trace Analyzer and the VA Stand with the Multi-Mode

Electrode MME are the components of a system that can be used to determine traces of inorganic substances. The instruments are used primarily in water, environ-

mental, pharmaceutical and food analysis. In the pharmaceutical industry, the method is used preferentially to determine organic substances.



The 747 VA Stand

combines mechanical stability with signal processing directly at the measurement station with its corresponding beneficial effect on the signal-to-noise ratio. As an alternative to the time-tested MME, a rotating disk electrode (RDE) with tips of glassy carbon, platinum or gold is available as an option. The 'Ultra Trace' graphite electrode allows trace metal determination down to the ppt range without mercury or prepurging.

▲ 746 VA Trace Analyzer with 747 VA Stand and two 700 Dosinos for standard addition

Antimony	(Sb)	500 ppt*
Bismuth	(Bi)	500 ppt
Cadmium	(Cd)	50 ppt
Chromium	(Cr)	25 ppt
Cobalt	(Co)	50 ppt
Copper	(Cu)	50 ppt
Iron	(Fe)	200 ppt
Lead	(Pb)	50 ppt
Mercury	(Hg)	100 ppt
Molybdenum	(Mo)	50 ppt
Nickel	(Ni)	50 ppt
Platinum	(Pt)	0.1 ppt
Thallium	(Tl)	50 ppt
Tungsten	(W)	200 ppt
Uranium	(U)	25 ppt

* 1 ppm = 1 part per million = 1 mg/kg
 1 ppb = 1 part per US billion = 1 µg/kg
 1 ppt = 1 part per US trillion = 1 ng/kg

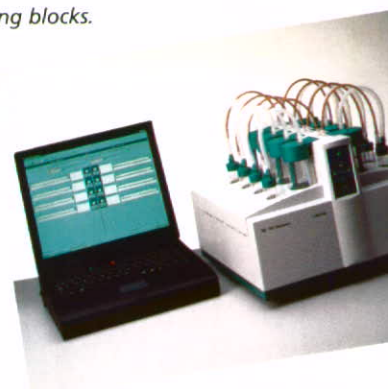
Rancimat

743 Rancimat

A New Era in the Determination of the Oxidative Stability of Fats and Oils

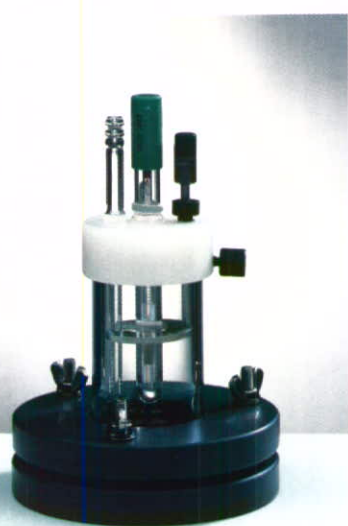
The Rancimat method has been developed as the automated version of the extremely demanding AOM method (active oxygen method) for the determination of the induction time of fats and oils. In this method the highly volatile organic acids produced by autoxidation are absorbed in water and used to indicate the induction time. In the course of time this method has become established and has been included in various national and international standards.

▼ The 743 Rancimat – 8 measuring stations in 2 independent measuring blocks.



Eco Chemie

Potentiostats / Galvanostats



The AutoLab range of electrochemical instrumentation made by Eco Chemie is now available in

Australia and New Zealand through MEP Instruments.

The basic configuration of these modular units contain a potentiostat/galvanostat, to which optional modules like a bipotentiostat or an FRA for electrochemical impedance spectroscopy (EIS), maybe added.

All instruments are controlled by two different software packages: GPES for electrochemical techniques and FRA for impedance spectroscopy.

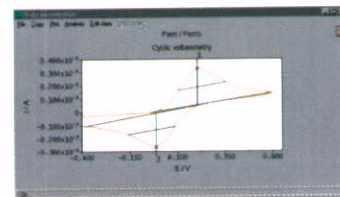
The combination of the Autolab hardware and software gives the user an unrivalled instrument to perform a wide range of electrochemical experiments.

Range of Instrumentation

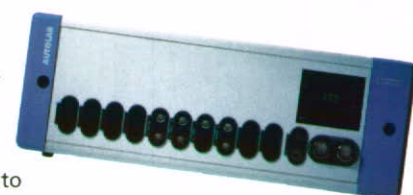
Autolab potentiostats available offer current ranges from 80mA to 1A and compliance voltages from 12 to 100V with the possibility to do iR compensation.

Optional modules to be added include:

FRA A module for Impedance Spectroscopy with frequency limits from 10 µHz to 1 MHz and a measuring range from 1mOhm to 100Gohm.



▲ CV Scan with peak evaluation



SPR This unit is used for Electrochemical Surface Plasmon Resonance tests to follow surface processes taking place on thin film electrodes.

BIPOT Allows the use of a second working electrode with a fixed potential as used in rotating ring disk electrodes.

EQCM For simultaneous electrochemistry and piezoelectric microgravimetry measurements

More information is available from MEP or visit Eco Chemie's website <http://www.ecochemie.nl>

Meters

pH Meters and Ion Meters

Comparison of pH meters for field, laboratory and plant



704 Pocket pH Meter 744 pH Meter 691 pH Meter 713 pH Meter 692 pH/Ion Meter

		704 Pocket pH Meter	744 pH Meter	691 pH Meter	713 pH Meter	692 pH/Ion Meter
Measurement ranges	pH	pH 0...14 (± 19.99)	pH 0...14 (± 19.99)	pH 0...14 (± 19.99)	pH 0...14 (± 19.999)	pH 0...14 (± 19.999)
	mV	± 2000 mV	± 2000 mV	± 2000 mV	± 1999.9 mV	± 1999.9 mV
	Temperature °C	-130.0...+199.9	-130.0...+199.9	-170.0...+500.0	-170.0...+500.0	-170.0...+500.0
	°F				-274.0...+932.0	-274.0...+932.0
	Concentration					1E-38...1E+38
Resolution	pH	0.01 pH	0.01 pH	0.01 pH	0.001 pH	0.001 pH
	mV	1 mV	1 mV	1 mV	0.1 mV	0.1 mV
	Temperature °C/°F	0.1 °C	0.1 °C	0.1 °C	0.1 °C/°F	0.1 °C/°F
pH calibration (number of buffers)		1 or 2	1 or 2	1 or 2	1 to 9	1 to 9

Sensors

712 Conductometer

The 712 Conductometer offers much more

Conductivity measurement has top priority when the quality of water samples needs to be monitored. Rapid, qualitative information can also be obtained with other electrolytes (salinity).

▼ 712 Conductometer with 728 Magnetic Stirrer



Metrosensors

Metrosensors – your guarantee to simple and correct solutions

Metrohm's experience in the design and manufacture of electrodes for all areas of Ion Analysis spans more than 40 years.

Your investment in a Metrosensor electrode not only provides you with a top-quality Swiss product and individually tested electrode but also with the right solution for your application.

Our range includes:

- pH glass electrodes
- Ion selective electrodes
- Surfactant electrodes
- Metal & Carbon electrodes
- Reference electrodes
- Conductivity measuring cells
- Pt 100/1000 resistance thermometers

Ask for our free comprehensive electrode catalogue

Aquatrode – the water electrode

The Aquatrode 6.0252.100 is a new combined pH glass electrode that has been specially designed for pH measurements in ion-deficient, poorly conducting samples such as natural surface waters or deionised water. It is suitable for a variety of applications ranging from field measurements to research and training at universities and even online pH measurements.

Buffer Solutions

Buffer solutions and ion standard solutions from Metrohm comply with the requirements of GLP and ISO 900X in exactly the same manner as our instruments.



▲ Aquatrode – the specially designed pH glass electrode for pH measurement in ion-deficient, poorly conducting samples such as natural surface water or deionised water.

Potentiometric Titration

751 GPD Titrino

751 GPD Titrino with real-time curve representation

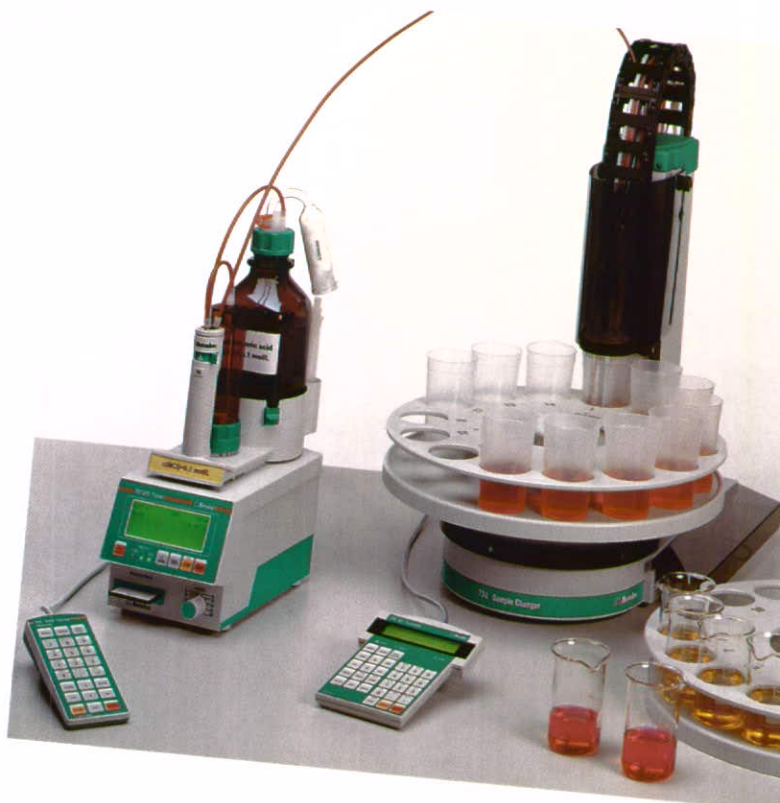
The 751 GPD Titrino with its graphics display and stirrer control by the programme is the flagship of the large Titrino family. The second RS 232C interface facilitates online communication. The screen shows the real-time curve and simplifies the dialogue. Thanks to the memory card, routine operation and method transfer are child's play. Once set up, the Titrinos require no specialised knowledge and can be operated by semi-skilled personnel.

Branch Focus

Method development and routine analysis in the following application areas:-

- Water, wastewater and environmental protection
- Chemistry, pharmaceuticals, petrochemistry
- Food stuffs, beverages
- Fertilisers, basic materials, explosives
- Power plants, energy
- Washing agents, detergents, cosmetics
- General analytical laboratories

► 751 GPD Titrino for routine work with the 730 Sample Changer



Karl Fischer Titration

758 KFD Titrino

The 758 KFD Titrino – live Karl Fischer plus outstanding features

The 758 KFD Titrino with its LCD screen and programmable stirrer control is the latest member of the Karl Fischer Titrino family.

It has many points in its favour:

- More information during the titration thanks to visual recognition of side reactions.

point titrations to two preselected pH/mV endpoints.

- Memory cards allow error-free method transfer from one KFD Titrino to another.

- The 758 KFD Titrino can control additional 685 Dosimats or 700 Dosinos and thus allows, e.g. the use of Karl Fischer reagents of different concentration or two-component reagents without re-equipment. Back titrations, solvent additions or bromine number determinations are also no problem.



- In use with the 768 KF Oven, volume/time curves provide information on the water release at elevated temperatures.
- In addition to the Karl Fischer titration, it can also handle end-

- The online balance connection eliminates input errors, the printer connection assures documentation meeting GLP/GMP requirements.
- Optimum automation with the 760 KF Sample Changer and TiNet.

756 KF Coulometer

Determination of trace amounts of water with the 756 KF Coulometer

Introducing the 756 KF Coulometer, Metrohm continues the tradition of building state-of-the-art instruments for ultra trace water analysis. Besides its extremely compact design, the 756 KF Coulometer fulfills every Karl Fischer analysis task.

Cell with or without diaphragm – the freedom of choice

The coulometric cell without diaphragm patented by Metrohm works with only one reagent and is insensitive to interferences. But as not all applications can be solved with this cell, Metrohm also offer a cell with diaphragm.

▼ Water determination right down to ppm levels – with full automation capabilities



774 Oven Sample Processor

The new concept for automated water analysis

With the 774 Oven Sample Processor, Metrohm presents a revolutionary new sample changer. It allows the application of the KF oven method to a series of liquid or solid samples. Combined with a coulometric or volumetric KF titrator, the Oven Sample Processor forms the ideal analysis system for the automatic determination of water in samples that contain interfering components or release their moisture only reluctantly.



Typical examples are:

- crude oil and oil products such as hydraulic oil, multigrade oil or used motor oil as well as
- organic amines, toners, plastics, pharmaceuticals, foodstuffs and freeze-dried products (lyophilisates).

Ion Chromatography

761 Compact IC

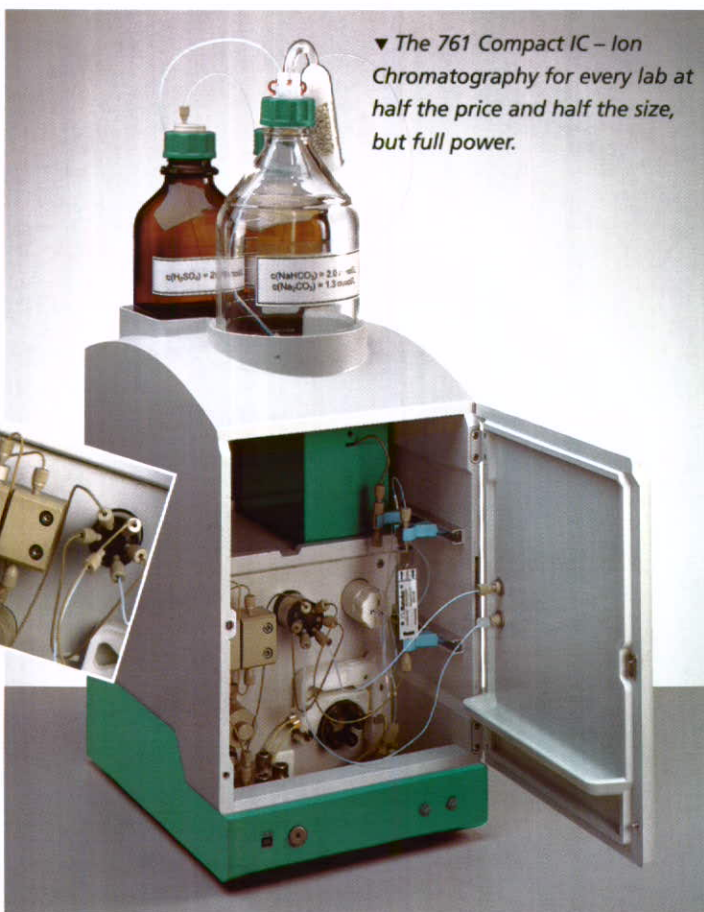
With the advent of Metrohm's revolutionary 761 Compact IC the analysis of anion and cations by ion chromatography has now become affordable for every laboratory.

- You receive as much compact IC power as you need – neither more nor less.
- The parameters for more than 300 applications are pre-stored in the system.
- You select your method and off we go.

- Update and upgrade online from the Internet.
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- Detailed information regarding performance, application and configuration
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Industries: Environmental, Pharmaceutical, Chemical, Wine, Food, Mining, Power, Semiconductor

▼ The 761 Compact IC – Ion Chromatography for every lab at half the price and half the size, but full power.



732/732 IC System

The modular IC concept for the most demanding applications

The smallest modular anion or cation system consists of three components: the low-pulsation 709 Double Piston Pump, the 733 IC separation centre and the high-performance 732 Detector.

The system convinces with its high performance and favourably priced construction. The Metrohm IC Detector detects very low concentrations (<10 ppt) of cations or anions. The 709 IC pump additionally improves the signal-to-noise ratios.

Additional modules can be added if and when the application demands it. Possible additions include the 752 IC pump for chem-

ical suppression IC, 766 IC Sample Processor for handling a large number of samples or the 754 IC Dialysis unit for sample preparation to name but a few.



▲ IC System with 709 IC Pump, 733 IC Separation Centre, 732 IC Detector and 752 IC Pump Unit

Potentiometric Titration

796 Titroprocessor

The 796 Titroprocessor expands Metrohm's range of comprehensive titration systems. These systems make short work of complex titrations and enable them to be automated. The 796 Titroprocessor has a number of features that set it apart from the competition. Thanks to the memory cards, it is extremely easy to operate and it is available with or without an integral A4 format printer.

In combination with the 717 Sample Changer, this integrated titration system can handle virtually all automation tasks in titration.

730 Sample Changer

The Titrinos and Titroprocessors have long been able to perform analyses automatically. However, large sample throughputs can only be achieved using an efficient sample changer system.

Thanks to its clearly structured keyboard, the 730 Sample Changer is easy to operate. The sequences are programmed via the straightforward dialogue in the language of your choice.



▲ 796 Titroprocessor with 717 Sample Changer and two 700 Dosinos



▲ Swing head in action

Swing head for large numbers of samples

Up to 48 samples, each of maximum volume 75 mL, can be efficiently processed with the swing head in a minimum of space.

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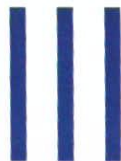
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