Alfred Bader fonds

Correspondence

Alberta, Univ. of
1994-1997

UNIVERSITY OF ALBERTA

Office of the Vice-President (Research and External Affairs)
University of Alberta
Edmonton, Alberta, Canada T6G 2J9
Tel. (403) 492-5353
FAX (403) 492-3189

To: Dr. Alfred Bader
924 East Juneau Avenue
Milwaukee, Wisconsin
FAX: 414-277-0709

From: Ron Kratochvil
Professor of Chemistry and Associate Vice-President (Research)
University of Alberta

Date: 2 June 1997

#10

Number of Pages (Including This One): 1

Dear Dr. Bader:

I have looked at some of the papers of Dr. Vladimir Havlicek and, although I cannot be certain because of the question of the relative contributions of the various authors of the papers, my opinion is that his major contributions to the work lie in the mass spectrometric characterization of the structures of compounds, and not in the synthesis. While someone who does characterization work of this kind might still call himself an organic or bioorganic chemist, in Dr. Havlick's case I would not think he could be classified as a synthetic organic chemist.

I hope this is of some help to you.

Best regards,

Ron Kratochvil

FAX FROM

DR. ALFRED BADER
Suite 622
924 East Juneau Avenue
Milwaukee, Wisconsin 53202
Telephone: 414/277-0730
Fax: 414/277-0709

May 19, 1997

TO: Professor B. Kratochvil
Chairman, Department of Chemistry
University of Alberta-Edmonton
FAX: 403/492-8231

Dear Professor Kratochvil:

May I ask you for a personal favor?

As you will see from the enclosed, Isabel and I set up an award for really good young organic or bioorganic chemists in the Czech Republic, much like the award in Canada. The description of the award is given on the enclosed.

In looking over the work of the latest recipient, Dr. Vladimir Havlicek, it is clear to me that he is an able man who has published a good deal, but to me, he seems much more like an analytical chemist, particularly interested in spectra, rather than on organic or bioorganic chemist. A few references to Dr. Havlicek's work are enclosed.

May I have your opinion whether you believe that Dr. Havlicek can indeed be considered an organic or bioorganic chemist?

With many thanks for your help and all good wishes, I remain,

Yours sincerely,

Alfred Bader

AB/cw

TRANSACTION REPORT

FOR: ALFRED BADER FINE ARTS 4142770703

SEND

RECEIVER	PAGES	NOTE
14034928231	3	OK

TRANSACTION REPORT

FOR: ALFRED RHIER FINE ARTS 4142770702

SEND

RECEIVER	PAGES	TIME
14034928231	2	JAN

Dr. Alfred Bader
924 East Juneau, Suite 622
Milwaukee, Wisconsin 53202
Phone: 414/277-0730
Fax: 414/277-0709

A Chemist Helping Chemists

June 3, 1997

Professor B. Kratochvil
Chairman, Department of Chemistry
University of Alberta
Edmonton, Alberta T6G 2G2
Canada

Dear Professor Kratochvil:

Thank you for your thoughtful fax of yesterday regarding the work of Dr. Havlicek.

There is no question in mind that Dr. havlicek has done some very interesting work, but he is just not what I or most chemists would consider an organic chemist or biochemist.

The enclosed correspondence will interest you.

With many thanks for your help and all good wishes, I remain,

Yours sincerely,

AB/cw

Enclosures

Dr. Alfred Bader
924 East Juneau, Suite 622
Milwaukee, Wisconsin 53202
Phone: 414/277-0730
Fax: 414/277-0709

A Chemist Helping Chemists

May 19, 1997

Professor B. Kratochvil
Chairman, Department of Chemistry
University of Alberta
Edmonton, Alberta T6G 2G2
Canada

Dear Professor Kratochvil:

May I ask you for a personal favor?

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May I have your opinion whether you believe that Dr. Havlicek can indeed be considered an organic or bioorganic chemist?

With many thanks for your help and all good wishes, I remain,

Yours sincerely,

AB/cw

Enclosure

Office of the Vice-President (Research and External Affairs)
University of Alberta
Edmonton, Alberta, Canada T6G 2J9
Tel. (403) 492-3333
FAX (403) 492-8138

To: Dr. Alfred Bader
414 East Juneau Avenue
Milwaukee, Wisconsin
FAX: 414-277-0709

From: Ron Kluger
Professor of Chemistry and Associate Vice-President (Research)
University of Alberta

Date: 21 May 1997

Number of Pages (Including This One): 1

Dear Dr. Bader:

I have received your request for an opinion on whether Dr. V. Havlicek can be classified as an organic or inorganic chemist. I will look into some of his papers and get an answer to you as soon as possible.

Best regards,

Ron Kluger

ALFRED BADER FINE ARTS

DR. ALFRED BADER

ESTABLISHED 1961

May 5, 1995

Via Facsimile (403/492-2997) & U.S. Mail

Mr. Ron Thomas
Editor, *Folio*
Office of Public Affairs
400 Athabasca Hall
University of Alberta
Edmonton, Alberta T6G 2E8
Canada

Dear Mr. Thomas:

Last month my wife and I spent two delightful days at the University of Alberta. We were treated wonderfully well, my five lectures on the history of chemistry, the restoration of paintings, and on how the Dutch artists looked at the Bible were well-received, and when we left Edmonton, we marvelled at that combination of excellence in chemistry, the beauty of your city and the friendliness of your people.

The only flaw we noted was in a booklet we were given, "Making Sense ... of Research at the University of Alberta." It reminded me of what is so wrong all over the western world: so much is for show rather than for substance. Millions of dollars are spent on public relations and much of this is wasted.

The glossy booklet's stated purpose is "making sense". But look at the booklet and see how it fails in some essays. For instance, it describes a mathematics professor's investigation into "linear properties and geometric phenomena of convex bodies in a space" in language that not one in a thousand educated non-mathematicians can understand.

An economics professor "explores attitudes of decision makers to government spending. His research showed that while politicians regard the budget process as important to determining government spending, public servants see political will as making the difference. 'Surprises like this are one of the reasons I enjoy research,' [he is quoted as saying]. 'You get a jolt from an unexpected result.'" I am still trying to figure out what this means.

By Appointment Only
ASTOR HOTEL SUITE 622
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Or look at the beautiful language of a religious studies professor: "The poetry and prose narrative of the Old Testament has as profound an insight into basic human questions as anything ever written. Its writers are brilliant." I wish I could write like that! And if that professor could have chosen a passage from the Bible, he might well have picked one from Amos or Isaiah, from Psalms or the Book of Ruth. But whoever did choose picked the third chapter of the Book of Malachi, one of the hardest-to-understand, non-poetic passages imaginable. That the Hebrew page has been printed upside-down seems symptomatic.

I read that David Cooke, Canada's minister of education, hired a consulting firm, "Prosebusters", to translate his ministry's "bafflegab" into English. That should not really be necessary at your great university.

Best wishes,

Agnes Baer

AB/cw

Enclosure

cc: President Rod Fraser (w/encl.)

Dr. Alfred Bader
924 East Juneau, Suite 622
Milwaukee, Wisconsin 53202
Phone: 414/277-0730
Fax: 414/277-0709

A Chemist Helping Chemists

January 19, 1996

Professor B. Kratochvil
Chairman, Department of Chemistry
University of Alberta
Edmonton, Alberta T6G 2G2
Canada

Dear Professor Kratochvil:

May I ask you for a personal favor?

During our happy days in Edmonton last April, we were helped a great deal by Dr. Jean Cooley. Unfortunately, Syncrude Canada has moved and the Canadian postal service has not seen fit to forward a letter which I wrote to her just recently.

May I impose on you to forward this to her?

With many thanks for your help and all good wishes, I remain,

Yours sincerely,

AB/cw

Enclosure

May). They can be categorized into the status quo, the obvious, or stated initiatives which are contradicted by the policies currently being pursued.

1) **Faculty renewal.** It isn't hard to predict that without faculty renewal we won't have much of a university left 10 years from now. In my department, however, there's loud gossip about who's leaving within the next two years, but merely whispers about any souls coming to replace them. We have been warned to anticipate a very significant ncrease in average teaching load. So the term 'faculty renewal' may mean something like "we'll give you one for every four or five we take away". In the retail sector this would be called misleading advertising.

2) **Exploration and development of information and telecommunications technology**. This began long before Dr Fraser arrived. Administrators (but not we who teach) tend to put much faith in the miracle that is to save us from the consequences of fewer staff. There may well be situations in which advanced technology can enhance learning (for example, I don't create a bunch of 'virtual classrooms

3) **Recruitment of outstanding students.** I wasn't aware that our University had been targeting only mediocre students up to now! We saw this platitude in *Degrees of Freedom* (1993) and in its predecessor *The Next Decade and Beyond* (1986). I'm waiting for the sequel. But haven't tuition fees doubled in the last five years and aren't they projected to double again within a few more years? My crystal ball shows quite the opposite of an influx of outstanding students. In the face of government threats to punish us severely if enrollment falls below a certain level, our administrators have only one obvious means to prevent this haemorrhage of cash: lower admission standards. I await their decisions with fearful anticipation. Ironically, in *The Next Decade and Beyond*, our leaders hinted at the necessity to reduce undergraduate enrollment here. Conventional wisdom of the time was that the University couldn't continue to offer quality programs for 28,000 students. By the time *Degrees of Freedom* appeared, the administration had made an about-face.

4) **Significantly improve the general learning environment for students.** Some major policies currently in effect are blatantly inimicable to this initiative. That's why I shake my head in disbelief to read a related quote from Dr Fraser further along in the *Folio* article. "Such a learning environment unleashes creative talent and an 'I can do it' attitude."

Dr Fraser's external initiatives were also found in the mission statements of previous administrations.

Working with government could be productive if we had one that was proud of its universities. But if we're to believe their public statements, our's seems neither to understand nor care about us. They meddle directly with our internal operations in ways that completely undermine what an outstanding university is supposed to be. For two absolutely frightening examples, read Minister (for Advanced Education and Career Development) Ady's White Paper, *New Directions for Adult Learning in Alberta*, and Gilles Cloutier's Discussion Paper, *Toward a*

Attracting professors who are international leaders in research and teaching has long been a priority at this, and indeed every, large university. But how does a policy of reducing salaries and emasculating tenure support this initiative? Don't get me wrong, our administration probably had little ability to thwart these government 'initiatives'. But couldn't they at least have the courage to acknowledge the crisis we're facing here? Instead, they talk only about 'new opportunities', 'improved means for delivering services to greater numbers', etc. As Quintilian (the Roman rhetorician) wrote, "[they] give to necessity the praise of virtue".

I couldn't suppress a smile when I saw the diagram Dr Fraser apparently uses to present his mission at public appearances. A stubby, inert block, leaning in no particular direction, and virtually unintelligible without accompanying dialogue. What an appropriate symbol for these initiatives.

Reuben Kaufman
Professor of Biological Sciences

'Making Sense ...' 'the only flaw' in his visit to Edmonton, guest lecturer says

Last month (April) my wife and I spent two delightful days at the University of Alberta. We were treated wonderfully well, my five lectures on the history of chemistry, the restoration of paintings, and on how the Dutch artists looked at the Bible were well-received, and when we left Edmonton, we marvelled at that combination of excellence in chemistry, the beauty of your city and the friendliness of your people.

The only flaw we noted was in a booklet we were given, "Making Sense ... of Research at the University of Alberta." It reminded me of what is so wrong all over the western world: so much is for show rather than substance. Millions of dollars are spent on public relations and much of this is wasted.

The glossy booklet's stated purpose is "making sense". But look at the booklet and see how it fails in some essays. For instance, it describes a mathematics professor's investigation into "linear properties and geometric phenomena of convex bodies in a space" in language that not one in a thousand educated nonmathematicians can understand.

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I read that David Cooke, Canada's minister of education, hired a consulting firm, "Prosebusters", to translate his ministry's "bafflegab" into English. That should not really be necessary at your great university.

Alfred Bader
Aldrich Chemical Company

Editor's note: Dr Bader is co-founder of the Aldrich Chemical Company and an internationally-known collector of 17th century Dutch and Flemish paintings. He was in Edmonton 10 and 11 April to deliver the 75th Chemical Society of Canada Conference lectures.

University of Alberta

Dr. Alfred Bader
924 East Juneau, Suite 622
Milwaukee, Wisconsin 53202
Phone: 414/277-0730
Fax: 414/277-0709

A Chemist Helping Chemists

November 1, 1995

Ms. Margaret St. Denis
Executive Assistant to Dr. Roderick D. Fraser
University of Alberta
3-1 University Hall
Edmonton, Alberta T6G 2J9
Canada

Dear Ms. St. Denis:

Please accept Isabel's and my sincere thanks to you and Dr. Fraser for sending us that beautiful catalogue, *"Rubens to Picasso"*.

We wish that we could be in Edmonton to see this, but that, unfortunately, is just not possible.

With all good wishes, I remain,

Yours sincerely,

AB/cw

University of Alberta
Edmonton

Canada T6G 2J9

Dr. Roderick D. Fraser
President and Vice-Chancellor

3-1 University Hall, Telephone: (403) 492-3212
Fax: (403) 492-9265
E-mail: rod.fraser@ualberta.ca

October 23, 1995

Dr. Alfred Bader,
2961 North Shepard Avenue,
Milwaukee,
WISCONSIN 53211,
U.S.A.

Dear Dr. Bader:

Dr. Fraser is in Asia at the present, but before he left he requested that a copy of the Rubens to Picasso catalogue be sent to you as a keepsake.

I am delighted to report that the Exhibition itself has been a tremendous success, such that the closing date is extended to November 5, 1995. If you are considering visiting Edmonton sometime before this date, I would be happy to make arrangements for you to see the Exhibition. Please feel free to contact me at (403) 492-9645 if I can be of any assistance.

Yours sincerely,

Margaret St. Denis.

Marg St. Denis,
Executive Assistant to
Dr. Roderick D. Fraser,
President and Vice-Chancellor.

MSt.D:ler

Enc.

ALFRED BADER FINE ARTS

DR. ALFRED BADER

ESTABLISHED 1961

July 18, 1995

Dr. Roderick Fraser
President and Vice-Chancellor
University of Alberta
3-1 University Hall
Edmonton, Alberta T6G 2J9
Canada

Dear Dr. Fraser:

Thank you for your letter dated June 28th to Dr. Bader and its enclosures.

Dr. Bader is in England until the end of the month and will respond personally upon his return to Milwaukee.

Best wishes,

Cheryl Weiss

Cheryl Weiss
Office Manager

By Appointment Only
ASTOR HOTEL SUITE 622
924 EAST JUNEAU AVENUE
MILWAUKEE WISCONSIN USA 53202
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ALFRED BADER FINE ARTS

DR. ALFRED BADER

ESTABLISHED 1961

August 1, 1995

Dr. Roderick Fraser
President and Vice-Chancellor
University of Alberta
3-1 University Hall
Edmonton, Alberta T6G 2J9
Canada

Dear Rod:

Thank you for your gracious letter of June 28th. Please don't mind the long delay in my reply, but I was in Europe until last Saturday.

We were treated so wonderfully well at your university, but unfortunately our schedule for the rest of the year is so very full that we cannot come again this autumn.

Best wishes, as always,

AB/cw

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President and Vice-Chancellor

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Fax: (403) 492-9265
E-mail: rod.fraser@ualberta.ca

June 28 1995

Dr. Alfred Bader
Astor Hotel, Suite 622
924 East Juneau Avenue
Milwaukee, Wisconsin 53202
U.S.A.

Dear Alfred:

Thank you for your May 5th letter. I was very pleased to have a long visit with you and Isabel, and delighted that you had the time to view our costume collection.

I also received your letter to the editor of Folio concerning the "Making Sense" booklet. The letter has now been published in Folio, and I enclose a copy. For my own part, I was very pleased with the publication of "Research Makes Sense." We were the first university in Canada to make the tough decisions on identifying our areas of research excellence, and the first to make the results public. I want this university to be an institution with the best students, the best scholars and the best facilities. Selecting--and celebrating--our areas of research excellence was one step on that pathway. In the same vein, we will strive for 100% acccuracy and plainer language in our next draft.

Alfred, now to another topic. You and Isabel may be interested in two rather unique events which will occur this Fall at the University of Alberta as described in the attached article from the June 13, 1995 edition of the Edmonton Journal, and in the attached edition of Folio. The "Rubens to Picasso: Four Centuries of Master Drawings" exhibit has us all very excited. The majority of works to be on display come from private collections whose owners wish to remain anonymous. We will be hosting special opening nights on September 13, 14 and 15 and the exhibit itself runs from September 16 to October 29. I would be very pleased to host you and Isabel, either at one of the openings, or at a private showing.

... 2.

Dr. Victor Chan, of our Department of Art and Design, has curated this exhibition while the Chair of the department, Dr. Desmond Rochfort, has been the guiding hand behind the funding for the exhibit. Dr. Rochfort has also arranged for the visit of Dr. Walter Persegati, the former Secretary General and Treasurer of the Vatican Museums, and Director of the Vatican Museums for 19 years, to visit. His lectures are on October 2 and 3 and the University will host a small dinner for him on Sunday, October 1. Again, I would be delighted to host you and Isabel.

Sincerely,

Dr. Roderick D. Fraser
President and Vice-Chancellor

RDF/cbd
Attachments

cc: Dr. Desmond Rochfort
Chair, Department of Art and Design

Japan Is Not The Problem. We're Committing Hari-Kari!*

A Generalized Theory of Pollution

R.U. Lemieux, FCIC
Professor Emeritus in Chemistry, University of Alberta, Edmonton

Concern with the deteriorating environment is expressed daily in newspapers and newscasts. Certainly, pollution of the atmosphere, waters and soil has become a very important concern. It appears that the chemical industry is widely felt to be the main cause, with the chemists and chemical engineers the chief culprits – not of course the owners and consumers. The simple word "chemical" now traumatizes many people. The old DuPont adage, "Better living through chemistry", is now considered by many to be a monstrous idea – although people, especially those privileged to live in regions where chemcial industries are most advanced, have never been healthier, better educated, better housed, better travelled and longer lived with more access to cultural benefits than any in history. It is an established fact that to have reached these laudable goals we are using and polluting our planet irreversibly at observable rates. It is a problem inherent to the modern consumer society and one which the scientists identified over 60 years ago but the depression years, wars, and recoveries from wars' devastation were not times that provided much incentive for remedial action. Clearly, we must act now to decrease the rates of pollution and exhaustion of our nonrenewable resources and bring these down to steady states that are compatible with an acceptable standard of living for the about five billion people that now populate our planet.

There appears to be little appreciation of the fact that the present state of pollution is the price that inevitably had to be paid, under the prevailing circumstances to enjoy standards of living which have increased immensely in recent years for virtually all of the people on our planet. The cost, in terms of pollution, to better man's lot on earth was higher than it might have been. However, humanity naturally progresses by reacting to the mistakes of the past and, normally, makes changes that best appeal to the politics of the time. This in itself represents a serious problem since the issues have become highly technical and only poorly understood by the majority of the electorate that, for this reason, is rather easily misled.

Pollution of our waters and soil, acid rain, over-cultivation, the exhaustion of nonrenewable resources, and perhaps even the greenhouse effect, are serious matters with which we must deal as well as we can and with high priority. This is widely recognized and indeed much meaningful remedial action has already been taken. However, the making of political footballs from these critically important but extremely technical problems must be avoided. This is absolutely necessary since the scientific literacy of the present-day voting public is much too low to serve as a reliably safe base for reaching wise decisions as to what can and should be done about pollution. Indeed, the electorate already appears to be in a highly disturbed state of mind over pollution, sometimes bordering on hysteria and steeped in superstition, a condition which is daily reflected in our newspapers and television.

The making of political footballs from these critically important but extremely technical problems must be avoided.

Cults have developed, extending to the occult, with an assortment of high priests – some promoted and maintained at public expense that oppose our modern civilization in manners that appear bent on tearing it apart and, most unfortunately, these prophets of doom are gaining support by alarmingly large numbers of people of very limited perspective. These are dangerous developments under any circumstance but particularly hazardous in our modern times when people are bombarded from all directions by propaganda that appears coordinated with our networks of communication, which are themselves, in as serious a state of pollution as is that of the environment.

If there was ever any time for qualified people to act calmly on the basis of established factual knowledge and to deliberately and unemotionally deal with the situation, it is now that analytical chemistry in concert with the biological and medical sciences have provided us with the tools that may well enable us to properly assess and address the problems and for industry to provide acceptable solutions based in the technologies which best meet the complex mixes of parameters that are involved, including the rapidly developing biotechnologies. However, rather than concentrating on educating the public toward a proper understanding of the problems associated with the maintenance of a healthy environment, our newspapers report polls, and publish items such as the concerns of teenagers on such tremendously complex and far-reaching subjects as atomic energy, solar energy, agricultural chemicals, food preservation, etc. For example, an Angus-Reid poll indicated that grade eight students see the nuclear industry as careless and environmentally dangerous. Surely, adults must be interested in what these young people are thinking, but that this is important only in the context of learning how their minds are being programmed in their schools and by the news media. Obviously, 13 to 14-year-olds are now prepared to hold fixed opinions on matters they basically do not and cannot understand. This kind of mentality, I think, is at the roots of our problem and represents a form of pollution that unfortunately extends throughout our society.

Analytical chemistry in concert with the biological and medical sciences have provided the tools that may enable us to assess and address the problems and for industry to provide acceptable solutions.

Proper scientific training teaches one to separate what you think you know from what you know you don't know – in other words to separate fact from either the unknown or what is hypothesis or fiction and surely from what is merely hearsay. In other words, it has a powerful humbling effect. Society as a whole, must develop this habit of thought if we are to avoid catastrophe and further develop and improve the welfare of man on earth. The objective must be to increase the proportion of voters in a democracy that vote according to informed

*Adapted from the 17th Le Sueur Memorial Lecture presented in Ottawa, November 15, 1989.

and objective analyses based on the available facts rather than family tradition, opportunity for personal gain or simple bias against, and distrust of, expert opinion even if it is certified to be expert by their own governments and universities.

Of course, changes toward a more properly informed electorate will be difficult to achieve for a wide number of reasons. Perhaps the main obstacle will be the news media which are far more interested in providing the opinions of scientifically illiterate editors and in entertainment rather than improving the reader's appreciation of the complexities involved. I see little promise for change in this regard since the popular styles of education are more and more themselves becoming just other forms of entertainment.

Pressures continue to exist for the universities to lower their academic standards in order to meet the always lowering standards of the high schools in the basic academic subjects of English, history, mathematics and the sciences. But more serious is the continuation of the training of our children to think that the highest forms of thought are, as do lawyers or clerics, to employ logic based in assumptions and in the context of circumstantial evidence and emotion, as is done in sermons and debates, in order to sway opinion toward preconceived goals. Instead, we must teach the young to reason in the frame of mind that has become essential to a highly technological age; that is, to always exercise great care to separate conjecture and hypothesis from what is truly known as a reproducible experimental fact and in the absence of such knowledge to keep an open mind. In other words, to practice the scientific method of inquiry in our daily lives; that method of thinking which liberated man from slavery and made democracy a viable form of government. In a recent speech, Lech Walesa said, "the higher the technology, the greater the freedom". I could not agree more. Like him, in my youth I experienced the brutality of life in a low technology environment.

Proper scientific training teaches one to separate what you think you know from what you know you don't know.

The root cause of our polluted condition is still a highly reactionary stance of our educationalists toward treating science as a cultural subject. I am not aware that the resistance to change is based on any well thought out reason. Instead, it seems related to a mixture of cultural traditions and intellectual laziness coupled to a virtually complete ignorance of what science really represents and a stubborn dedication not to make an effort to learn. Many university students, if they have a chance, avoid science subjects like the plague. Such dedication to ignorance must have been seeded somewhere.

Superficial notions such as those largely expressed on television talk shows are attractive to intellectually lazy people and these abound in a society where everyone has the right and freedom to hold opinions on any and all subjects and does. This is a democratic right which must be maintained. But that these loose notions become broadcast uncritically by the news media to the extent that they may and do assume an aura of importance and authenticity represents another kind of problem. The propagandists take advantage of this and great hoaxes or misconceptions are generated including those about the Love Canal, the hazards of PCBs and dioxins to the point of hysteria. Our politics go accordingly with the "grease going to the squeaking wheel" and vast sums of money are wasted such as shipping PCBs to Britain and then back with great public outcry when these could have been safely disposed of here in Canada in the first instance. The list of such mindless actions grows every day.

It seems that expertise has become equated with prejudice and therefore not a reliable base for planning and action.

It seems that expertise has become equated with prejudice and therefore not a reliable base for planning and action. This anti-intellectual attitude certainly relieves stress and well promotes ego building and is obviously popular with youth who now must be heard on all subjects and in a real sense obeyed both because they are numerous as voters and may become belligerent. In fact, the major changes in our universities over the past 20 years have not come from the professors, but, instead, from the students' demands. In my day, the professors were the university – now the learners want to be the teachers. This attitude for student power must have developed in the modern high school. To compound this problem, their thoughts and concerns in those areas where they know about as much as they know about brain surgery are given prominent notice in the press.

We must teach the young to reason in the frame of mind that has become essential to a highly technological age – to separate conjecture and hypothesis from reproducible experimental fact.

In 1985, the American Association for the Advancement of Science (AAAS) launched an education reform project in response to national alarm that children are basically ignorant of science and technology. To cite one example, in an international comparison, American 13-year olds scored last in mathematics and tied two Canadian provinces for last place in science. Out of the panic caused by this discovery came a 217-page document by AAAS staff and several hundred educators and a few scientists as consultants and titled, "Science for All Americans." Dr. C.E. Finn, Professor of Education at Vanderbilt University published a critique of this document in the *American Spectator*, (August 1989). He points out that experts often forget what it is like actually not to know mathematics and science and can easily become attracted to books which have to do with learning about science rather than involvement with science. This of course opens the doors to the educationalists who do not wish to go to the trouble of really learning science. As the result, scientific curricula are created which offer historical perspectives and interconnections between scientific facts for which the student has absolutely no proper appreciation. As Professor Finn puts it, "It is like teaching sophisticated techniques of literary analysis to individuals who have never read a great novel, poem or play".

We are up to our necks and drowning in prejudices, misinformation and superstitions which I call pollution of the mind. Polluted mentalities are bankrupting our human relations and polluted government is bankrupting our economy. It is noteworthy in this regard that the environmental activists are reported to be mainly under 35 and nearly all are socialists. This is why the Swiss refer to the so-called Green Revolution as the Watermelon Revolution – green on the outside but red on the inside.

The approach that offers most hope for long-term recovery is in the education of our children up to and through high school. To be effective we must first, I think, be able as adults to shed ourselves of the prejudices about science both as to not being compatible with religious principles and being a mere tool for specialists – something like a dentist's drill which can be useful but only to the dentist. Instead, the focus must be on the fact that it is the body of scientific knowledge that has produced modern techlologies which have become the dominant feature of life in the 20th century and its role must inevitably increase in the 21st century as the pool of scientific knowledge will surely increase.

A high profile must be granted in our schools to the cultural aspects of science. The scientific tradition for problem solving that requires hard and documented facts as the basis for drawing conclusions and making predictions should be ingrained into our children at an early age. To learn to think properly for yourself is not indoctrination. Thought control as we find exercised by many agencies throughout our society is antiscience and must be eliminated if we are not to commit social hari-kari. It is too late to start acquainting students with proper habits of thought in the senior years of high school or at university. Exposure to the natural sciences and how scientists work should begin in grammar schools and be emphasized throughout junior and high school. The kind of science survey courses that some wish for university arts students must be opposed since these could lead adults to believe that they actually know science when, in fact, all they know is something about science, a subject about which they remain ignorant. Such courses may be useful if presented at the early formative years but always when an appreciation of the underlying scientific principles are stressed and understood. Thus, the person would be equipped intellectually to live at ease and with dignity in the 21st century amongst all the products and rewards which accrue to societies based in high technologies.

Pollution and our ability to cope with it, are major concerns. However, it is important to keep in mind that there are forms of pollution that are far more dangerous than pollution of our physical environment and which are not receiving the attention required for the prevention of serious deterioration of our society and its human relations. I always felt that my main duty as a professor was to start students thinking for themselves. My best hope is that I have done so.

R.U. Lemieux, FCIC, is one of Canada's most brilliant and productive scientists. He has achieved eminence as a pioneering researcher, teacher, entrepreneur and leader committed to the value of science. His research has contributed to fundamental advances to organic chemistry and to our understanding of the human immune system. Three companies have been founded to pursue the practical applications of his work.

Dr. Lemieux was born in Lac LaBiche, Alberta and after receiving his BSc from the University of Alberta, he went on to earn a PhD from McGill. After research and teaching at Ohio State University, University of Saskatchewan and the National Research Council, he joined the University of Ottawa as vice-dean of the Faculty of Pure and Applied Science. He returned to the University of Alberta in 1961, where he was appointed University Professor in 1981.

In addition to the LeSueur Award his numerous awards and honors include the first Canada Gold Medal for Science and Engineering, over a dozen honorary degrees, and the King Faisal International Prize in Science.

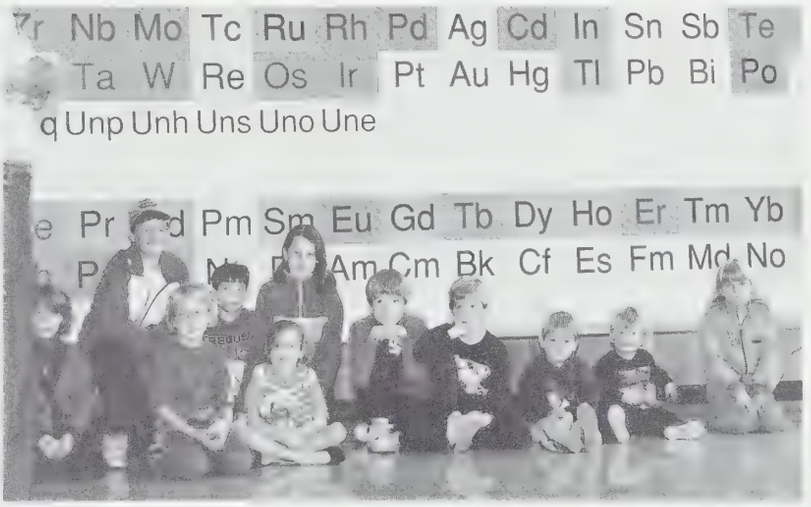
NCW Festivities

continued from p. 16

Victoria on the weekend of October 19 and 20. With the help of the University Public Relations Department, the event, organized by Peter Wan, MCIC, and Ian Blazey, Administrative Officer of the Chemistry Department, was advertised in the local newspaper and numerous other outlets.

Members of the Department gave up their weekend to help out by setting up engaging demos, interesting experiments, acting as guides and even making coffee and blowing up helium balloons for the kids. The popularity of the open house was enhanced by the appearance of a photo of a young girl intensely absorbed by the orange phosphorescence of some manganese crystals in the "Fun-with-Light" lab on the front page of the Saturday edition of the Times-Columnist. This free advertisement attracted even more people on the Sunday and the Open House was completely overwhelmed! Well over 1500 people attended during the two days.

The most popular event was by far Dr. Zonk's (also known as Reg Mitchell, FCIC) Chemistry Magic Show. Complimentary tickets for the three scheduled shows went quickly and many visitors were visibly disappointed in being turned away by the lack of seating. Some other popular events included: tours of Terry Gough's, MCIC, laser laboratory; a glass blowing demo given by Dave Searle; Graham Branton's, MCIC, "Chemistry-for-Kids" show and David Harrington's, MCIC, "World at 77K" demo. Hands-on demonstrations were very popular with the public, especially David Berry's, MCIC, chromatographic separation of ink colours.



School children pose under the giant periodic table (designed by Karel Hartman) at the University of Victoria's Chemistry Open House.

It was our unanimous conclusion that a large percentage of the public is keen on coming to the university to learn more about chemistry and that an open house is by far the best way for communicating the central role chemistry plays in our society.

Peter Wan, MCIC

Meetings / Rencontres

Edmonton Update

"Why you'll never see Capillary Zone Electrophoresis on *The National*". Jay Ingram, host of the CBC radio program *Quirks and Quarks*, kicks off the **75th Canadian Chemical Conference and Exhibition** with the answer to that question. Plan to be there. The conference will be held **May 31-June 4, 1992** in the Edmonton Convention Centre.

Have you made your travel plans yet? Canadian Airlines International is the official conference airline. Obtain a minimum of 15% discount on regular fares and the lowest available fare at time of booking, by using the convention toll free number 1-800-665-5554 and quoting Convention No. 1183 when you or your travel agent book your flight.

See the November/December 1991 issue of *Canadian Chemical News* (pp. 25-28) for a list of symposia. Just before or after the conference you may wish to participate in a workshop, a short course or a tour of the Canadian Rockies; details are found in the January 1992 issue (pp.23-24). Watch for the preliminary program and conference registration form in next month's (March) issue. Plan now to enjoy a taste of Western Canadian hospitality by registering for the highlight of the social program – the conference barbecue and outing to be held at historic Fort Edmonton Park.

Any questions? Contact: William A.G. Graham, FCIC, Conference Chair, 75th Canadian Chemical Conference, Department of Chemistry, University of Alberta, Edmonton, T6G 2G2; Tel: 403-492-3254; Fax: 403-492-8231.

Globe'92, the second in a biennial series of international trade fairs and conferences which focus on business and the environment, will take place in Vancouver from **March 16-20, 1992**. Conference plenary speakers include: The Honourable John Fraser, Speaker of the House of Commons and Chairman of the Globe'92 International Advisory Board; Gro Harlem Brundtland, Prime Minister of Norway, Chair, World Commission on Environment and Development and Honourary Patron Globe'92; and Frank Popoff, Chairman and CEO Dow Chemical International.

One of 12 conference streams will focus on the chemical, mining, plastics and cement industries. Key speakers will be Stephen Van Houten, President, Canadian Manufacturing Association; Dennis Wilcock, President and CEO, Dow Canada; and Keith Hendrick, Chairman, Noranda Minerals.

For more information, contact: Globe'92, Suite 601, 535 Thurlow St., Vancouver, V6E 3L6; Tel: 604-666-8020; Fax: 604-666-8123.

Call for Papers

September 19-24, 1993. 12th International Corrosion Congress - Corrosion Control for Low Cost Reliability, Houston, Texas. A 500 to 700 word abstract, written in English, will be required along ?with the completed conference form and must be received by **May 1, 1992**. Contact: 12th ICC, P.O. Box 218340, Houston, TX 77218-8340, USA; Tel: 713-492-0535; Fax: 713-492-8254; Telex: 792310 NACE HOU.

Courses

April 27-May 1, 1992. 19th Intensive Workshop on Industrial Hygiene, University of Toronto, Toronto. Contact: Julie Mendonça, Department of Chemical Engineering and Applied Chemistry, University of Toronto, 200 College Street, Toronto, M5S 1A4; Tel: 416-978-6615; Fax: 416-978-8605.

September 28-October 2, 1992. 20th Intensive Workshop on Industrial Hygiene, University of Toronto, Toronto. Contact: Julie Mendonça, Department of Chemical Engineering and Applied Chemistry, University of Toronto, 200 College Street, Toronto, M5S 1A4; Tel: 416-978-6615; Fax: 416-978-8605.

Of Special Interest

May 25-28, 1992. 12th Canadian Symposium on Catalysis, Banff, Alta. Sponsored by the Catalysis Division of The Chemical Institute of Canada. Contact: Dr. Alan Sanger, General Chairman, 12th CSC, Coal and Hydrocarbon Processing, Alberta Research Council, P.O. Bag 1310, Devon, Alta., T0C 1E0, 403-987-8166; Fax: 403-987-5280 or Dr. Emerson Sanford, Program Chair, 12th CSC, Syncrude Research, P.O. Box 5790, Station L, 10120 - 17th Street, Edmonton, Alta., T6G 4G3; Tel: 403-464-8462; Fax: 403-464-8405.

October 18-21, 1992. 42nd Annual Conference of the Canadian Society for Chemical Engineering, Hilton Hotel, Toronto. Contact: Dr. N.E. Anderson, Technical Program Co-Chairman, Kilborn Inc., 2200 Lake Shore Blvd. W., Toronto, M8V 1A4; Fax: 416-231-5356.

IUPAC-Sponsored

April 22-24, 1992. Organic Chemistry: Its Language and Its State of the Art, University of Geneva, Geneva, Switzerland. Contact: Dr. M. Volkan KisakGrek, Editor, Helvetica Chimica Acta, Postfach 313, CH-4010 Basel, Switzerland.

May 15-19, 1992. International Symposium on Calorimetry and Thermodynamics of Biological Processes - 8th ISBC Conference, Gullmarsstrand Conference Centre, G?teborg-Gullmarsstrand, Sweden. Contact: 8th ISBC, Department of General and Marine Microbiology, Carl Skottsbergs Gata 22, S-413 19 Göteborg, Sweden; Tel: 46-31-418700; Fax: 46-31-826790.

June 7-12, 1992. Third International Conference on Heteroatom Chemistry - ICHAC-3, Palazzo del Turismo, Riccione, Italy. Contact: Prof. A. Fava, C.N.R.-I.Co.C.E.A., Via della Chimica, 8, 1-40064 Ozzano Emilia - BO, Italy.

June 28-July 2, 1992. Ninth International Conference on Organic Synthesis, ICOS 92, University of Québec at Montréal, Montréal. Contact: J.C. Richer, Département de chimie, Université de Montréal, C.P. 6128, Succ. A, Montréal, PQ, H3C 3J7.

June 29-July 3, 1992. 2nd International Symposium on Surface Chemistry, Adsorption and Chromatography, Moscow, USSR. Contact: Dr. Lyudmila Kolomiets, Institute of Physical Chemistry, Leninskii Prospect 31, 117915, Moscow, USSR.

July 8-10, 1992. 5th International Symposium on Solubility Phenomena, Moscow, USSR. Contact: Dr. K.G. Kravchuk, Symposium Secretary, Fifth International Symposium on Solubility Phenomena, N.S. Kurnakov Institute of General and Inorganic Chemistry, USSR Academy of Sciences, Leninsky Prospect, 31, Moscow 117907, USSR; Fax: 7-095-234-1279.

Dr. Alfred Bader
2961 North Shepard Avenue
Milwaukee, Wisconsin 53211

November 9, 1994

Professor R. S. Brown
Department of Chemistry
E3-44 Chemistry Building
University of Alberta
Edmonton, Alberta
Canada T6G 2G2

Dear Professor Brown:

Isabel and I have just returned from a week in Canada which included three happy days at Queen's. Now I have to thank you for your very thoughtful letter of October 17th.

I talked to many academics in the Chemistry Department, and all of them really look forward to your coming to Queen's, and Isabel and I much look forward to meeting you there on our next visit, or at the next CIC meeting in May.

All good wishes.

Sincerely,

(Dictated by Dr. Bader and
signed in his absence)

University of Alberta
Edmonton
Canada T6G 2G2

Department of Chemistry
Faculty of Science
E3-44 Chemistry Bldg., Tel. (403) 492-3254 Fax (403) 492-8231

October 17, 1994

Dr. Alfred Bader
Astor Hotel, Suite 622
924 East Juneau Avenue
MILWAUKEE, Wisconsin
U.S.A. 53202

Dear Dr. Bader:

I regret not being able to meet you in person during your visit to Queen's, however my duties here do not allow me to leave the University of Alberta at this time. I hope this note will serve as a "next best" option.

First, let me express to you my enthusiasm for what I see as some exciting building years for the Department of Chemistry at Queen's University. I am confident that the current administration is committed to providing the support and environment for transforming that Department into a leading one in Canada, and I am pleased to be part of it. Even though I am not physically on board until the late spring of 1995, there are a number of initiatives that the Department has enthusiastically undertaken in my absence. The first is a self-study to understand the current state of affairs of the Department with respect to human resources, facilities, teaching and research. I hope we have this completed by the late Fall of 1994, after which a blue-print can be made to guide the future direction of the Department. Second, a complete study of the space situation of the Department is underway in the capable hands of Dr. Brian Hunter. On the basis of this, the Department will prepare a set of plans for refurbishing the Department facilities and bringing them up to a state of the art condition. The projected time line for presenting this to the Dean of Arts and Sciences will be April-June of 1995.

Of course you are interested in knowing our plans concerning the filling of the Bader Chair. We have had some discussions concerning a generic description of the sort of person we would like to assume this honoured position. That individual would have a highly respected international profile in research of an organic/bioorganic nature, be prepared to assume a leadership and mentoring role within the Department,

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and have outstanding teaching skills. Several names have been brought up, and of course we are interested in expanding the list by inviting input from respected sources. Our current feeling is that a person of this calibre cannot be formally approached until the Department has a clear idea of its direction and the facilities that would be available to attract the candidate.

I hope this brief note gives you some idea of the initiatives we have begun. Our goal is clear and unwavering; namely to bring the Department of Chemistry into the forefront as a Nationally ranked facility in chemical research and training. I would welcome your comments should you wish.

Sincerely,

R.S. Brown

RSB:lf

REPRINTED FROM: FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY JOURNAL, MARCH, 1994

Ray Lemieux

EDITORIAL

Toward Enhanced Symbiosis of Chemistry and Biology

The invitation that I comment on the bridging of chemistry and biology could appear somewhat anachronistic since the gap began to close at least as long ago as Berzelius in the 18th century, when it was already appreciated that chemistry can contribute to the improvement of medical care. In the following century it was demonstrated, particularly by the efforts of such giants as Pasteur, Liebig, and Fischer, that biological phenomena are the result of complex series of coordinated enzyme-catalyzed chemical reactions. The advent of synthetic chemistry in the 19th century, by causing a veritable explosion of man-made chemicals, led to the characterization of several million unnatural substances with the result that organic chemistry lost its original meaning and became associated with the physical sciences. Meanwhile, the 20th century witnessed the evolution of molecular biology—the formal wedding of chemistry with biology—giving birth to the production of natural compounds with artificial forms of life in chemical reactors. The whole gamut has been run and biology is now fully recognized as chemistry in action.

The theories and methods of chemistry played a major role in this scientific revolution, as is evident from the large number of chemists who, for contributions basic to biology, won Nobel Prizes both in chemistry and in physiology or medicine. The following list of the awards, in chemistry alone, clearly identifies the contributions to be at the very roots of modern molecular biology: 1902, E. Fischer, carbohydrates; 1915, R.M. Wilstätter, chlorophyll; 1928, H.O. Wieland, bile acids, and A.O.R. Windaus, steroids; 1929, A. Harden and H.K.A.S. von Euler-Chelpin, fermentation; 1930, H. Fischer, haemin; 1937, W.N. Haworth, vitamin C, and P. Karrer, vitamins A and B2; 1939, R. Kühn, carotenoids and vitamins, A.F.J. Butenandt, sex hormones, and L. Ruzicka, terpenes; 1946, J.B. Sumner, crystalline enzymes, J.H. Northrup and M.W. Stanley, pure virus protein; 1947, R. Robinson, alkaloids; 1948, A.W.K. Tiselius, serum proteins; 1955, V. du Vigneaud, polypeptide hormone; 1957, A.R. Todd, nucleotides; 1958, F. Sanger, insulin; 1961, M. Calvin, carbon dioxide assimilation in plants; 1962, M.F. Perutz and J.C. Kendrew, protein structure; 1970, L.F. Leloir, sugar nucleotides; 1972, C.B. Anfinsen, S. Moore and W.H. Stein, active site of ribonuclease; 1975, J.W. Cornforth, enzyme catalysis; 1978, P.D. Mitchell, biological energy transfer; 1980, P. Berg, recombinant DNA, and W. Gilbert and F. Sanger, base sequences in nucleic acids; 1982, A. Klug, nucleic acid-protein complexes; 1984, R.B. Merrifield, solid-phase protein synthesis; 1988, J. Deisenhofer, R. Huber, and H. Michel, structure of a photosynthetic center; 1989, S. Altman and T. Cech, catalysis by RNA; 1993, M. Smith and K. Mullis, site-specific mutagenesis. These magnificent successes of the past cause ever-increasing pressures for more in the faith that improvements in the life sciences will assist humankind in achieving ever higher standards of health and contentment.

An important source of the pressures for greater involvement by chemists in studies of biological systems emanates from granting agencies in attempts to better serve public will. These aspirations are in turn strongly felt within the chemical community where they have become a constant preoccupation. As my colleague, Jack Edward, at McGill University has recently put it, "Most organic chemists know of stars in their field who confide that while their skill in molecular acrobatics gives them great satisfaction in dazzling their audience of other organic chemists, the truly important scientific challenges of today are in molecular biology and next year . . . five years from now . . . sometime, they will apply their skills in this field. We wait, and nothing happens."

In industry, team work is a job condition and both intra- and interdisciplinary research is the rule. In contrast, the university researcher is basically an entrepreneur in charge of his own team for the investigation of a subject for which he managed to win financial support. The trend appears to be toward research of biological significance, but most often in the absence of active collaboration with biologists. That many of the leading organic chemists are reluctant to work with biologists in a thoroughly symbiotic relationship is not surprising. Most of the reasons are quite obvious but do not appear to have received the attention these deserve.

The practice of organic chemistry has become a very broad and highly sophisticated special branch of science. Effective participation in the field increasingly depends on specialization coupled to strong *intra*disciplinary collaborations with experts in spectroscopic, computational, and theoretical branches of chemistry, not to mention kineticists, thermodynamicists, etc. Thus, there is little cause to deliberate on the opportunities for *inter*disciplinary collaborations. Furthermore, their basic mandate is to remain successful in funding in order to keep organic chemistry per se strong at the best world standards.

Anyone who has served on national grant selection committees knows that the funds are always inadequate and the competition fierce. The focus is more on finding reasons not to fund rather than to support. Therefore, there is good cause to fear the loss of identity in coauthorship of publications with multidisciplinary teams in journals that most chemists never read. The loss of identity is clearly perilous in the publish-or-perish economy of university research. The estrangement from the former colleagues also presents a problem especially in view of the exclusivity of strongly entrenched club-like environments that inevitably develop within disciplines. The chemist is also put off from embracing collaborations with biologists since often his role is that of a provisioner of commercially unavailable compounds, the preparation of which required little ingenuity and likely not acceptable for publication in a prestigious journal. This becomes particularly hazardous when the cost of the service rendered represents a substantial portion of the financial support for the research and the contribution is merely acknowledged in a footnote.

I submit that a highly effective symbiosis will best evolve when biologists actively seek collaborations with chemists by making their needs known to the chemical community. I consequently recommend the establishment of lines of communication between the biological and physical sciences that focus on the complementarity of activities that present the opportunities for research collaborations rather than past accomplishments.

Raymond U. Lemieux

University Professor Emeritus
Department of Chemistry
University of Alberta
Edmonton, Alberta
Canada T6G 2G2

With all good wishes
Ray Lemieux

ADVANCES IN CARBOHYDRATE CHEMISTRY AND BIOCHEMISTRY, VOL. 50

HOW EMIL FISCHER WAS LED TO THE LOCK AND KEY CONCEPT FOR ENZYME SPECIFICITY[1]

BY RAYMOND U. LEMIEUX AND ULRIKE SPOHR

Department of Chemistry, University of Alberta, Edmonton, Alberta T6G 2G2, Canada

I. INTRODUCTION

Emil Fischer's genius was in the identification of important areas for research in the field of organic chemistry, which, as the name implies, was concerned with compounds derived from living organisms. Once the project was identified and engaged, he brought unsurpassed creativity for successful experimental involvement and logical interpretation of the results. He seemed to have had a global view of natural science, and his driving interest was to contribute to an understanding of the chemical processes of living organisms. He is quoted (1) as stating, in a letter to his mentor, Adolf Baeyer, that he wished to synthesize the first "artificial ferment" (enzyme activity) and that, with the achievement of this goal, he would consider his mission in life accomplished. Later, in the course of his research on polypeptides, he realized that he would not reach this goal. He, of course, could have no idea of what the synthesis of an enzyme would involve.

Our assessment of the literature suggests that Fischer's motivation to enter the field of carbohydrate chemistry was the realization that knowledge of the relative configurations of the asymmetric carbon atoms of the sugars was an essential stepping stone for research in the biological systems, that area of inquiry central to his interest in a scientific career. His brilliant success in meeting this challenge has rightly earned him the title of father of carbohydrate chemistry. This chapter demonstrates that a strong claim can be made that he is also a leading pioneer of biological chemistry.

Hudson (2) published a scholarly review of the monumental contribution

[1] Presented at the symposium "Emil Fischer: 100 Years of Carbohydrate Chemistry," 203rd National Meeting of the American Chemical Society, Division of Carbohydrate Chemistry, San Francisco, California, April 5–10, 1992.

of the relative configurations of the sugars — the feat for which Emil Fischer is best known. Indeed, this stellar accomplishment appears to have overshadowed other major contributions, particularly the first insights into enzyme specificity. We now attempt to present, with fidelity, how Emil Fischer was led to his "lock and key" concept for enzyme specificity. The objective is to produce a more widespread appreciation of the profound significance of this landmark contribution (3), which arose from his recognition of asymmetric induction. Although not always literal, our translations into English are expected not to be misleading. The nomenclature is retained essentially as used by Fischer.

Emil Fischer's proof of the relative configurations of the four chiral centers in open-chain glucose (4) appeared in 1891. The following three years saw a brilliant series of follow-up papers, based on the knowledge that certain sugars differ only in configuration. These publications mark the origin of our appreciation that molecular forces provide the stereochemical guidance necessary to living processes. Especially because of the present worldwide concern with molecular recognition, it seemed most appropriate to survey these classical contributions as a centenary commemoration to the first person in the field. One of his many students and a life-long friend, Karl Freudenberg, remarked in his excellent biography (5) of Emil Fischer:

> *Theoretical questions played a minor role in his thoughts. . . . Emil Fischer was the clever tactician who proceeded on a broad front. . . . There were many who were better read than he, but no-one who had more practical experience.*

II. Asymmetric Induction

Whereas the configurations of the sugars are truly a lasting monument to Emil Fischer, the concept of asymmetric induction, also referred to as partial asymmetric synthesis, initiated a new era in chemical research that is still with us today.

The modern concept of asymmetric induction is illustrated by the formulas in Fig. 1. As shown, the addition of hydrogen cyanide to the optically active aldehyde can lead to two diastereomers (**1** and **2**). If the process is under thermodynamic control, the formation of the more stable isomer will be favored; that is, that isomer for which the non-bonded interactions between the newly formed cyano and the hydroxyl groups with the dissymmetric R* group are weakest. On the other hand, the difference in the yields of **1** and **2** can be the result of kinetic control arising from a difference in the energies of the transition states — that state with the lower energy will form faster and lead to the product of higher yield. It is noteworthy that the tenets

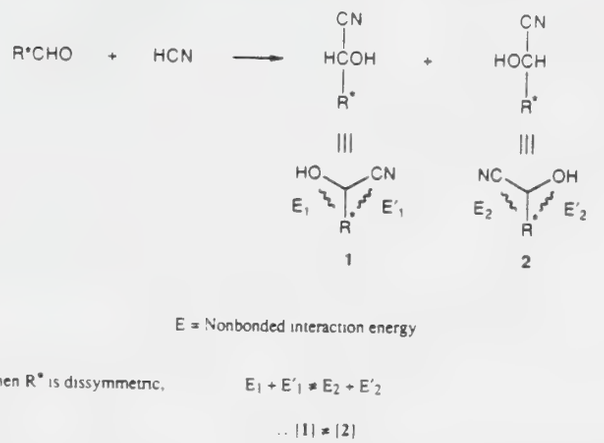


FIG. 1. — Asymmetric induction — under thermodynamic control, **1** will form in higher yield if $E_1 + E'_1 < E_2 + E'_2$.

of conformational analysis first provided the theoretical base for the formulation in 1952 of an appreciation for the steric control of asymmetric induction, which has become known as Cram's rule (6).

Although organic chemistry was still at a primitive state of development, a strong foundation for Emil Fischer's work had been laid by such great chemists as Berzelius, Wöhler, Liebig, Baeyer, and Kiliani. Furthermore, Louis Pasteur had reported (7), as outlined in Fig. 2, the preferential metabolism of the *dextro*-enantiomer of tartaric acid about 15 years prior to Fischer's doctoral studies with Adolf Baeyer at the University of Strasbourg. An understanding of optical isomerism had been provided in 1874 by the van't Hoff–Le Bel theory of the asymmetric carbon atom (8) (see Fig. 3) and ball and stick three-dimensional molecular models were in use much as they are

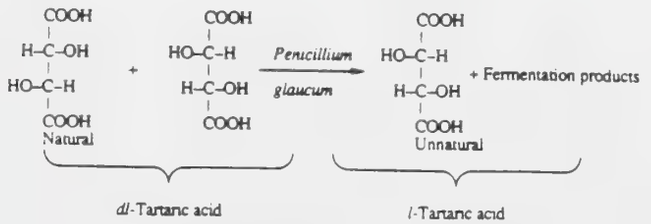


FIG. 2. — Louis Pasteur's preparation of D-(*levo*)-tartaric acid.

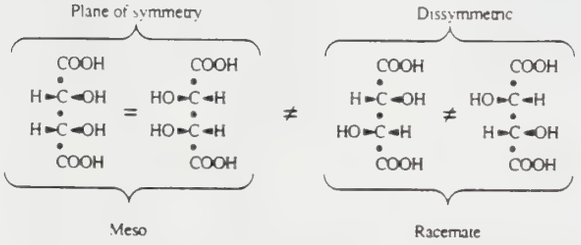


FIG. 3. — The basic assumption for Fischer's research of the optical isomerism of sugars.

today. As Emil Fischer stated (4):

> *All previous observations in the sugar group are in such complete agreement with the van't Hoff–Le Bel theory of the asymmetric carbon that the use of this theory seems justifiable.*

The concept of the existence of asymmetric forces in nature was not new to Fischer. Indeed, Louis Pasteur (9) was generalizing about asymmetry in 1874 when he prophesied:

> *I am convinced that life as we know it has arisen out of asymmetrical processes in the universe. The universe is asymmetric.*

He was convinced that optical activity is a peculiarity of life and, therefore, his view was directed toward asymmetry at a cellular level rather than at the molecular level developed by Emil Fischer.

Thus, the stage was well set in 1882 when Emil Fischer, at the age of 30 years, was appointed Professor and Director of the Chemical Institute at the University of Erlangen and thereby gained full independence in the direction of research. He chose to study the carbohydrates, and his first publication in the field appeared in 1884. The work was concerned with the reaction of sugars with phenylhydrazine, a compound that he had discovered as a teaching assistant about 10 years earlier while helping one of Baeyer's students. At that time, his father, Laurenz Fischer, who was a very successful businessman, added to his portfolio a brewery in Dortmund. His son, Emil, who was already a chemist, became involved and it is recorded (1) that he had advised his father to purchase a Linde ice-making machine to cool and store the beer. Also, Emil developed an interest in mycology, the science of lower plants, and he recommended that the brewery acquire a microscope to differentiate yeast species and to detect contaminants. He had actually become highly knowledgeable about yeasts some 6 years earlier while he was studying in Adolf Baeyer's laboratory and, in the course of a brief stay in Strasbourg in 1876, through a viniculturist named Dr. Fritz, he became intensively involved in the study of lower plants at the Strasbourg-Botanical Institute.

Fortunately for chemistry, he did not stay in Strasbourg because he wrote in his memoirs (10),

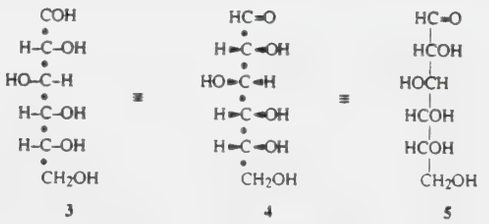
> *I certainly would have done my research in this field* (mycology) *had I stayed longer in Strasbourg.*

He was then 24 years of age.

Organic chemistry in the late 19th century was focused on the chemistry of natural products. The main opportunities, in terms of the techniques of the time, were offered by the major components of living tissues, that is, the carbohydrates, nucleic acids, lipids, tannins, and proteins. The idea that organic compounds could be synthesized only within living organisms had long been dispelled. Nevertheless, as already pointed out, Louis Pasteur (9) had quite recently expressed the opinion that there existed forces that could be exerted only within living cells. This idea was strenuously opposed by Liebig (11), who held that fermentation and similar processes were due to the action of chemical substances. The Pasteur–Liebig controversy ended when Buchner (12) succeeded in extracting a cell-free fermentation system from yeast that fermented glucose.

Van't Hoff had predicted, in 1874, that there should exist 16 normal straight-chain optically isomeric aldohexoses (8,13). It was the awesome challenge to substantiate this prediction that Fischer accepted in the mid-1880s, and that was met by his classical contribution in 1891 entitled, "On the Configuration of Glucose and Related Compounds" (4).

He represented glucose as shown in formula 3 and indicated that it should be interpreted as seen for **4**. Thus, the hydrogen atoms and the hydroxyl groups at the four asymmetric carbons are considered to project above the plane of the paper. The representation was later simplified to that shown for



3 4 5

dextro-Glucose

5 and became known as a Fischer projection formula (14). Fischer realized that an arbitrary assignment of absolute configuration was necessary to an orderly development of organic chemistry. Fortunately, his assignment of **3** to *dextro*-glucose proved correct.

The preparation of α-hydroxy acids by way of the cyanohydrin was established by Winckler (15) in 1832 by the synthesis of mandelic acid from benzaldehyde. As Emil Fischer emphasized, it was Kiliani (16) who first applied the well-known cyanohydrin synthesis of α-hydroxy acids from aldehydes and ketones to the building up of aldonic acids from aldoses. The reduction of these acids to fatty acids then provided Kiliani's classical proof of the structures of glucose and fructose (17). Although he had used sodium amalgam for the reduction of sugars to alditols, it was Fischer who learned to reduce the aldonolactones to aldoses. The overall process of building aldoses to higher sugars has become known as Fischer–Kiliani synthesis.

We have no evidence that Kiliani was aware of the formation of diastereoisomeric aldonic acids in the course of his cyanohydrin reaction. Fischer knew that the readily available *l*-arabinose had been subjected to the cyanohydrin reaction by Kiliani and found to provide a substance he called "arabinocarbonic acid." Indeed, Fischer offered the opinion that the reaction of sugars with hydrogen cyanide discovered by Kiliani in 1885 was the most important reaction in carbohydrate chemistry (18). Fischer characterized this product as "*l*-mannonic acid" and realized that, likely, the compound could be epimerized to *l*-gluconic acid by heating with quinoline. However, he felt this procedure was so tedious and inefficient that the acid would not have been prepared in this way unless it had first become available by some other method in order that its physical properties be known. He reported (18) that, in fact, a good quantity of *l*-gluconic acid formed along with the *l*-mannonic acid on the addition of hydrogen cyanide to *l*-arabinose (see Fig. 4). He found this strange and commented as follows:

> *The simultaneous formation of the two stereoisomeric products on addition of hydrogen cyanide to aldehydes, which was observed here for the first time, is quite remarkable in theoretical as well as in practical terms.*

Also, in 1890 Fischer had proven that the reduction of fructose with sodium amalgam yields a mixture of mannitol and sorbitol and pointed out that this conformed with the van't Hoff–Le Bel theory (19). It seems, therefore, that the idea of asymmetric induction was clearly in a state of incubation prior to his publication of the relative configurations of the sugars in 1891.

Fischer's involvement with the relative configurations of the sugars required the preparation of pure substances and he gradually accumulated experimental data (20–22), which required the formation of epimeric aldonic acids in unequal amounts (see Table I). Thus, he was able to write (23) in 1892:

> *A second question of general importance relates to the quantities in which the two stereoisomeric products are obtained on the generation of a new asymmetric carbon atom. Starting with nonracemic optically inactive starting materials, only racemic products are*

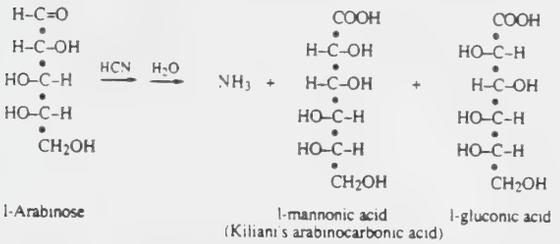


FIG. 4. — The discovery of asymmetric induction. The yield of the *l*-mannonic acid, under the conditions then used, was about three times greater than that of the *gluco* isomer (see Table I).

formed and that means the two stereoisomers are formed in equal quantities. In the case of the present syntheses (Kiliani cyanohydrin syntheses), *where the sugars used as starting materials are already asymmetric systems, this rule does not apply.*

Two years later, in 1894, he wrote as follows (3):

To my knowledge, by these observations strictly experimental proof has been provided for the first time that in the case of asymmetric systems the further synthesis occurs in an asymmetric sense.

III. Yeast Fermentations and Enzymes

Obviously, Fischer had conceived of the phenomenon we now refer to as asymmetric induction and had become deeply interested in its relevance to biological processes. It was that year that he abandoned Würzburg University to accept the chair of chemistry at the University of Berlin, which was regarded as the highest position in the realm that could be achieved by a professor of chemistry. He was promised a large new institute and it appears that the design and financing of this laboratory met with considerable controversy. It seems probable that Fischer took advantage of this discontinuity in his research to write up much of the work he had done in Würzburg on the

TABLE I

Some Early Observations of Asymmetric Induction by Fischer

			Yield (%)	Reference
l-Arabinose (50 g)	⟶	Mannonic acid	34	20
		Ca-gluconate	11	
d-Mannose (2 kg)	⟶	α-Mannoheptonic acid	87	21
d-Xylose (40 g)	⟶	Gluconic acid lactone	51	22
		Idonic acid	35	

fermentation of sugars and the interpretations of the results, in a series of monumental publications in 1894.

The use of the enzyme system then known as invertin, which was extracted from beer yeast with water and precipitated from the aqueous solution, was available to Fischer when he began his classical studies of the enzymic hydrolysis of glucosides reported in 1894. The stage was also set by another enzyme known as emulsin, which Fischer purchased from E. Merck, Darmstadt, and which was known to hydrolyze several natural aromatic glucosides such as salicin, coniferin, arbutin, and the synthetic phenyl glucoside. These aryl glucosides were already known to not be cleaved by invertin.

The lock and key concept for enzyme specificity appears to have gelled in Fischer's mind in the course of using yeasts in his studies on the configurations of sugars. It is noteworthy in this connection that it was not until 1878 that the term "enzyme" was introduced by Kühne (24). Until then, the substances responsible for these biological activities were referred to as ferments. In fact, enzyme is a Greek term that means "in yeast." It is pertinent to note with regard to enzyme action that Pasteur's opinion, that the fermentation process could not be separated from the living cell, did not take into account the observation, made in 1833 by Payen and Persoz (25), that starch was converted into reducing sugars by a thermolabile substance present in the precipitate that formed on adding alcohol to a cell-free aqueous extract of malt. They termed the substance a "diastase" and the "-ase" ending of this term became in time used to designate the protein catalysts that we now call enzymes. In an Emil Fischer memorial lecture, Forster (26) reported that, as early as 1837, Berzelius held the opinion "that in living plants and animals there take place thousands of catalytic processes between tissues and fluids." It took Fischer to appreciate the significance of the diastase activity.

Fermentations using ordinary beer yeasts had played key roles in the investigations on the configurations of glucose performed in Würzburg, which Fischer published in 1891 (4). For example, in 1889, Fischer and Hirschberger (27) reported the fermentation of *d*-mannose, a sugar that they had obtained by oxidation of mannitol with nitric acid and found identical to an aldohexose of widespread occurrence in plants (28). In the following year, he reported that the fermentation of racemic mannose left the *l*-isomer intact (29). Similar observations were made with regard to the nonfermentability of *l-(dextro)*-fructose, *l*-glucose, and *l*-galactose (29) (see Table II). In addition, both the optically active isomeric guloses and various heptoses and octoses were found to resist fermentation. He saw these results as an essential extension of the older observation by Pasteur (7) that microorganisms alter only one of two enantiomers; that is, the fermentation of sugars depends on

TABLE II
Experiments That Demonstrated the Chemical Basis of Biology

Racemic mannose $\xrightarrow{\text{yeast}}$ *l*-mannose + CO_2 + ethanol
Similarly, *d*-glucose, *l*-fructose, or *d*-galactose $\xrightarrow{\text{yeast}}$ CO_2 + ethanol
However, *l*-glucose, *d*-fructose, or *l*-galactose $\xrightarrow{\text{yeast}}$ no fermentation

the total configuration and not only whether it is the *dextro* or *levo* form. He therefore concluded:

> *The fermentability of hexoses is in close relationship to the geometric shape of the molecule and can even be designated as a stereochemical question.*

In a landmark paper (30) that he coauthored with Hans Thierfelder, a mycologist, the behavior of different sugars toward pure yeasts was described. In this connection, he realized that the yeasts he had used in his earlier investigations were mixtures and, therefore, the results could be misleading. For this reason, he turned his attention to the fermentation of sugars by 12 different pure yeast species. Furthermore, he realized that he was in a uniquely fortunate position to undertake these studies because the research on the relative configurations of the sugars had left him with a fine inventory of rare carbohydrate structures. It is interesting to note how the fermentations were scaled down for the study of rare sugars as substrates (Fig. 5). In this regard, he wrote:

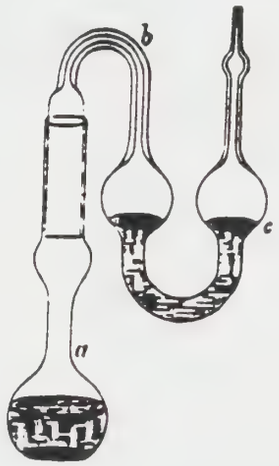
> *Since the preparation of the artificial sugars is in part quite tedious and the experiments had to be modified repeatedly, we used a small fermentation tube, as shown below, in order to save material* (30).

As seen in Table III, all six yeasts rapidly fermented glucose, mannose, and fructose. However, three of the yeasts had difficulty in fermenting galactose. None could metabolize either the naturally occurring sugars *l*-arabinose and rhamnose or synthetic sugars including *l*-glucose, sorbose, α-glucoheptose, and α-glucooctose. Thus, the data presented in Table II were confirmed with pure yeast cultures and Fischer proposed the generalization:

> *The same observation is likely to be found for other microorganisms as well as for other groups of organic compounds and perhaps a very great number of chemical processes occurring within an organism are influenced by the geometry of the cell.*

IV. THE LOCK AND KEY CONCEPT

A number of glycosides were available to Fischer by way of the Koenigs–Knorr reaction and his own glycoside synthesis, which involves treatment of



Actual size

FIG. 5.—Emil Fischer's fermentations on a semi-micro scale using an apparatus of the size shown. (a) ~70 mg sugar, 0.35 ml water, 0.35 ml sterilized yeast extract, and 13 mg yeast species; (b) S-trap for evolved CO_2; (c) aqueous barium hydroxide.

the sugar in alcoholic hydrogen chloride solution. Consequently, the fermentation of a number of glycosides by different pure yeast species could be examined (30). The results, presented in Tables III and IV, showed that certain yeasts that avidly fermented glucose, fructose, and mannose only reluctantly fermented galactose and that a yeast that fermented sucrose and

TABLE III

The Selective Fermentation of Natural Sugars by Pure Yeasts

Yeast	Sugar							
	Glucose		Mannose		Galactose			
	d	*l*	*d*	*l*	*d*	*l*	*l*-Fructose[a]	*d*-Sorbose[b]
S. pastorianus I	+++	–	+++	–	+++	–	+++	–
S. pastorianus II	+++	–	+++	–	++	–	+++	–
S. pastorianus III	+++	–	+++	–	+++	–	+++	–
Brauereihefe	+++	–	+++	–	+++	–	+++	–
Brennereihefe	+++	–	+++	–	+	–	+++	–
Milchzuckerhefe	+++	–	+++	–	+	–	+++	–

[a] Used by Fischer to designate natural D-fructose.

[b] Also negative were *d*-talose, *l*-gulose, *l*-arabinose, rhamnose, α-glucoheptose, and α-glucooctose.

TABLE IV

The Fermentation of Glycosides by Different Pure Yeasts

	Sucrose	Maltose	Lactose	Methyl α-glucoside[a]	Glucosyl resorcinol[b]
S. pastorianus I	+++	+++	−	+	−
Brauereihefe	+++	+++	−	+	−
Brennereihefe	+++	+++	−	+	−
S. productivus	+	+++	−	+	−
Milchzuckerhefe	+++	−	+++	−	Not tested

[a] From Fischer synthesis.
[b] From Koenigs-Knorr synthesis.

lactose did not ferment maltose. These observations led to his concern as to whether or not the different yeasts possessed different enzymes. Experiments were designed to answer this question, and it was soon established that, in fact, yeast contains at least two different enzymes. The procedure is outlined in Fig. 6, where it is seen that, whereas an extracellular enzyme of the Frohberg yeast could hydrolyze sucrose but not maltose, the cells contained an enzyme that ferments both the disaccharides. On this basis, it was concluded:

> *These present observations are undoubtedly in favor of the assumption that the yeast contains two different enzymes.*

Of course, it is now established that the glycolysis of glucose to carbon dioxide and ethanol occurs by way of a complex pathway involving 10 different enzymes acting on a variety of sugar phosphate intermediates. The extracellular enzyme preparation that Fischer used was termed invertin, the origin of the term for the enzyme we now know as invertase. He termed the intracellular enzyme yeast-glucase (31) and this enzyme is of the type we now refer to as an amylase.

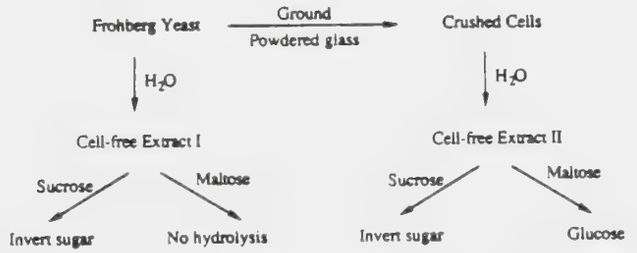


FIG. 6.—How the presence of different enzymes in a yeast cell was established.

Fischer then examined the lactose yeast in the same manner as he did the Frohberg yeast and found it to contain both an invertin-like enzyme and a lactose-cleaving enzyme, which he termed lactase. From these results he concluded that the first step in the fermentation of lactose, as for the fermentation of sucrose and maltose, is the hydrolysis of the disaccharide to monosaccharide. From this observation, he drew the landmark conclusion that he considered it most unlikely that any polysaccharide (the term included disaccharides) can be fermented without first being hydrolyzed to hexose (31).

The research with Thierfelder (30) had led to the hypothesis that the active chemical agents of yeast cells can react only with those sugars that are configurationally related. It was this stereochemical assessment of the fermentation process that, in turn, now led to the question (32):

Would similar differences be found for the ferments that could be separated from the organism and termed "enzymes"?

To answer this question he turned to a study of the properties of two glucosidases, then known as invertin and emulsin (32). The substrates were to be the large number of artificial glucosides that he had synthesized from different sugars and alcohols. The results of these studies are presented in Table V. It is

TABLE V
Effects of Structure and Configuration on Enzymatic Hydrolysis

Glycoside	Crude enzyme preparation	
	Invertin[a]	Emulsin[b]
α-Glucosides		
Methyl	+	−
Ethyl	+	−
Sucrose	+	−
Maltose	+	−
β-Glucosides		
Methyl	−	+
Phenyl	−	+
Salicyl	−	+
α-Galactoside[c]		
Methyl	−	−
β-Galactosides		
Methyl	−	+
Lactose	−	+

[a] Aqueous extract of air-dried beer yeast.
[b] Product of E. Merck, Darmstadt.
[c] Also, neither of the enzyme preparations hydrolyzed α-glycosides of rhamnose or arabinose.

to be noted that Fischer did not know the configurations of the anomeric carbon of glycosides. Furthermore, he presented these compounds as furanoside structures in accordance with the prevailing notions on sugar structures.

Fischer was intrigued by the fact that emulsin caused hydrolysis of both β-glucosides and β-galactosides but had no effect on either the α- or β-xylosides (33). Since, at the time, Fischer expected glycosides to be furanosides, he suggested that both the enzymes required the presence of a free hydroxyl group at position 5 of a hexoside.

At this point Fischer concluded that the enzymes, in terms of the configurations of the substrates, are as fastidious as yeast and other organisms. He then returned to the above-mentioned hypothesis that he and Thierfelder had proposed (30) and concluded (32) that the protein substances known as invertin and emulsin, like the substrates whose hydrolyses they effected, were asymmetrically formed molecules. On the basis of this consideration, he came to the momentous lock and key concept for enzyme activity and commented as follows:

> *The restricted effects of the enzymes may therefore be explained by the assumption that the approach of the molecules that cause the chemical process can occur only in the case of a similar geometric shape.*
>
> *To use a picture, I would like to say that enzyme and glucoside have to fit to each other like a lock and key in order to exert a chemical effect on each other.*

V. Insights on Enzyme Specificity

Emil Fischer developed a strong interest in the structural requirements for enzyme activity as the result of effects of changes in the structures of the α- and β-methyl glucosides on their properties as substrates for the enzymes invertin and emulsin, which, as we have seen, he had shown to be α- and β-glucosidases, respectively. As already mentioned, he was fascinated in 1895 by the fact that emulsin had no effect on either the α- or β-methyl xylosides (33). In a 1912 publication with Karl Zach (34), he reported that β-methyl 6-deoxyglucoside was hydrolyzed by emulsin and wrote:

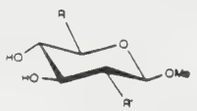
> *It appears to us very strange that the effect of the enzyme on the methoxyl group at the other end of the carbon chain depends on the sixth carbon atom.*

The following question, which appears to be the origin of the use of chemical synthesis to provide probes for the assessment of the structural requirements for complex formation, was asked:

> *How will the enzyme behave if there is a carbon richer alkyl at the end of the chain?*

Soon after his death in 1919, his colleagues, as coauthors, reported the results presented in Table VI. Since methyl 2-deoxyglucoside had not been

TABLE VI
The Probing by Fischer of the Active Site of an Enzyme (Modern Formula)



Substituent			
R	*R'*	Hydrolysis by emulsin	Reference
CH_2OH	OH	+	32
CH_2OH	H	−	35
H	OH	−	33
CH_3	OH	+	34
CH_2Br	OH	−	36

hydrolyzed either by emulsin or by enzymes of yeast extract, it was concluded (35) that the presence of an hydroxyl group at the 2-position plays an essential role in the lock and key mechanism. Other collaborators reported (36) in 1920 that, although emulsin readily cleaved β-methyl 6-deoxy-*d*-glucoside (34), the enzyme had no effect on β-methyl 6-bromo-6-deoxy-*d*-glucoside. Thus, it appears that among Emil Fischer's last thoughts was the consideration of molecular recognition and how synthetic methodologies may provide the means to a precise understanding at the molecular level of his lock and key concept for enzyme activity. This idea was examined by many others, but a proper understanding had to await the development of synthetic methodologies for the synthesis of oligosaccharides and congeners thereof for the probing of protein combining sites.

As already stated, Fischer was deeply intrigued by the phenomenon of enzyme activity. He realized that the substances were proteins and this undoubtedly was why he next undertook the study of amino acids and peptides. He fully appreciated that the specificity of enzyme catalysis depended on the occurrence of a complementarity for interacting dissymmetric surfaces. In this regard, he wrote (3):

> *This example* (the cyanohydrin reaction) *appears to me to provide a simple solution for the natural asymmetric synthesis. The formation of the sugar, as the plant physiologists assume, occurs in the chlorophyll grain, which itself is composed of optically active substances. . . . The prepared sugar is released and later on used by the plant, as is known, for the preparation of other organic components. Their asymmetry is thus explained from the nature of the building material. Of course, they also provide material for new chlorophyll*

grains, which again produce active sugars. In this way optical activity is passed on from molecule to molecule, such as life goes from cell to cell. Therefore it is not necessary to deduce the formation of optically active substances in the plant from asymmetric forces that reside outside the organisms, as Pasteur presumed.

In a biography prepared for the 1966 issue of *Advances in Carbohydrate Chemistry*, Karl Freudenberg wrote (5):

Under his leadership, synthetic and theoretical chemistry was reunited with biochemistry, and a broad scientific basis restored to organic chemistry.

Fischer never allowed synthesis to become an end in itself and thereby lose contact with general problems. In this regard, Freudenberg recorded (5) the following comment made by Fischer — probably incidentally — in 1904:

Only 6 of the 32 heptoses and only 2 of the 128 nonoses have been prepared. But, since these compounds have not yet been found in nature and are, therefore, of only minor interest, their systematic elaboration may be left for a later period.

Freudenberg further commented (5):

He never gave unbridled rein to his synthetic efforts, nor did he fall into the temptation of purposeless synthesis. He always remained a true scientist — a student of nature. . . . This great individual was a man of inflexible veracity and simplicity. . . . Emil Fischer's life was based on responsibility: a responsibility for the austerity and purity of his work and its aims, responsibility for the university as an important organ of our cultural and economic life, and responsibility for each of his students.

Although few are endowed with comparable talent and energy, his career is surely a splendid example for all. Hopefully, like the passing of optical activity from molecule to molecule, this chapter will help induce some transfer of Emil Fischer's way of thinking and actions to future generations of organic chemists.

VI. Concluding Remarks

It is appropriate to close this chapter with an illustration of how Emil Fischer's lock and key concept has since been found to be relevant to enzyme specificity. Thus, it will be seen that, in fact, specific structural features of the substrate act somewhat like the wards of a key. That is, insertion of the substrate into the enzyme's active site is strongly demanding in complementarity as is inserting a key into the barrel of a lock. Formation of the complex brings the structural features of the substrate and the enzyme that are to interact into close proximity and proper orientation. Thus, the organization and thermal energy required to achieve the transition state are greatly diminished and catalysis is effected. The hydrolysis of maltose and other α-linked glucosides by the commercial enzyme, which is most commonly

referred to as glucoamylase, but is also known as amyloglucosidase or simply AMG, serves well because not only is there much known about the lock and key characterization of the reaction pathway but also a consideration of this enzyme establishes a connection with Emil Fischer (37). It was in the course of an investigation of the effect of various enzyme preparations on cellobiose that the decision was made to examine an enzyme preparation derived from the fungus *Aspergillus niger*. It did not catalyze the hydrolysis of cellobiose, whereas emulsin did, and the conclusion was drawn that cellobiose must have a β-linkage.

As the name implies, the enzyme is an amylase. It is an *exo*-hydrolase that releases glucose from the nonreducing ends of starch and dextrins. Along with alpha amylases, glucoamylases are fungal enzymes produced by a variety of *Aspergillus* species that have found major industrial importance for the production of high-glucose syrups and related applications (38). Their use in the brewing of beer was likely the reason that Fischer examined the glucoamylase that is produced by the fungus *A. niger*.

The enzyme was examined by Fischer following earlier studies by Bourquelot (39) in France. Bourquelot (39) reported that he had made known in 1883 that an extract from a culture of *A. niger* hydrolyzed maltose. He now provided evidence that the solution also caused hydrolysis of trehalose. However, since this activity was lost on heating to 63°C but that responsible for the hydrolysis of maltose was maintained up to 75°C, he concluded that the fungus produced two different "ferments"—one a maltase, the other a trehalase.

Pazur and Ando (40) separated the glucoamylase from other carbohydrases of *A. niger* by ion-exchange chromatography. They later found that the enzyme also hydrolyzes isomaltose but at a much lower rate than maltose (41). It was reasonable, therefore, to test whether or not the enzyme would hydrolyze a (1 → 3)-linked disaccharide of glucose. Consequently, nigerose was examined and found to hydrolyze at a rate intermediate to those of maltose and isomaltose. Thus, it became apparent that, although the enzyme has a high specificity for an α-D-glucopyranosyl disaccharide, the structure of the aglycon can be varied without total loss of activity. On the other hand, the enzyme was found to be quite ineffective for the hydrolysis of either methyl or phenyl α-D-glucopyranoside (42). The profound difference in rate was attributed to a difference in the conformations of the glucosyl units of maltose and methyl α-D-glucopyranoside. This postulation was made because it had been suggested (43) that the glucosyl unit of maltose was in a boat conformation. Because methyl α-D-glucopyranoside was believed to favor a chair form, it was considered that the difference in rate of hydrolysis was related to the ease with which the glucosyl units in the compounds can transform into the conformation preferred by the enzyme (42). However,

with the advent of high-resolution nuclear magnetic resonance it became evident (44) that the glucosyl units of maltose are held extensively in the same $^4C_1$(D) chair conformation as methyl α-D-glucopyranoside and, therefore, another explanation had to be sought. The answer was provided by Bock and Pedersen (45), who studied the effect of deoxygenation at the various hydroxyl-group positions on rate of hydrolysis.

Lemieux (46) recently reviewed the studies with his coworkers on the origin of the specificity in the recognition of oligosaccharides by proteins. In the course of these studies, it became evident that hydroxyl groups are invariably involved in providing the stereochemical complementarity required for the binding of an oligosaccharide by monoclonal antibodies and lectins. However, binding studies using monodeoxy derivatives revealed that only some of these hydroxyl groups establish essential polar interactions with the protein. These were termed the key hydroxyl groups. On applying this technique to the hydrolysis of maltose by the amyloglucosidase of *A. niger*, Bock and Pedersen found that hydroxyl groups on both of the glucose units were essential for efficient catalysis. The key hydroxyl groups proved to be OH-3 of the reducing glucose unit and OH-4′ and OH-6′ of the nonreducing glucose unit of maltose.

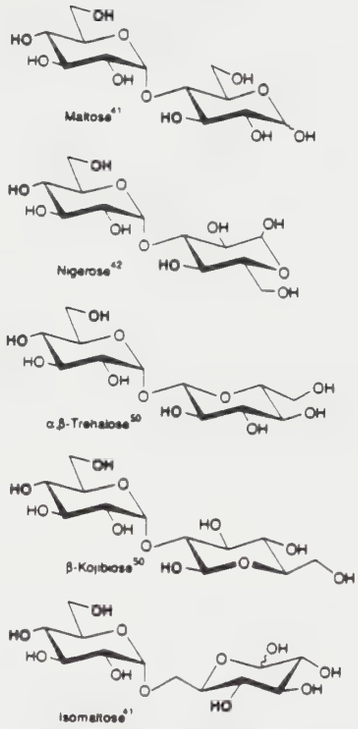
The two key hydroxyl groups of the nonreducing unit must establish polar interactions that tend to anchor this glucose unit in the enzyme's active site. That methyl α-D-glucopyranoside is not a good substrate was no longer surprising because this compound cannot provide the key hydroxyl group of the aglycon. Since maltose, isomaltose, and nigerose are all substrates, it became apparent that the catalysis could entertain structural variations in the aglycon as long as it can project an hydroxyl group toward the active site in a manner similar to OH-3 of maltose. Indeed, as may be seen in Table VII, conformational analysis of these disaccharides indicates that in each case a similar disposition of the three key hydroxyl groups can be achieved with relative ease. In a sense, these hydroxyl groups perform as the wards of a key and thereby provide a fine illustration of Emil Fischer's lock and key concept for enzyme specificity.

The turning of the key once the complex has formed is a separate issue. In this regard, Lemieux (47) has pointed out that rotation about the glycosidic bond must weaken the *exo*-anomeric effect and thereby importantly activate the anomeric carbon to nucleophilic attack. Therefore, it seems likely that the role of the key hydroxyl group of the aglycon is to accommodate the rotation prior to the attack by water to form β-D-glucopyranose, which is the first product of the reaction.

It appears that the overall mechanism for the hydrolysis of maltose by glucoamylase will soon be delineated. A brief summary of how this is being accomplished deserves comment.

TABLE VII

The Three Key Hydroxyl Groups[a] (Bold Letters) Necessary for Efficient Hydrolysis of an α-D-Glucopyranoside by the Glucoamylase of *Aspergillus niger*

Structures


[a] Lemieux and Bock (44) have pointed out why the two-dimensional structural formulas used to represent the various disaccharides provide a useful approximation of the conformational preference.

Svensson and coworkers (48) were able to separate commercial *A. niger* glucoamylase into two catalytic components, which were termed G1 and G2. It is now established (49) that G2 is a proteolytic fragment derived from G1. Meagher and Reilly (50) showed the two forms to behave similarly and this finding appears common to all major variants of amyloglucosidase that contain the catalytic domain. The amino acid sequences of G1 and G2 had been established by Boel *et al.* (51). Using glucoamylase-specific synthetic oligonucleotides and molecular cloning of the complementary DNA synthesized from *A. niger*, the primary structure of the mRNA for the G1

enzyme was established. *In vitro* translations of the mRNA followed by immunoprecipitations with glucoamylase-specific antisera showed that both G1 and G2 were in the culture medium. Thus, a goal contemplated by Emil Fischer, that is, the synthesis of an enzyme that he had examined (37), was accomplished.

Aleshin and coworkers (49) have reported the X-ray crystal structure at 2.2-Å resolution of a G2-type variant produced by *Aspergillus awamori*. Meanwhile, an attempt was made to determine the amino acid residues that participate in the substrate binding and catalysis provided by G2 of *A. niger* (52). The results of the chemical approach indicated that the Asp-176, Glu-179, and Glu-180 form an acidic cluster crucial to the functioning of the enzyme. This conclusion was then tested by site-specific mutagenesis of these amino acid residues, which were replaced, one at a time, with Asn, Gln, and Gln, respectively (53). The substitution at Glu-179 provided an inactive protein. The other two substitutions affected the kinetic parameters but were not of crucial importance to the maintenance of activity. The crystal structure (49) supports the conclusion that Glu-179 functions as the catalytic acid but Asp-176 does not appear to be a good candidate for provision of catalytic base. Thus, there still exists considerable uncertainty as to how the disaccharide is accepted into the combining site for hydrolysis. Nevertheless, the kind of scheme presented by Svensson and coworkers (52) almost surely prevails.

As already mentioned, the glucoamylase project was chosen to illustrate Emil Fischer's lock and key concept for enzyme specificity. It is seen that his vision has become unequivocally established. Many other developments could have been chosen, as can be appreciated from recent reviews by Hehre (54) and by Svensson (55). Cornforth (56) provided a fine overview of asymmetry and enzyme action in his Nobel prize lecture. Noteworthy is the conclusion that "stereospecificity is something not just incidental, but essential to enzyme catalysis." In other words, the key must fit the lock.

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Edmonton
Canada T6G 2G2

Department of Chemistry
Faculty of Science
E3-44 Chemistry Bldg., Tel. (403) 492-3254 Fax (403) 492-8231

Dr. and Mrs. Bader -

For long distance calls, dial 1, then the number. When operator asks for your authorization code, punch 588851.

The key provided will open both your office doors and all entry doors to the Chemistry Building.

Ron Kratochwil

ALFRED BADER FINE ARTS

DR. ALFRED BADER

ESTABLISHED 1961

May 8, 1995

Professor Ray Lemieux
Department of Chemistry
E5-52 Chemistry Bldg. East
University of Alberta
Edmonton, Alberta T6G 2G2
Canada

Dear Professor Lemieux:

Thank you for your letter of April 26th.

My three recommendations to chemists thinking about starting their own chemical company are:

1) Keep control of the company as long as possible. Don't go to venture funds who will give substantial sums of money but then will want control. It is far better to save money or even to borrow from friends and family than to sell stock too early.

2) Specialize and think internationally. If, for instance, you have real expertise in making purines, start a company entitled "Purines Unlimited" and make the chemical community aware of your existence.

3) Get the very best people to work with you and then compensate them as well as you possibly can.

As you will see from the enclosed, my autobiography, *Adventures of a Chemist Collector*, is now available quite reasonably in Canada. That book is really the history of the fine chemical business between 1950 and 1990 and details my many mistakes.

I very much enjoyed my two days in Edmonton and greatly admire your chemistry department. What really discouraged me, however, was a booklet produced by the University, and my letter relating to this is enclosed.

Best regards.

Sincerely,

AB/cw
Enclosure

By Appointment Only
ASTOR HOTEL SUITE 622
924 EAST JUNEAU AVENUE
MILWAUKEE WISCONSIN USA 53202
Tel 414 277-0730 Fax 414 277-0709

ALFRED BADER FINE ARTS

DR. ALFRED BADER

ESTABLISHED 1961

May 5, 1995

Via Facsimile (403/492-2997) & U.S. Mail

Mr. Ron Thomas
Editor, *Folio*
Office of Public Affairs
400 Athabasca Hall
University of Alberta
Edmonton, Alberta T6G 2E8
Canada

Dear Mr. Thomas:

Last month my wife and I spent two delightful days at the University of Alberta. We were treated wonderfully well, my five lectures on the history of chemistry, the restoration of paintings, and on how the Dutch artists looked at the Bible were well-received, and when we left Edmonton, we marvelled at that combination of excellence in chemistry, the beauty of your city and the friendliness of your people.

The only flaw we noted was in a booklet we were given, "Making Sense ... of Research at the University of Alberta." It reminded me of what is so wrong all over the western world: so much is for show rather than for substance. Millions of dollars are spent on public relations and much of this is wasted.

The glossy booklet's stated purpose is "making sense". But look at the booklet and see how it fails in some essays. For instance, it describes a mathematics professor's investigation into "linear properties and geometric phenomena of convex bodies in a space" in language that not one in a thousand educated non-mathematicians can understand.

An economics professor "explores attitudes of decision makers to government spending. His research showed that while politicians regard the budget process as important to determining government spending, public servants see political will as making the difference. 'Surprises like this are one of the reasons I enjoy research,' [he is quoted as saying]. 'You get a jolt from an unexpected result.'" I am still trying to figure out what this means.

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Or look at the beautiful language of a religious studies professor: "The poetry and prose narrative of the Old Testament has as profound an insight into basic human questions as anything ever written. Its writers are brilliant." I wish I could write like that! And if that professor could have chosen a passage from the Bible, he might well have picked one from Amos or Isaiah, from Psalms or the Book of Ruth. But whoever did choose picked the third chapter of the Book of Malachi, one of the hardest-to-understand, non-poetic passages imaginable. That the Hebrew page has been printed upside-down seems symptomatic.

I read that David Cooke, Canada's minister of education, hired a consulting firm, "Prosebusters", to translate his ministry's "bafflegab" into English. That should not really be necessary at your great university.

Best wishes,

Agnes Baer

AB/cw

Enclosure

cc: President Rod Fraser (w/encl.)

NEWSCRIPTS

by K. M. Reese

Bafflegab in Canada

In mid-1994, Dave Cooke, minister of education in Canada, termed discourse in his ministry "bafflegab," according to the *Quarterly Review of Doublespeak* which cited the *Toronto Star* for July 30 1994. Cooke evidently was ignited by a 97-page policy document that his troops had produced [illegible] riculum guidelines for Canada's mentary schools. He had hired a [illegible] sulting firm, "Prosebusters," to translate the document into English

Among other sins, the document converts music and dancing into "organization of sounds" and "sequencing of movements." Reading occurs when one "interprets or constructs meaning from a text by applying language knowledge and meaning-making strategies, as well as personal experience to it." And so on.

A history of the world

From the neighborhood of Chicago comes an unidentified document that purports to be a history of the world "pasted together . . . from genuine student bloopers collected by teachers throughout the U.S., from eighth grade through college level." Excerpts follow:

Ancient Egypt was inhabited by mummies, and they all wrote in hydraulics. They lived in the Sarah Dessert and traveled by Camelot.

David was a Hebrew king skilled at playing the liar. He fought with the Finkelsteins, a race of people who lived in Biblical times. Solomon, one of David's sons, had 300 wives and 700 porcupines.

The Greeks were a highly sculptured people, and without them we wouldn't have history. The Greeks invented three kinds of columns—corinthian, ironic, and dorc—and built the Apocalypse. They also had myths. A myth is a female moth.

Queen Elizabeth was the Virgin Queen. As a queen she was a success. When Elizabeth exposed herself before her troops, they all shouted "hurrah." Then her navy went out and defeated the Spanish Armadillo.

During the Renaissance, America began. Christopher Columbus was a great navigator who discovered America while cursing about the Atlantic. His ships were called the Nina, the Pinta, and the Santa Fe. Sir Francis Drake circumcised the world with a 100-foot clipper.

Meanwhile in Europe, the enlightenment was a reasonable time. Voltaire invented electricity and also wrote a book called Candy. Gravity was invented by Isaac Walton. It is chiefly noticeable in the autumn, when the apples are falling off the trees.

Johann Bach wrote a great many musical compositions and had a large number of children. In between, he practiced on an old spinster, which he kept up in his attic.

The sun never set on the British Empire because the British Empire is in the east and the sun sets in the west.

Flotsam and jetsam

Recently at hand is a memorandum, addressed to the staff of a large association, that begins, "[Our pest management contractor] will exterminate the first floor of the headquarters building on April 14, after 6 PM."

• • •

An anonymous contributor, who wrote, "I can't stop laughing," sent in a newspaper story about three janitors who in the utility room of an elementary school in California tried to euthanize a gopher that a student had found on school grounds and brought to them. To that end they sprayed the rodent with several cans of "a freezing solvent used to clean gum and wax off floors." One of the janitors then tried to light a cigarette, and the resulting blast blew all three of them out of the room. All apparently came out okay, as did the 16 pupils who were treated for minor injuries. The gopher was released later in a field.

• • •

Jim Klent of Fremont, Calif., reports hearing of a T-shirt bearing the word Catalyst. Below it appeared

1. Angus
2. Hereford
3. Guernsey
4. Jersey
5. Holstein

ALFRED BADER FINE ARTS

DR. ALFRED BADER

ESTABLISHED 1961

May 5, 1995

Via Facsimile (403/492-2997) & U.S. Mail

Mr. Ron Thomas
Editor, *Folio*
Office of Public Affairs
400 Athabasca Hall
University of Alberta
Edmonton, Alberta T6G 2E8
Canada

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University of Alberta
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Faculty of Science
RU Lemieux, CC, FRS, University Professor

Canada T6G 2G2

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Department Fax: (403) 492-8231

April 26, 1995

Dr. Alfred Bader
Alfred Bader Fine Arts
Suite 622, The Astor
924 East Juneau Avenue
Milwaukee, WI 53202
U.S.A.

Dear Dr. Bader:

It was good to meet you again and to see that you are still in fine form. I was much impressed by the level of energy you put into your lectures - four in two days!

I found your lecture on the development of Aldrich Chemicals very interesting and only hope that some of our people in the Industry Liaison Office had been there to learn what successful entrepreneurship entails. At the end of your lecture you made three recommendations for the starting of a chemical company. I would very much appreciate a brief note from you that outlines these recommendations. My reason for making this request is that the points you made are surely valid but not at all well appreciated by many here who appear to believe that they can be instrumental in building local industry through government funding and university participation. My main reason for wanting to do this is that I gave the university an excellent opportunity twenty years ago, even wrote the business plan. I personally wished to concentrate on my university research without further distractions from the building of an enterprise and did not wish to be involved, except as consultant. This proved to be a major mistake. I was completely ignored. I could never have believed what they did with the project. Perhaps the next generation will be a lot wiser when it comes to industrial innovation.

All best wishes.

Yours sincerely,

Ray Lemieux

RUL:ce

(1) Keep ownership as long as possible
(2) Think internationally
(3) Get the best people possible and treat them well.

Schedule for Visit by Dr. and Mrs. Alfred Bader

(Sponsored jointly by the Department of Chemistry of the University of Alberta; the Edmonton Section of the Chemical Institute of Canada, and the Edmonton Art Gallery)

Sunday, 9 April 1995

Dr. and Mrs. Bader arrive at 2:22 pm from Vancouver on Canadian Flight #644. To be met for dinner and evening by Dr. and Mrs. Gerry Tertzakian. Reservations at Hotel MacDonald (by Dr. J. Cooley).

Monday, 10 April 1995

Ron Kratochvil to pick up at 8:00 am at hotel and take to CBC Radio Station for interview, then to Chemistry Department. Dr. Bader's office while in the Department will be W3-39B, Phone (403) 492-3687.

9:30 am	Bob Jordan, Acting Chair
9:45 am	Ron Kratochvil
11:00 am	Seminar, V-107 – Josef Loschmidt – The Father of Molecular Modelling
12:30 pm	Lunch, Faculty Club – Ron Kratochvil, John Vederas, Dick Peter
2:00 pm	Dr. and Mrs. Norman Jones, afternoon and dinner
7:00 pm	Edmonton Art Gallery, open for viewing prior to Dr. Bader's lecture
8:00 pm	Lecture – The Adventures of a Chemist-Collector, at Edmonton Art Gallery

Tuesday, 11 April 1995

9:00 am	Pick up at Hotel McDonald – Stan Brown
9:30 am	Stan Brown
11:00 am	Seminar, V-107 – History of the Aldrich Chemical Company
12:30 pm	Lunch, Faculty Club – President Rod Fraser
3:30 pm	To be arranged
5:30 pm	Dinner – Edmonton Section CIC members
7:30 pm	Lecture – The Bible Through Dutch Eyes (Rembrandt and the Jews), at Kings University College

Wednesday, 12 April 1995

Departure at 8:30 am on Northwest Flight #1022

Tuesday 11th April

9:00 am Baders will be picked up by Stan Brown and taken to the Chemistry Department

11.00 am talk at U of A Chemistry Department, V-107

"History of the Aldrich Chemical Co."

Lunch: with Dr. Rod Fraser (President U of A and Alumnus of Queen's) at the Faculty Club

3:30 pm return to Hotel - Transportation arranged by Chemistry

5:15 pm Dinner with members of the CSC Lecture series, La Ronde Restaurant at Crowne Plaza Hotel

7.30 pm Talk at King's University College

"The Bible Through Dutch Eyes (Rembrandt and the Jews)"

Refreshments/informal discussion following talk
Transportation to Hotel by Jean Cooley

Wednesday 12th April: Depart at 8:30 am Transportation to airport by Jean Cooley at about 7:00 am.

75th CSC Conference Lectures

Schedule for Dr. Alfred Bader's visit April 9-12th 1995

Sunday 9th April:

Dr. and Mrs. Bader arrive. Canadian 644 at 2:22 pm. Jean Cooley will meet plane.

Hotel MacDonald, 10065 100 Street
April 9 - 12
Confirmation number 6364
Non Smoking room with two double beds

Evening: dinner with Gerry Tertzakian. Gerry will pick up the Baders at 4:30-5:00 and arrange for their transportation to the hotel after dinner.

Monday 10th April:

8:00 am Baders picked up by Dr. Ron Kratochvil and taken to CBC Radio
7909 51 Avenue
8:40 am CBC Interview - 5 minutes air time on Edmonton AM

Morning Chemistry Department Dr. Bader's office in the Chemistry Department will be W3-39B, Phone (403) 492-3687

11.00 am talk at U of A Chemistry Department V-107

"Josef Loschmidt - The Father of Molecular Modelling"

12:30 pm Lunch, Faculty Club with Ron Kratochvil, John Vederas, Dick Peter

2:00 pm Afternoon and Dinner Dr. and Mrs. Norman Jones

7.00 pm (approximately) at the Edmonton Art Gallery. Transportation arranged by the Jones.
7.00-8.00 pm Gallery will be open for viewing.
8.00 pm Talk "The Adventures of a Chemist-Collector"
Light refreshments/informal discussions following talk.

Transportation to Hotel by Jean Cooley or Ron Kratochvil. Transportation also for the Jones.

ALFRED BADER FINE ARTS

DR. ALFRED BADER

ESTABLISHED 1961

June 2, 1995

Professor Ray U. Lemieux
Department of Chemistry
E5-52 Chemistry Bldg. East
University of Alberta
Edmonton, Alberta T6G 2G2
Canada

Dear Ray:

Thank you so much for your thoughtful letter of May 24th.

I very much hope that you will enjoy the enclosed book as much as I have already enjoyed spending yesterday evening looking at your book, *Explorations with Sugars*.

I laughed and cried - or at least, almost cried - a number of times. Some of your statements, such as the one on page 41 enclosed, should be on every bulletin board of every chemistry department.

I also had to smile when thinking back about a long discussion I had with someone from the CIC a few years ago. I was told that the CIC was planning to establish the Lemieux Award, with qualifications very much like those of the Bader Award. And they asked me whether I had any objections! Of course, I had to laugh and replied that I was that more people would establish more such awards, and surely that was really good for chemistry in Canada.

Of course, I have noted what you have said about Saul Wolfe, who was both your first Ph.D. student and who won, fittingly, the first Lemieux Award. Saul is a very great chemist, and yet, I am somewhat disappointed about his being so unhappy these last few years.

I was particularly interested in your comments regarding my letter to the Editor of Folio. Would it be possible for you to check this fall whether the Folio plans to publish the letter. Perhaps you should share your comments with your new President, Rod Fraser, who knows me well and whom I appreciate very much.

By Appointment Only
ASTOR HOTEL SUITE 622
924 EAST JUNEAU AVENUE
MILWAUKEE WISCONSIN USA 53202
TEL 414 277-0730 FAX 414 277-0709

Another, albeit minor, disappointment has been the student fellowships which Isabel and established in Canada some years ago. The capital is in Canada for three such scholarships, but this last year and some other years also, only two were awarded. There simply weren't enough student applicants! Of course, talking to you, I am running into an open door because you may have noted that the two students who won it this year both came from your University in Edmonton. But what can be done to make these more widely known? Of course, I realize that a $1,000 prize is not nearly as much as it was when you and I were students, but still ...

Isabel and I send you our very best wishes.

Sincerely,

AB/cw

Enclosure

University of Alberta
Edmonton

Canada T6G 2G2

Department of Chemistry
Faculty of Science
RU Lemieux, CC, FRS, University Professor

E5-52 Chemistry Building East, Telephone/Fax: (403) 492-3599
Department Fax: (403) 492-8231

May 24, 1995

Dr. Alfred Bader
Alfred Bader Fine Arts
Suite 622, The Astor
924 East Juneau Avenue
Milwaukee, WI 53202
U.S.A.

Dear Alfred:

Many thanks for your prompt reply to my letter of April 26th. Certainly, your recommendations to would-be entrepreneurs concur well with my own thoughts and experience. Your letter will make it possible, if necessary, to document what you said in the course of your lecture.

My letter brought the unexpected reward of a copy of your letter to Ron Thomas, Editor, Folio. You hit the nail right on the head, so to speak. The culprit for large waste of time and money on the "Research Makes Sense" publicity campaign is our Vice-President, Research, Dr. Martha Piper. I could hope she meant that the doing of research in universities makes sense but I suspect that this notion is too abstract for her to properly appreciate. It is all very depressing to see the efforts of many highly dedicated first class scholars, such as those who built our Department of Chemistry over the past 30 years, no longer appreciated. As you said, "so much for show rather than substance." The problem, of course, is that show is easier and more entertaining than substance and we have democratized our university to the extent that individuals are elected to positions of great responsibility for which they have neither the talent nor the competence, not to mention previously demonstrated excellence in leadership, but do put on quite a show. It is all very disappointing. Hopefully, like a plague, the madness will pass before the point of no return that University administrations with the government as the venture capitalist can build new technologies by funding what the bureaucrats believe is significant research.

I have enclosed with this letter a copy of the autobiography that I prepared for the ACS and published in 1990. Perhaps it can serve as an exchange for a copy of your book.

Best regards and all good wishes.

Yours sincerely,

Ray

RUL:ce
Enclosure

Dr. Alfred Bader
2961 North Shepard Avenue
Milwaukee, Wisconsin 53211

December 31, 1992

Dr. and Mrs. R. Norman Jones
Department of Chemistry
University of Alberta
E3-43 Chemistry Building East
Edmonton, Alberta T6G 2G2
Canada

Dear Magda and Norman,

I am sorry that a long trip to England has delayed my thanking you for your wonderful letter of November 5th.

I do not have to tell you, Norman, but for your kindness in my fourth year research project at Queen's I would probably not have gone into chemical research.

Unfortunately, I do not get the Canadian Chemical News. I did receive the letters in the October issue, but there might have been more in November or December. If so, I would appreciate it if you could send me copies.

All good wishes for 1993.

Sincerely,

Dr. Alfred Bader
2961 North Shepard Avenue
Milwaukee, Wisconsin 53211

February 15, 1993

Dr. R. Norman Jones, W3-60C
Department of Chemistry
University of Alberta
Edmonton, Alberta T6G 2G2
Canada

Dear Norman:

Thank you so much for your kind letter and your thoughtfulness in writing to the Canadian Chemical News.

There have been all sorts of funny and serious articles about my dismissal.

The silver lining is that I really enjoy my work. I continue to try to help chemists, particularly in the Czech Republic, to deal in paintings, and to work on two books.

The enclosed picture of you and me when we were still young and charming will amuse you.

Fond regards to you and Magda.

Sincerely,

Enclosure

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February 8th,1993.

Dr. Alfred R. Bader
2961 North Sheppard Avenue
Milwaukee
Wisconsin 53211
U.S.A.

Dear Alfred,

Magda and I were pleased to receive your letter of Dec.31/92. We anticipated that you had a very busy time over the last few months.

I am enclosing a photostat copy of my Letter to the Editor, as it appeared in the January issue of Canadian Chemical News. There has not been any further correspondence on this topic, but if anything appears, I will send you a copy.

A little while ago friends from Ottawa sent us a copy of"Castle for Queen's". The purchase of Hertsmonceaux Castle... a most generous gift. We are following the developments with great interest.

Magda joins me in sending our greetings and best wishes to you and Isabel.

Yours sincerely,

Norman

Dr. R.Norman Jones

Enc.

RNJ/mkj

Dear Alfred and Isabel,

I have just heard from Ron Kratochvil that you will be visiting the U of A campus later on this Spring. I am hoping that there might be sometime in your schedule for me to get your candide advice on how we might reinforce and build for the future in the chemistry arena.

Enclosed is a copy of my installation address - given January 20th or my 20th day on the job. I would also appreciate hearing your comments on it.

I look forward to seeing both of you in April.

Yours sincerely

Rod

University of Alberta

"Alberta Bound"

Dr. Roderick Fraser's speech on his installation as the 11th President of the University of Alberta, January 20, 1995

The chorus of Gordon Lightfoot's classic song "Alberta Bound" holds real meaning for me and provides a theme for my remarks today. Indeed, it's good to be Alberta Bound.

Eminent Chancellor, Your Honour, Ladies and Gentlemen. Mes chers amis, mes chers collègues. Je suis très heureux d'être ici devant vous. C'est un très, très grand plaisir pour moi et pour ma famille.

Ninety years ago, my mother's father, my Grandfather MacNaugton, was "Alberta Bound." He studied accounting at Mt. Morency Business College in Quebec, but he dreamed of becoming a farmer.

It was this dream that drew my grandfather to Alberta. Arriving in Edmonton in 1905, he collected a pair of oxen and moved eastward to establish himself as a homesteader in Ranfurly, about 40 kilometres east of Vegreville. There he met and married my grandmother, raised four children and lived his dream of "farming the land."

Because I spent so many of my childhood summers on that family farm in Ranfurly, I think I have a pretty clear idea what attracted my grandfather to Alberta nearly a century ago:

- the beauty of the prairies,
- the vastness of the sky,
- the richness of the land,
- the integrity of the people,
- the enormity of the potential.

These factors have remained steadfast over the past 90 years. They continue to distinguish Alberta from other places and keep so many "Alberta Bound."

For me, the irony of life has brought me full circle: After more than 30 years away, I am delighted to be Alberta Bound! And, moreover, it has me facing a set of challenging opportunities of a different kind – yet, in some ways analogous – to those faced by my grandparents some 90 years ago.

Life has certain privileges and responsibilities. As I reflect on my own life, and my return to Alberta, I am struck by how extremely privileged I am to have been selected to serve as the 11th President of the University of Alberta.

The University of Alberta is truly a distinguished institution – one that is renown for its scholarly achievements, its commitment to excellence in teaching, research and service to the community, and its depth, scope and diversity of academic programs.

I am honoured and humbled by the privilege of assuming the presidency of this outstanding institution. It is the greatest privilege that I have ever been given.

And yet, with this privilege comes responsibilities. Today's universities are being challenged to seize the opportunities presented by several monumental changes in our society, while, at the same time, honouring the age-old traditions of teaching and scholarship.

Universities have successfully evolved over more than 1,000 years. But, how do we now prepare for the 21st century? What are the challenges we face? What are the opportunities that await us? Can we rely on our past to guide us into the future?

The University of Alberta is a proud part of my family's history. My mother attended Normal School in Corbett Hall, and my father holds two degrees from the U of A. More personally, it was on the diagonal path leading northwest from the Rutherford Library to the old cafeteria that I first met my wife Judith on a cold, windy fall day some 32 and one-half years ago.

Whilst my connection to the University is rooted in the past, my focus as President is clearly directed to the future. In my vision, I see the University of Alberta, now one of Canada's largest full-service, research-intensive universities, entering the next century as indisputably one of Canada's very best universities, and this in three mutually reinforcing ways:

FIRST, in preparing students for life after graduation;
SECOND, in having professors who are national and international leaders in their disciplines;
THIRD, in ensuring that service to our communities is a priority for all of us.

First, our graduates will be prepared to work effectively and live fulfilling lives in the 21st century. They will be able to compete successfully with graduates from the best publicly-funded universities – not only in Canada, not only in North America, but in the world.

I want our students to feel confident and proud about the merit of their degrees – degrees that will be acknowledged and respected, across the country, the continent, and throughout the world for both their quality and their value.

In order to accomplish this, we must work together to create what I call an "optimal learning environment" – an environment that fosters critical thinking, independent judgment, written and oral communication skills, and knowledge in a specific area of human or scientific endeavour. It must also be an environment that facilitates and celebrates the development of the whole person.

Moreover, this learning environment must be constructed in the context of a complex world that has diverse value systems and increasing interdependence, one in which students face a career of several job changes.

I believe that an old Chinese proverb provides us with insight to creating such an environment. It states:

> Tell me, I forget.
>
> Show me, I remember.
>
> Involve me, let me do, I understand.

Whether it is through Socratic debate, industrial internships, student study teams, or the harnessing of new information and telecommunications technology, every student at the University of Alberta should be challenged to "be involved", to "do" so that they will "understand" forever.

Through this approach and others, we must discover ways of better unleashing the creative and entrepreneurial talents of our students. They will live and work in a world in which large institutions become less important as employers. And, conversely, self- employment and employment in small- and medium-sized firms will continue to grow sharply.

To assist us in these tasks, we must couple the best components of the traditional methods of learning with the most innovative uses of information technology, whose rapid development seems likely to have an impact on universities and on learning as great as that of the introduction of the Gutenberg Press in the mid-1400s!

We must aggressively explore these new technologies in order to exploit them to better achieve the learning outcomes we desire.

A final characteristic of this optimal learning environment is that it must better encompass an understanding of the global world in which we live. Graduates of the University of Alberta must be able to cope with the economic, cultural, social and political realities of an international society.

Teaching and learning programs and the campus community must become global in perspective so that each student gains a significant international experience.

The second aspect of my vision is a professoriate made up of people known . . . nationally and internationally. . . as leaders in their areas of research, scholarship, and creativity – leaders who are creating, integrating, transmitting and applying new knowledge.

Through our research and scholarship, we will help produce the new ideas, products, processes and services that will both provide the foundations of a productive Canadian society, and also enhance the social and cultural environment in which we will live.

We have done superbly well in Alberta with our resource-based economy. But we now need to enhance that advantage by increasing the efforts directed towards the new economy, the economy that is increasingly centred on knowledge and the exchange of information. Our University researchers will play a key role in this effort.

Starting as one of Canada's largest universities, with a number of research areas that are already amongst Canada's finest, we are extraordinarily well positioned to be a full and active partner in the economic growth and in the health and human development of Alberta and Canada today. At the same time, this very strength gives us the capacity to generate the new knowledge that will serve our grandchildren and great-grandchildren as they strive to solve the problems of their day.

And, finally, the third aspect of my vision depicts a university whose faculty, staff and, especially, students are active citizens of the society of which we are a part. We must expand our individual roles so that each of us contributes directly through service to one or more of our communities, from local to international.

The importance of community service is something my Grandmother MacNaughton understood and believed in intensely. She gave selflessly of her time and energy to the United Farm Women of Alberta, and eventually served as one of its fourteen Directors.

One of my most valued possessions is the briefcase she used as a Director. Perhaps it was because she risked to serve at a time when it was unusual for women to lead, that I cherish this symbol of her service. I used it every day until just a few years ago. It is still a symbol to me of the importance of service to one's community.

And so, as we proceed through this decade and prepare to move into the 21st century, times that will most certainly be characterized by turbulence and enormous change, I believe there will be a major sorting out of universities. Only a handful will emerge from the fray as strong, full service, research-intensive universities.

It is my vision that the University of Alberta will be one of these. It will be viewed universally and indisputably as one of Canada's best universities.

What then must we do to get from here to there? What will our strategies be?

First and foremost, we must have a relentless focus on quality – creating a stimulating, productive, and supportive environment for all of our teaching, learning and research initiatives.

This quality environment will not only help us attract and retain the very best minds, but will allow these minds to focus successfully on the unsolved mysteries and problems of our world.

Clearly, our most valuable resource is the individuals who make up our community – our students, our support staff, our faculty, and our alumni and friends. The quality of these individuals is absolutely and fundamentally tied to everything we do.

Secondly, we must monitor and assess our performance to know how well we are performing compared to our peers, compared to those national and international universities we wish to emulate and, most importantly, compared to the goals to which we aspire.

Thirdly, we must work at better aligning our activities to the nature of the intellectual and practical problems we are facing as a society.

Solving many of the most pressing problems of today's world, such as environmental management, the alleviation of poverty and the prevention of violence, or global climate change, requires knowledge from a wide spectrum of disciplines. We must better engage those disciplines in collaboration, so that the critical thinking needed to understand these issues is successfully brought to bear.

For our fourth strategy, we must build a more responsive, less hierarchial management system to better and more quickly adapt to our changing circumstances.

Our fifth strategy is selectivity. Even with the intellectual and economic wealth of Alberta and Albertans, we cannot be all things to all people. Keeping our relentless focus on quality, we must be more selective on how we allot our relatively scarce resources.

That leads us to our sixth strategy. We must become better at building new partnerships and enhancing existing ones. We must seek partners in Edmonton, throughout Alberta, across Canada, and around the world – partnerships amongst teaching scholars, amongst researchers, and amongst other educational institutions – partnerships with the private sector, with government, with alumni and with close friends.

I was fortunate to grow up in a family that enjoyed music. My mother and my three sisters all play the piano; and I love to sing. In my childhood, my family would gather Sunday evenings for a traditional sing-song. Each member of the family would participate, each brought unique strengths, each contributed to the overall harmony.

It is this harmony that we wish to achieve here at the U of A. We must value the contributions of each individual member of the University community, clearly recognizing that each has a critical role to play in meeting our vision.

So that's it – six strategies as we move to fulfil our vision – a relentless focus on quality, the monitoring of performance, creative alignments, a responsive management system, selectivity, and partnerships.

As we now move to implement our overall strategy, we do so on the sure promise, with the sure understanding that we are servants of our broader society: of our students, of Albertans, of Canadians, of culture, of citizenship, of knowledge, but, fundamentally, we are servants of truth. *Quaecumque vera.*

My grandfather knew what he was doing in 1905, when he was Alberta Bound. I am grateful for his courage, wisdom and fortitude to follow his convictions – to abandon accounting for farming, for being Alberta Bound. While he might have disagreed with some of my choices, he would not have any quarrel with my decision to return to Alberta. He, more than anyone, understood the draw of the prairies and the big sky.

Now, ninety years later, I am as convinced as he was that this is the place to be . . . that this is the place where it is going to happen . . . that, with the commitment of all of us who are Alberta Bound, we will be successful in ensuring the University of Alberta will enter the next century as one of Canada's very finest universities.

Join me in meeting this challenge. Encourage others to join us in this effort. Together we can make it happen. Together we WILL make it happen.

Dr. Alfred Bader
2961 North Shepard Avenue
Milwaukee, Wisconsin 53211

July 25, 1994

Professor B. Kratochvil, Chairman
Department of Chemistry
University of Alberta
Edmonton, Alberta T6G 2G2
Canada

Dear Professor Kratochvil:

You must have realized how very much I enjoyed chatting with you during that delightful dinner and performance in Winnipeg.

Surely you know that my heart is at Queen's, and I am delighted that Professor Stan Brown has accepted the chair of chemistry there. For many years, Alberta has had the great chemistry department, and there was a time when one of your professors, Rubin Sandeen, was rightfully considered the greatest teacher of organic chemistry in Canada. Queen's has had its ups and downs, I am happy that Professor Brown will now help it to go up.

Since winning the Parsons Award, I have been absolutely swamped with invitations to speak hither and yon and don't quite know how to fit many more talks into my schedule. Specifically, I plan to be at the Anaheim A.C.S. meeting early in April, and either just before or after that meeting may go to the UBC for two or three talks. At the end of May, I very much look forward to the next C.I.C. meeting in Guelph, and right after that we will leave for Europe.

Professor Piers in Vancouver will be coordinating my talks there. The one possible window for other talks in Western Canada might be just before or just after the talks in Vancouver.

All good wishes.

Sincerely,

University of Alberta
Edmonton

Canada T6G 2G2

Department of Chemistry
B Kratochvil, Chairman

E3-36 Chemistry Building, Telephone (403) 492-3249
Fax (403) 492-8231

9 June 1994

Dr. Alfred Bader
2961 North Shepard Avenue
Milwaukee, Wisconsin 53211
USA

Dear Dr. Bader:

It was a pleasure speaking with you in Winnipeg. Your "menu" arrived today. If I can take you up on your comment that you might be willing to give three talks, I would suggest one lecture each from groups A and C, and a third from either B or D. The choice from within each group would be yours (my personal preference from the A category would be for the talk on Josef Loschmidt).

As for timing, I understand that you are committed for the remainder of 1994. I propose the late spring or early summer of 1995, when the weather in Edmonton is quite pleasant. We would be glad to explore the possibility of a lecture series through the western Canadian cities as per your suggestion. If the time of May - June is agreeable with you we will contact some of the other Universities. Please let me know whether this is appropriate for your schedule. We would be pleased to reimburse you for at least part of your travel costs; this can be settled once the extent of visits to other cities has been determined.

On returning to Edmonton I spoke with Stan Brown. It appears that the odds of his moving to Queens are now about 99:1. This will be our loss but good for Queens. We welcome the development of another strong and vibrant chemistry department in Canada. I am confident that Stan will work hard to bring this to pass at Queens, which already has a good nucleus of people in some areas. Your support and encouragement of Queens has had a positive effect in the past and will continue to do so. What helps them is good for chemistry in all of Canada; thanks for all you have done for the discipline.

Sincerely,

Ron Kratochvil

Ron Kratochvil

Dr. Alfred Bader
2961 North Shepard Avenue
Milwaukee, Wisconsin 53211

June 6, 1994

Professor B. Kratochvil, Chairman
Department of Chemistry
University of Alberta
Edmonton, Alberta T6G 2G2
Canada

Dear Professor Kratochvil:

I so enjoyed being able to chat with you last week.

As promised, please find enclosed the "menu" of my talks.

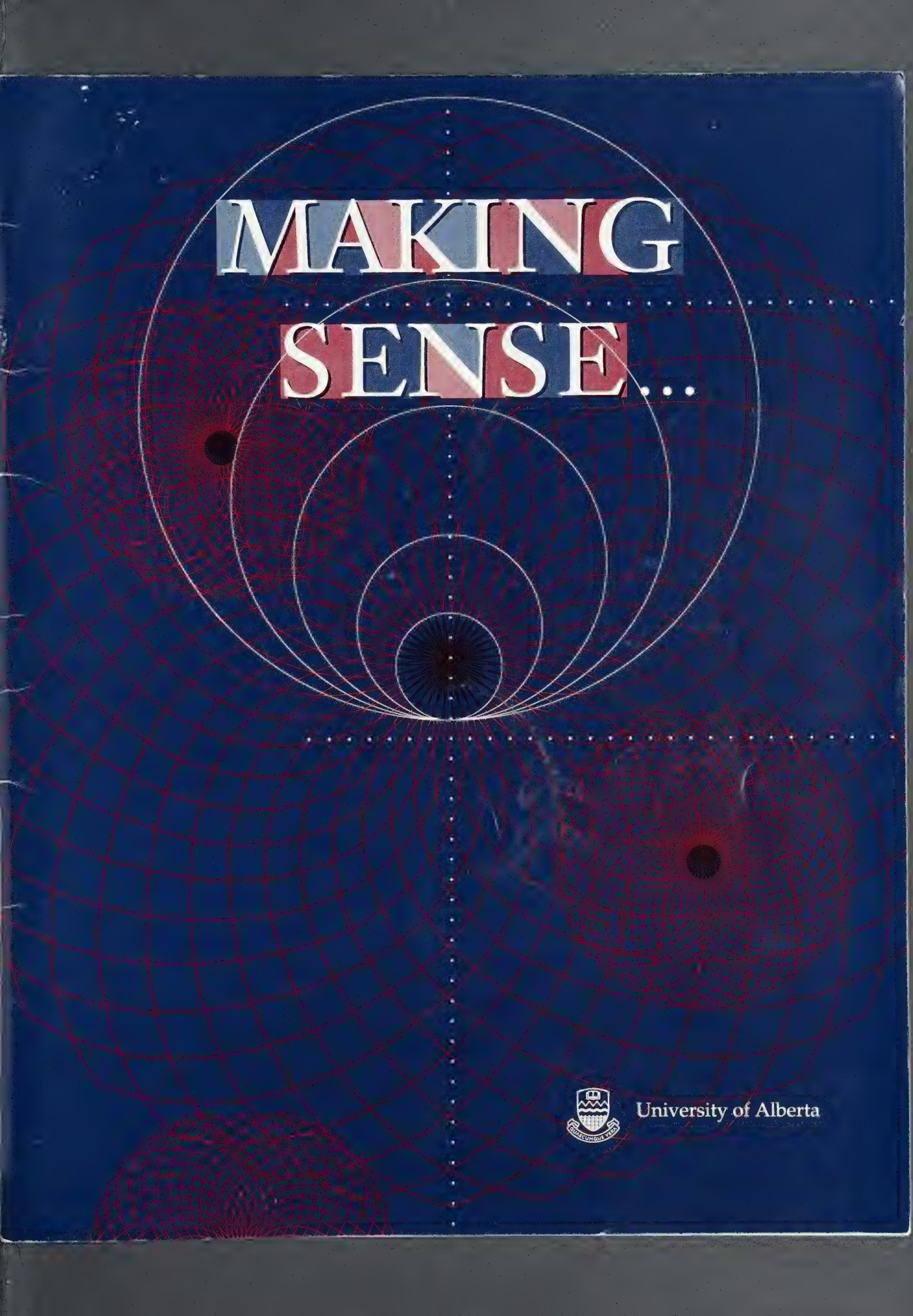
Of course, it would be difficult and expensive to travel from Milwaukee only to Edmonton, but perhaps sometime in the next few years a lecture series from Winnipeg through Saskatoon, Edmonton, Vancouver and Victoria could be arranged.

All good wishes.

Sincerely,

Enclosure

MAKING SENSE...



University of Alberta

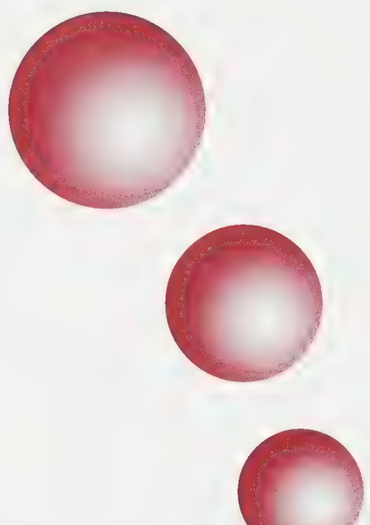
Contents

The University of Alberta is one of Canada's largest research-intensive universities, with an enrollment of more than 30,000 students. Research funding in 1993-94 exceeded $87 million, putting the U of A in the top five Canadian universities in total funding. The University is an active participant in the Canadian Networks of Centres of Excellence. Through the transfer of University-based technology and knowledge to the commercial sector, the U of A, as the largest research institute in the province, is a major engine of economic development for Alberta and Canada.

...OF RESEARCH AT THE UNIVERSITY OF ALBERTA

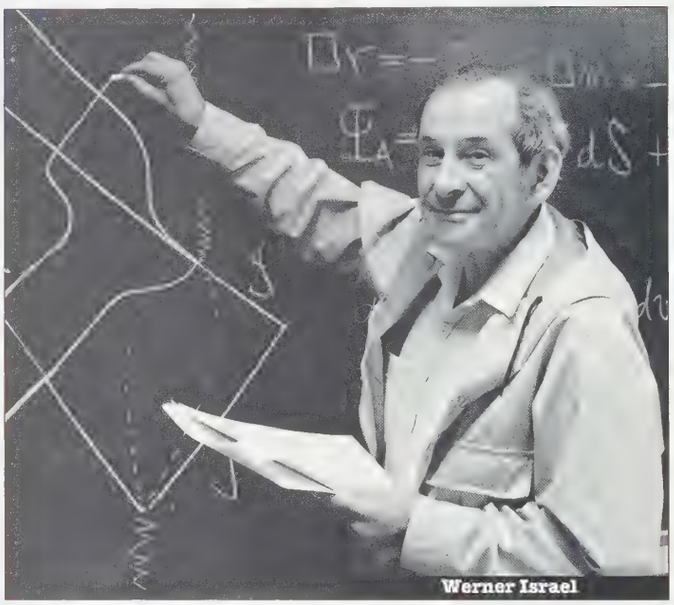
Making Sense is the essence of research — making sense of the world we live in, our past and future, our heritage and ourselves.

Making Sense of Our Universe



Are the Answers in Black Holes?

Ten years ago, Werner Israel was the only cosmologist on staff in the Physics Department. Now the University's cosmology group includes more than 20 people, led by Dr Israel and physics professors Don Page, Bruce Campbell, and Valery Frolov.



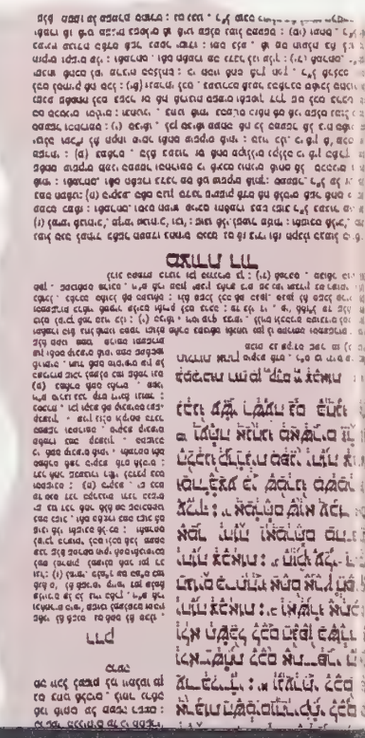
Werner Israel

One of the group's major interests is black holes.

"They're a meeting ground and a place where we can test our ideas," Dr Israel explains.

Black holes — the result of the gravitational collapse of stars — are so powerful that neither light nor matter can escape from them. These extreme conditions allow theorists like Dr Israel and his colleagues to study, and perhaps resolve, the apparent contradictions among three basic areas of physics — thermodynamics, quantum mechanics and general relativity.

"Black holes offer a tantalizing and mysterious glimpse of the possible unification of these areas," says Dr Israel. ◆



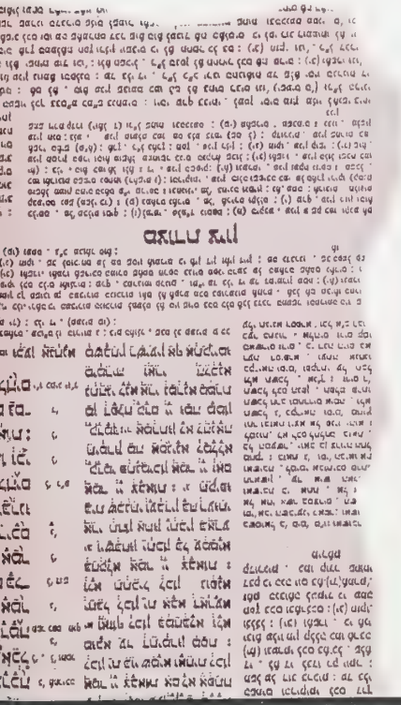
Nicole Tomczak-Jaegermann

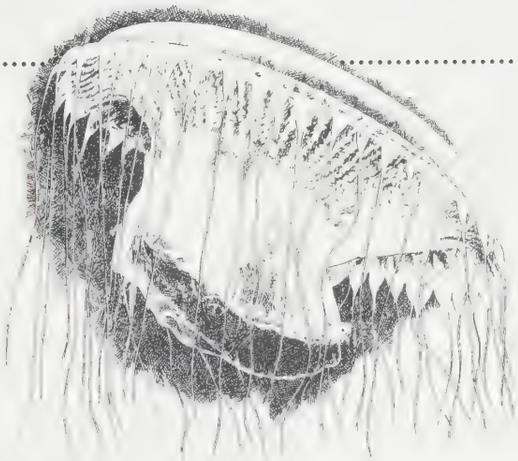
Feeling Our Way Through Infinity

It's the bizarre things that happen in infinite-dimensional worlds that fascinate mathematics professor Nicole Tomczak-Jaegermann. She investigates linear properties and geometric phenomena of convex bodies in a space.

"A big part of the practical methods of the sciences is in their linear nature," explains Dr Tomczak-Jaegermann. "So it is important to explore the outer limits of their applicability."

This area of pure mathematics combines deep analytic methods with geometric intuitions. It relates indirectly to the outside world by providing abstract frameworks for theories on the borderline between mathematics and physics. ◆

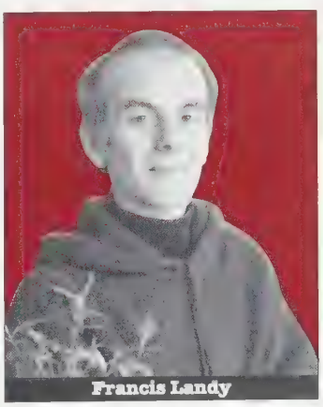




Voices From the Past

Listening to voices from the remote past gives us a sense of continuity and feeling of belonging, says religious studies professor Francis Landy.

Dr Landy is using the methods of literary criticism to explore the books of the Old Testament. "The poetry and prose narrative of the Old Testament has as profound an insight into basic human questions as anything ever written," he explains. "Its writers are brilliant." ◆



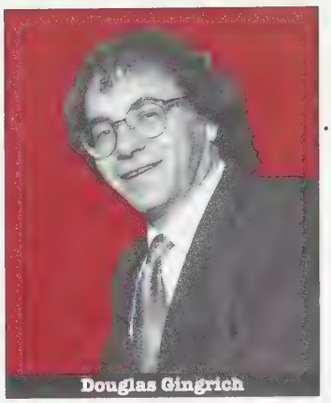
Francis Landy

Getting to Basics

Curiosity about the basics of life is what drives zoology professor Andy Spencer's research on jellyfish. He's looking for clues about how the nervous systems of jellyfish and higher animals are similar. And his research on jellyfish suggests that the basic molecular and physiological mechanisms used by jellyfish nerve cells aren't much different from those of higher mammals, even humans.

Evolution has simply rearranged the same building blocks, says Dr Spencer, director of the Bamfield Marine Station on Vancouver Island. Our nerve cells aren't smarter, they're just more plentiful, he explains.

He's now looking at even more primitive groups than the jellyfish to discover whether they, too, have the same basic building blocks in their nervous systems. ◆



Douglas Gingrich

The Missing Particle

Physics professor Douglas Gingrich is searching for a particle — the Higgs particle. It's one of the fundamental particles of nature. And it hasn't been discovered yet.

"The Higgs particle is significant because it gives all other particles in the universe mass," Dr Gingrich says. "It's a necessary ingredient we have to find in order to make sense of our theories." ◆

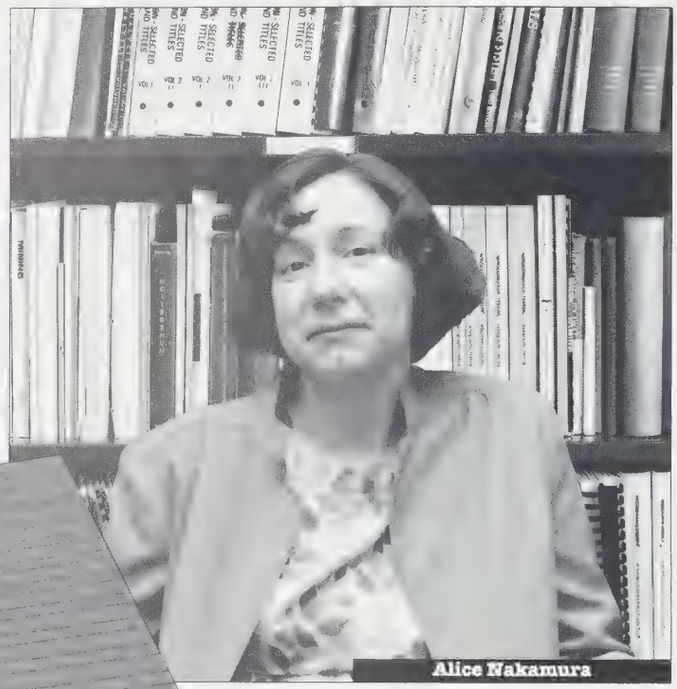
Thomas Chacko

What Happens Below the Crust?

Geology professor Thomas Chacko studies the processes that occur far below the earth's surface, in the deep crust 10 kilometres or more below our feet.

Understanding more about these deep processes helps us understand more about the geology of the earth. As well, techniques developed for this research are often useful in locating economically important minerals. ◆

Making Sense of Our Economy



Alice Nakamura

Challenging Assumptions About Women

The research of business professor Alice Nakamura is challenging some widely held assumptions. And her studies on the employment continuity and earnings of women who have children is influencing public policy across North America.

One of the assumptions Dr Nakamura has challenged is that women will work in the labor market for a shorter period than men do, so it's expensive to hire women for positions that need substantial investments.

But Dr Nakamura, using a different kind of data set from earlier studies, found that the relationship between having children and length of time in the workforce was really not that strong.

Full-time working women do reduce their work when they have children — but not to a great extent. Therefore, losses to employers from hiring and training women, some of whom will have children, are likely to be less than previous studies suggested. ◆

Paul Boothe

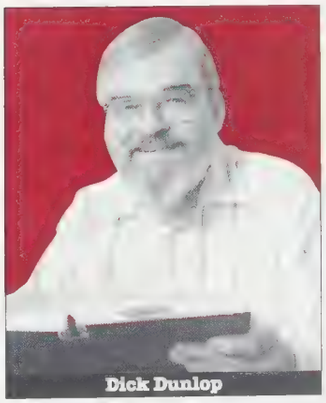
Spending Taxpayers' Money

What makes governments spend money the way they do?

For economics professor Paul Boothe, this question is an inspiration for his long-term academic research. His work on modelling government budgets and analyzing debts and deficits is aimed at filling in some of the pieces of the spending puzzle.

Besides doing economic analysis, Dr Boothe also explores attitudes of decision makers to government spending. His research showed that while politicians regard the budget process as important to determining government spending, public servants see political will as making the difference.

"Surprises like this are one of the reasons I enjoy research," says Dr Boothe. "You get a jolt from an unexpected result." ◆



Dick Dunlop

Creditors' Rights

Collecting debts can be a nightmare. It shouldn't be — there are laws to cover these situations. However, in Canada, creditor-debtor law tends to be a mess, says law professor Dick Dunlop. His book, *Creditor-Debtor Law in Canada*, is a detailed guide to this area of law.

"In most provinces, creditor-debtor law is antiquated, incoherent and has more to do with the nineteenth century than the twentieth," says Professor Dunlop. "Reform is desperately needed. This research gives us a basic picture of the law and a starting point for reform." ◆

Basic Research Helps Oil Recovery

In a global economy reliant on fossil fuels, it's opportune that much of chemical engineering professor Jacob Masliyah's fundamental research into the motions and forces in fluids has been applied directly to the recovery of bitumen from oil sands.

Dr Masliyah has developed a computer package that simulates the process of extracting bitumen from oil sands. The program makes it possible to detect changes in the extraction process as they are occurring, and to estimate their effect on bitumen recovery. There's a financial benefit to the industry, too: the program also makes it possible to predict a commercial plant's efficiency in recovering bitumen. ◆

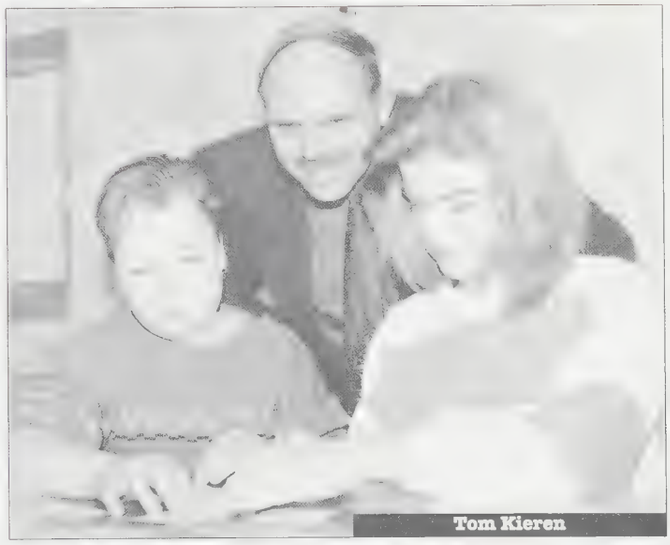
What Price Derivatives?

In financial markets, several spectacular corporate mishaps have put derivatives at the centre of much controversy.

For business professor Giovanni Barone-Adesi, derivatives — futures, options and other instruments whose price depends on that of an underlying asset — are a fertile ground for research.

Part of Dr Barone-Adesi's research focuses on the complicated mathematics involved in putting a value on derivatives.

His other work is policy oriented: he has studied the possible use of derivatives by governments or firms as a way to improve financial contracts. ◆



Tom Kieren

Mastering Math

In our increasingly high tech world, where math and science rank high as keys to economic competitiveness, Tom Kieren is studying how children understand mathematics.

"A critical feature of understanding mathematics is forming an image, then doing things with it," the education professor says. "We want to find out how children form that image."

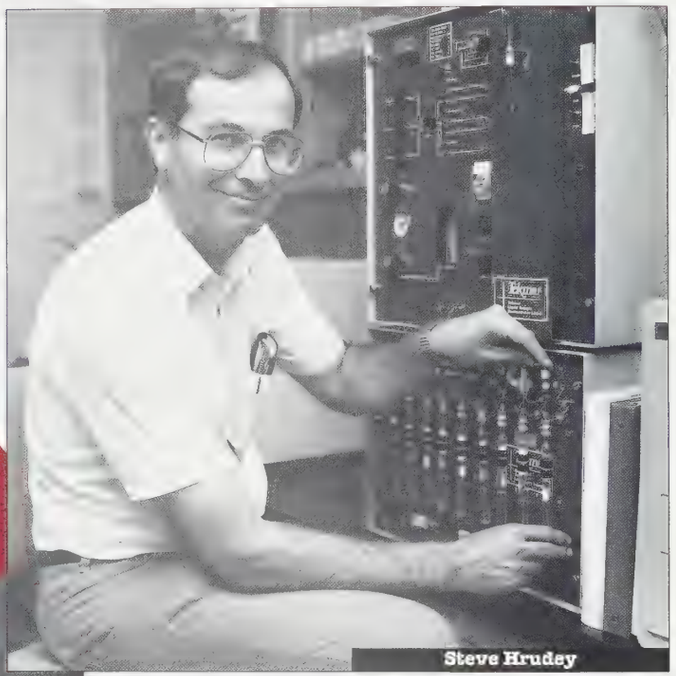
Dr Kieren's aim is to help teachers in the classroom create a situation where mathematical understanding can grow. ◆

Making Sense of Our Environment

Living Within Our Environmental Means

"We will have to accept that Mother Earth has finite resources and we must find more sustainable ways of living within those finite constraints," says environmental health professor Steve Hrudey. "That will require our society to make increasingly difficult choices."

Dr Hrudey's research is aimed at helping us make those difficult choices. He holds Canada's first Eco-Research Chair in Environmental Risk Management, a focus for interdisciplinary research on understanding and managing environmental risks.



Steve Hrudey

One research project in progress is a study of legal issues in environmental decision making. It focuses on the compatibility of science and law in environment-related decisions made by the courts and administrative boards.

Another project, with Dr Margaret-Ann Armour, is to develop safe and effective procedures to convert small-scale laboratory wastes into non-toxic wastes that can be disposed of safely. ◆

Marvin Dudas

The Ripple Effect of Pollutants

Whether they're spills, leaks or emissions, most pollutants end up on the ground — where soil science professor Marvin Dudas studies how they interact with the soil and affect our environment.

"When pollutants are introduced to soil, chemical and biological reactions may immobilize them or contribute to their movement through the ground to food crops and wildlife and to groundwater," Dr Dudas explains.

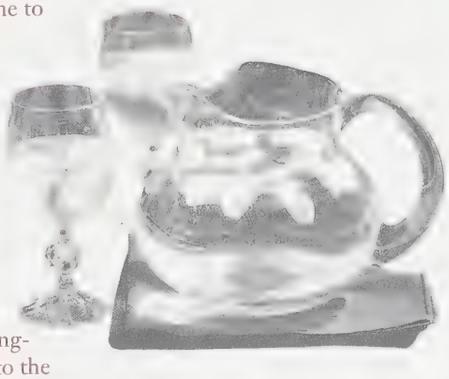
He is studying how chemical reactions of pollutants impact on soil quality, groundwater and surface water — and ultimately on human health. ◆

Ellie Prepas

No Toxins From the Tap

Some groups of freshwater algae produce toxins that have been linked to deaths of cattle, wildlife and family pets. In some cases, the animals have died only 10 minutes after drinking from the algae-infested water. These toxins have also been linked to several liver-related illnesses in humans.

The toxins first came to biosciences professor Ellie Prepas' attention during a study of ponds in rural Alberta.



Dr Prepas is now part of a multidisciplinary research team studying the occurrence of these toxins in drinking water from sources ranging from farm ponds to the water supply of the cities of Edmonton and Camrose.

The understanding gained from this research is vital to developing sound public policy on how to protect people from the toxins, Dr Prepas says. ◆

Farming and Forestry Without Pesticides

Entomology professor John Spence is looking for ways to make life miserable for pesky insects — but better for the environment.

Research in his lab is aimed at increasing the effectiveness of biological and cultural methods for controlling insects — it's part of an international effort to find safe alternatives to the widespread use of pesticides.

The goal is to promote an 'ecological engineering' approach — understanding how natural systems work and then applying this understanding to resource management and conservation.

"I believe it's possible to do agriculture and forestry without pesticides. It's a goal we should aim for," Dr Spence says. ◆

John Spence

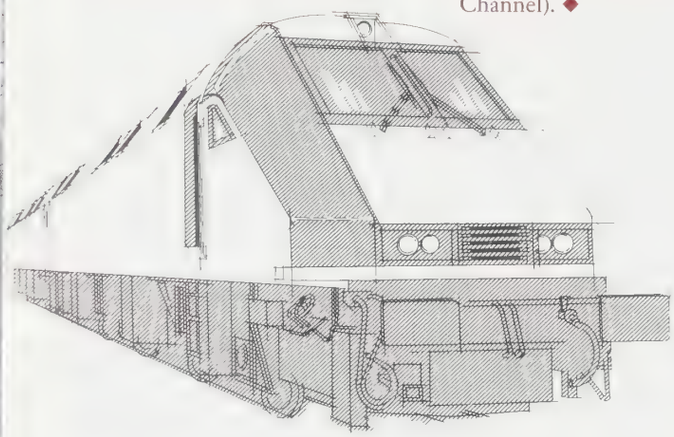
Zdenek Eisenstein

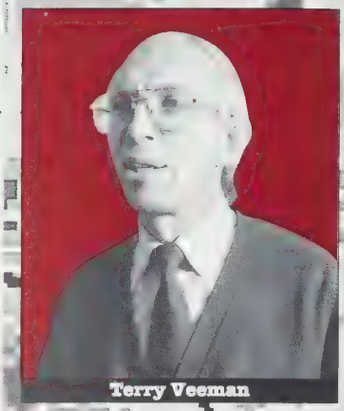
Tunnel Expert Advises Chunnel Team

In more than 30 years of research, civil engineering professor Zdenek Eisenstein pioneered many of the concepts at the heart of today's high-tech approach to tunnelling. His appointment as senior consultant to the Chunnel technical team confirmed his reputation as one of the world's leading authorities on tunnelling — making passage-ways through the environment for such things as trains, vehicles and pipelines as well as water, power and communications services.

Dr Eisenstein's Chunnel job was to consider the results of geological testing and evaluate the most suitable construction methods and machinery.

A unique souvenir of his work is a stamp in his passport — the very first given out by British Customs confirming entrance to the Chunnel zone (the international territory in the middle of the 50-kilometre tunnel under the English Channel). ◆





Terry Veeman

Standards for Sustainable Development

Research on the components of sustainable development has led economics and rural economy professor Terry Veeman to suggest a number of measures to improve current economic policy.

His suggestions include adding into the costs of a product the presently excluded costs of pollution damages, and establishing minimum standards for the conservation of certain natural resources.

"There are some resources — Alberta's mountain parks, for example — for which there are no replacements," Dr Veeman says. But he doesn't think all resources must be preserved.

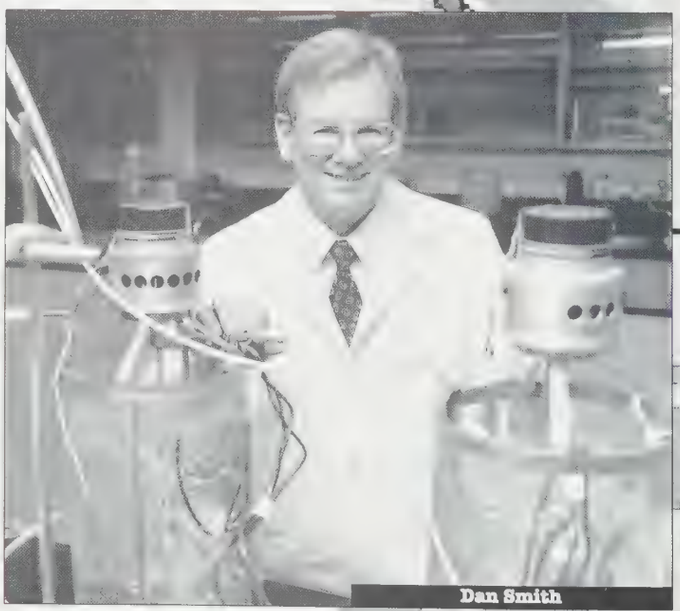
"We must identify the critical natural capital," he says. "It's vital to establish safe minimum standards for the preservation of these resources, so we keep options open for future generations." ◆

Watchdogs of Our Water

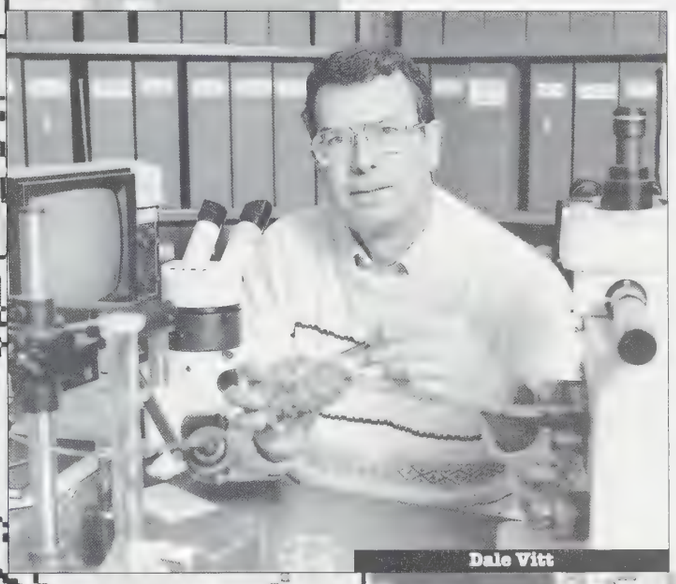
We tend to take clean drinking water for granted. Civil engineering professor Dan Smith's task is to make sure that that water *is* drinkable.

His research team has been studying wastewater treatment, discharges into rivers, and water treatment for about 15 years. Their work ranges from the condition of raw water in rivers to the quality of water that comes out of the tap in our homes.

"As engineers, we have a responsibility to guide people to the better way to protect public health and the environment," Dr Smith says. ◆



Dan Smith



Dale Vitt

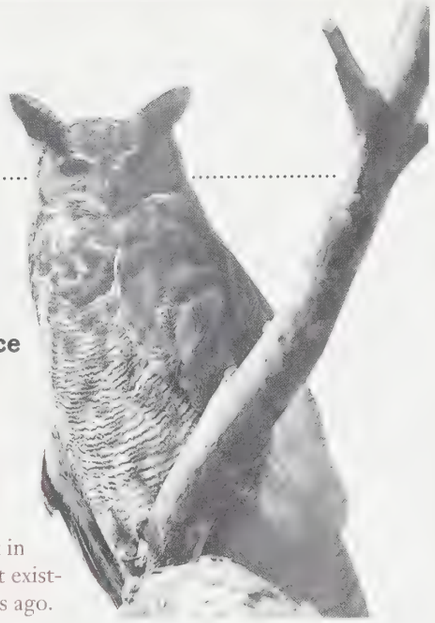
A Precious Resource

It was once assumed that peatlands in Canada developed about 10,000 years ago, very soon after the glaciers receded. But botany professor Dale Vitt's research shows that in many areas very little peat existed earlier than 6,000 years ago.

Why does this matter?

"Things must have happened much faster than we thought," Dr Vitt says. Climatic change in the past must have had a very large effect on these wetlands. Given the forecasts of future climatic change, there could be even more change in store for wetlands.

"We should care about what will happen to our wetlands," Dr Vitt says. "They're valuable wildlife habitat and the source of much of our clean water. They're going to be much more precious in the next hundred years." ◆



Restoring the Land

Restoring land disturbed by humans is not only a technical challenge, it touches on many deeper, philosophical and cultural issues as well. How does our ability to restore damaged ecosystems influence our idea of nature? If we can create nature, what will nature really mean?

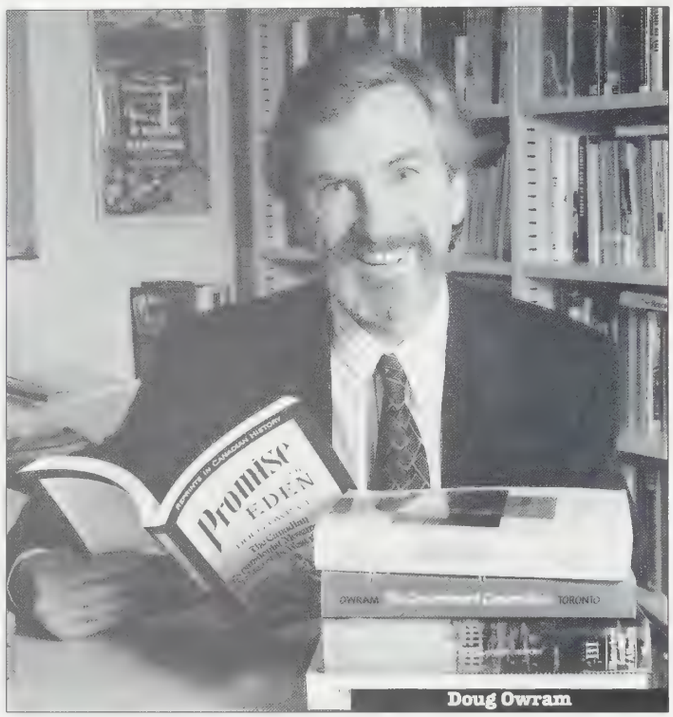
These are some of the questions that fascinate anthropologist-sociologist Eric Higgs — who's also a philosopher by training.

Dr Higgs' research is aimed at understanding what constitutes good ecological restoration, and exploring the links between culture and nature.

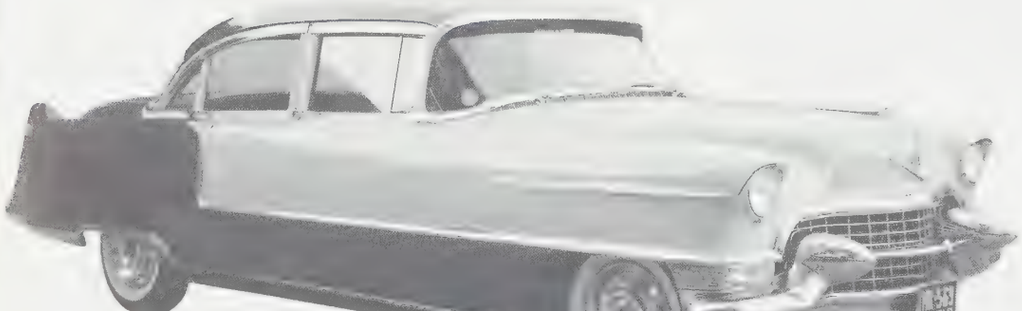
"If we're going to create nature, we have to understand how our culture affects what we do," he says. "There's more to ecological restoration than technical prowess." ◆

Eric Higgs

Making Sense of Our Past



Doug Owram



Busting Boomer Myths

Much has been written about the economic effects of the baby boom. Now history professor Doug Owram has written, in a forthcoming book, on the social and cultural history of the baby boom generation in Canada.

One of Dr Owram's reasons for tackling this subject is to put to rest some of the myths about that generation, especially the myth about the uniqueness of baby boomers. He argues that, although the generation has some special characteristics, it's not unique.

"Boomers have an overwhelming sense of themselves as unique," says Dr Owram. "That translates into self-confidence on the positive side and arrogance on the negative side.

"Moral superiority of one generation over the previous one is false. Boomers should start seeing themselves as part of history rather than apart from it." ◆

Old Bones Tell Tales

Using the evidence locked in the bones and teeth of skeletons, anthropology professor Nancy Lovell is studying the health of ancient Egyptians.

Many illnesses and injuries leave their mark on bones — the more obvious ones are healed fractures and vertebrae fused by the bony growths of arthritis. Anemia shows up as enlarged marrow spaces in bones. Tartar deposits, decay, and wear on teeth give clues about diet.

"I look at skeletons and try to reconstruct a person's life history," explains Dr Lovell. "The study of individuals allows me to discern patterns in society as a whole — for example, the frequency of illness and injury and what groups they affect most. The challenge is then to relate these data to the social context." ◆

Nancy Lovell

John Orrell

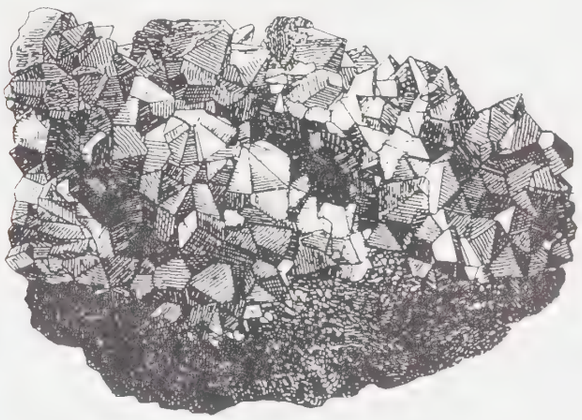
The Play's the Thing?

For English professor John Orrell, the theatre's the thing.

Dr Orrell specializes in the history of English playhouses — research that combines his interests in architecture and literature. His best-known project is the reconstruction of Shakespeare's Globe Theatre. Dr Orrell is the prime architectural consultant to the International Shakespeare Globe Centre. This exact-as-possible replica of the original Globe is scheduled to open in London in 1995.

Reconstructing the Globe was a major piece of detective work. The evidence was scant: a few drawings, some building contracts, passing references in correspondence, suggestive stage directions, and little more.

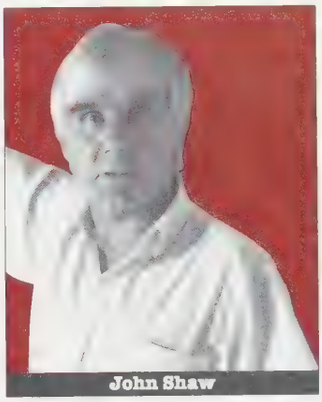
"The aim is to restore Shakespeare to his own voice," Dr Orrell says. "We're recreating Shakespeare's original instrument." ◆



Sleuthing for Ore

With one foot in academia and the other in industry, geology professor Roger Morton does basic research that can be applied by industry to aid in the search for and discovery of new mineral resources. He likens the work of economic geologists to solving a geological whodunit.

"In economic geology we retrace the events and processes that led to the formation of ore deposits," Dr Morton explains. "You can't afford to ignore any kind of evidence — chemical, physical or observations in the field." ◆



John Shaw

Drumlins Debate

Imagine a river with more than 4000 times the discharge of the North Saskatchewan, rushing underneath a glacier down the length of Alberta. That's what geography professor John Shaw believes happened about 14,000 years ago. It's part of his controversial theory on the origin of drumlins — unique, cigar-shaped hills.

Conventional theory says drumlins were formed by glaciers, which gradually scour and reshape the ground beneath them.

According to Dr Shaw's theory, drumlins were formed by a sudden release of meltwater from the huge ice sheet that once covered Canada. This catastrophic flood formed the extensive drumlin fields of northern Saskatchewan, then poured over Alberta.

Evidence for the new theory comes from a variety of sources, including laboratory experiments, studies of the internal structure of drumlins and analysis of remote sensing images. ◆

Making Sense of Ourselves

Helena Fracchia

Life Among the Ruins

Classics professor Helena Fracchia studies places and the people who lived in them long ago. She and her husband, classics professor Maurizio Gualtieri, are excavating three major archaeological sites in Italy: a pre-Roman fortified hill town, and two rural Roman villa complexes. One complex is in central Italy, the other is in the south, and over the centuries they both evolved into small villages.

Dr Fracchia's research is a form of ancient demographics, piecing together how the indigenous tribal society evolved and became part of the Roman Empire. That evolution is particularly clear in southern Italy where her findings show how an indigenous centre high on a hill was made marginal by the Roman road systems that bypassed it.

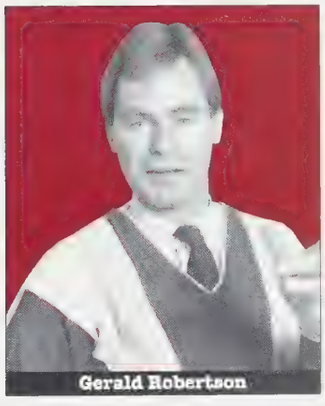
"When you dig a settlement, you see the full socioeconomic development," says Dr Fracchia. "Archaeology is infinitely more significant if you have a context — you get a real picture of what life was like. Learning about life in those times helps us understand more about our own culture, the origin of many of our customs and the framework of our society." ◆

Power to Control Our Lives

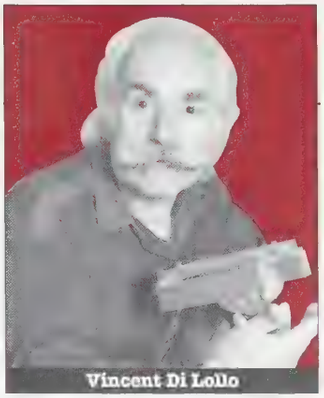
When it comes to laws governing the decisions people make about their finances and medical treatment, one of the most contentious issues is personal control. It's also one of the issues that concerns law professor Gerald Robertson.

Professor Robertson has explored the issue of personal control in two projects. One is in decision making in financial matters (enduring powers of attorney). The other is in health care (advance directives or "living wills"). In both cases, he recommended the creation of new provincial legislation.

"We're talking about the power of the individual to exercise autonomy over their own decisions," says Professor Robertson. "The law must strike a balance between individual interests and those of society." ◆



Gerald Robertson



Vincent Di Lollo

How Does the Brain See?

Psychology professor Vincent Di Lollo's goal is to understand the complex processes in the brain that enable us to see.

"When we understand how the visual system works, we'll have a better understanding of problems such as dyslexia," he says.

"What is not known about the visual system far exceeds what is known," Dr Di Lollo explains. "Much has been discovered in the past 10 years. For example, we now know that when we look at a rose swaying in the wind, its color is processed in one part of the brain, its shape in another, and its movement in yet another.

"Our work now is to understand how the brain combines these separate processes so that we may perceive a whole rose." ◆

TREATY NUMBER THREE

The North-West Angle Treaty

JULY

1871

...But arrangements will be made next year to get these things for those who are farming, it cannot be done before as you can see yourselves very well. Some are farming, and I hope you will all do so."

Chief—"One thing I did not say that is most necessary—we want a cross-cut saw, a whip saw, grindstone and files."

Governor—"We will do that, and I think we ought to give a box of common tools to each Chief of a Band."

Chief—"Depending upon the words you have told us, and stretched out your hands in a friendly way, I depend upon that. One thing more we demand—a suit of clothes to all of us."

Governor—"With regard to clothing, suits will be given to the Chiefs and head men, and as to the other Indians there is a quantity of goods and provisions here that will be given them at the close of the treaty. The coats of the Chiefs will be given every three years."

Chief—"Once more; powder and shot will not go off without guns. We ask for guns."

Governor—"I have shewn every disposition to meet your view, but what I have promised is as far as I can go."

Chief—"My friends, listen to what I am going to say, and yo[illegible] brothers. W[illegible] ow with our

A New View on Aboriginal Peoples

Shifting perspective on aboriginal peoples — that's what anthropology professor Michael Asch's research is about. He says that by stepping outside our culture, we can gain a better understanding of the relationship between aboriginal peoples and Canada.

In one project, Dr Asch is studying certain court decisions on aboriginal rights. "Our laws reflect an understanding of aboriginal peoples that's about 100 years old," he says. "I'm interested in how the law would change if it was based on a contemporary perspective. My goal is to move court decisions away from our cultural biases." ◆

Consumers' Choice

Many retailers from across Canada have become members of the Canadian Institute of Retail and Services Studies, based at the University. The Institute carries out research projects for individual companies as well as more basic research of general interest to retailers.

One such study, headed by one of the institute's directors, business professor Adam Finn, is an evaluation of market research techniques used to collect data on the retail choices consumers make.

"Today the investment in a single mega-store is huge and the risk is high," says Dr Finn. "Retailers need to be much more certain about the most favourable location and price levels. We can help." ◆

La complexité historique du Québec

Dans la recherche qu'il a consacrée aux entrepreneurs canadiens-français du Québec, Claude Couture conteste les idées reçues qui décrivent la Belle Province des années antérieures à 1960 comme une société monolithique dominée par l'Église.

Claude Couture

Pour le professeur de sciences sociales de la Faculté Saint-Jean, ce point de vue simpliste nie la complexité historique de la société québécoise. Ses travaux démontrent que, bien avant la Révolution tranquille, le Québec possédait déjà une élite d'affaires influente.

«Si [les Québécois] pouvaient avoir une meilleure compréhension de la complexité de leur passé, peut-être envisageraient-ils l'avenir sous un jour meilleur, dit le professeur Couture, et peut-être n'auraient-ils pas besoin de la souveraineté pour protéger leur culture.

«Tout ceci doit être saisi dans le contexte d'une vision complexe de la société. Si nous n'adoptons que des points de vue simples, nous risquons de reléguer aux oubliettes des éléments importants de la société canadienne et québécoise.» ◆

The Complexity of Quebec

Claude Couture's research on the French Canadian business community in Quebec challenges conventional thinking that portrays Quebec, before 1960, as a monolithic society dominated by the church.

Such a simplistic view denies the historic complexity of Quebec society, says the Faculté Saint-Jean social sciences professor.

His studies show that, long before the Quiet Revolution, there was an influential business elite in the province.

"If Quebeckers could have a better understanding of the complexity of their past, maybe they would feel less insecure about their future," says Dr Couture. "It may be that they don't necessarily need sovereignty to protect that culture.

"This has to be understood in a complex vision of society. If we take only simple views, we risk scrapping important parts of Canadian and Quebec society." ◆

From Clothing to Culture

Through her research on textiles, human ecology professor Sandra Niessen has a window into Indonesian tribal society. Her studies of changes in clothing of the Batak tribe during the nineteenth and early twentieth centuries have illuminated much about the culture of the tribe.

"While some might bemoan the fact that the Batak have lost their traditional dress, this is a very limited view," says

Sandra Niessen

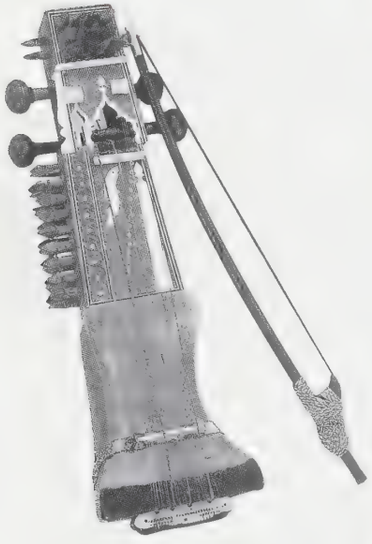
Dr Niessen. "As outsiders, we miss a lot if we can't get beyond how things look to us.

"Sure, the Batak have lost traditions. But they've created traditions, too." ◆

Regula Burckhardt Qureshi

What Music Has to Say

Music is not only to be played, it is to be explored, says Regula Burckhardt Qureshi, professor of ethnomusicology. Her research on South Asian music, Western art music and ethnic



Canadian music has led to the discovery of crucial links between the sounds of music, the way we make music, and the way we live, think and behave.

"What makes music powerful? Why is music important? These are the kinds of questions that interest me," Dr Qureshi says. "I want to explore the emotive and social power of music. At the same time, I look at music as an instrument of social, economic, political and ideological change. It's a non-threatening doorway into and bridge across different communities." ◆

Focus on Ukraine

The Canadian Institute of Ukrainian Studies plays a leading role in research on Ukraine. It publishes books, reports and journals, prepares educational materials for Ukrainian-English schools in Alberta, and supports the work of scholars studying the history, culture and traditions of Ukraine and its people, who were among the early settlers of Alberta.

A special unit within the Institute — the Peter Jacyk Centre for Ukrainian Historical Research — is in the process of translating from Ukrainian into English the classic, ten-volume *History of Ukraine-Rus*. When this project is completed, it will offer the English-speaking world the best scholarly synthesis of Ukrainian history. ◆

Susan McDaniel

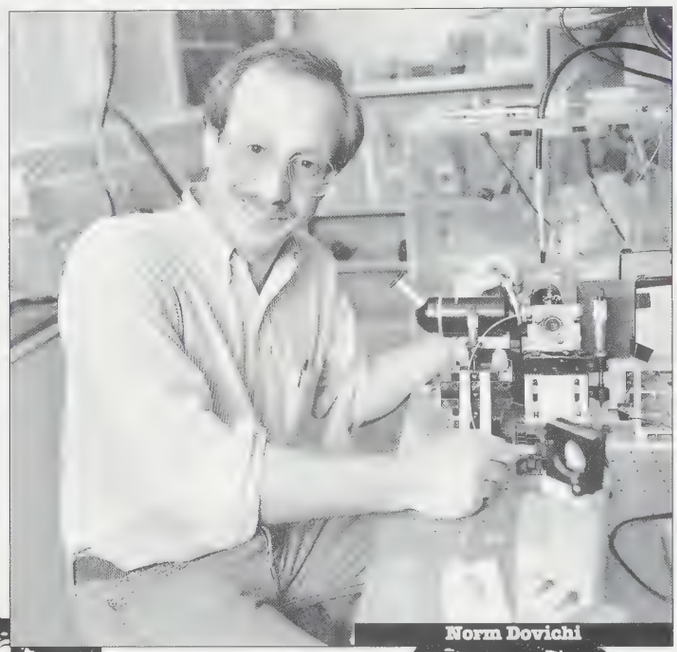
Modern Families

While unemployment is often portrayed as a problem of today's youth, the fact is, those unemployed young people are often the sons and daughters of unemployed older people. How are the families coping? They're changing, says sociology professor Susan McDaniel. Her research charts how families restructure as a result of changes in the workforce.

"The idea that you work at a job, retire from that job and then collect a pension has been turned on its head. Middle-aged people are being laid off with no hope of re-employment," explains Dr McDaniel. "As well, many people that we presume are retired are actually working part-time.

"The effects on the family are mixed. On one hand, families are caught in a tremendous crunch. Dual incomes are the norm. Economic insecurity creates stress and health problems. At the same time, there's more flux and flexibility in the way families are structured. Modern families are not based on the 1950s model of one breadwinner with the rest of the family depending on him." ◆

Making Sense of the Future



Norm Dovichi

A Future Without Genetic Diseases

Chemistry professor Norm Dovichi has a ringside seat at what's been called the most exciting scientific show on earth — identifying genes and understanding how gene mutations cause certain diseases.

His lab is a world leader in developing the technology used to determine the make-up of DNA and other biological materials. The technique he is developing does the job faster, more accurately and at a lower cost than any other system.

Since Dr Dovichi began publishing his work on this technology, he's been besieged with proposals, invitations and funding to apply the technology in the biological sciences.

His team is the only Canadian group — and one of only three outside the U.S. — funded directly by the U.S. Department of Energy's Human Genome Initiative, a massive project to map the entire human genetic blueprint.

Knowing which particular gene mutation causes a particular genetic disease could revolutionize the diagnosis and treatment of disease. ◆

John Tulip

Inventing the Ideal Laser

A prostate patient could find surgery less painful and be home by the end of the day, thanks to a new surgical laser invented by electrical engineering professor John Tulip.

The YAG laser (yttrium-aluminum-garnet) is ideal for surgery because it cuts tissue and coagulates blood. (Carbon dioxide lasers, the most common surgical lasers, cannot stop bleeding.) In addition, the YAG laser can be used in endoscopic surgery (surgery performed without incisions). Besides prostate surgery, clinical applications include knee surgery, destruction of gallstones and kidney stones, neurosurgery and gynaecology.

"The laser is useful but expensive," says Dr. Tulip. "Our research is now aimed at reducing its size, complexity and cost." ◆

Grant McFadden

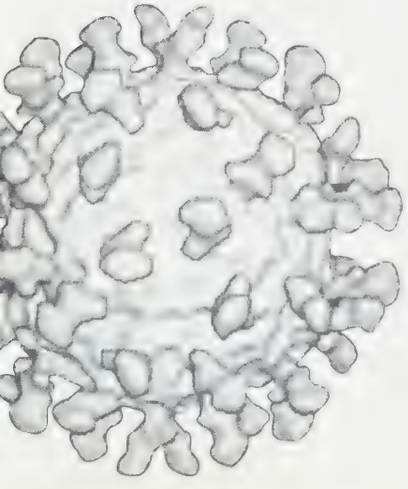
Putting a Virus to Work

Basic research on viruses led biochemistry professor Grant McFadden to research that may help people with heart problems.

Dr McFadden studied a rabbit virus that tricks a part of the immune system into inactivating itself so it can't signal the immune system to destroy the virus.

He wondered if this strategy could be used to solve a problem for heart patients: When balloon angioplasty is used to open blocked arteries, the immune system is activated and attempts to seal the arteries back up. Would the rabbit virus protein work in humans to prevent this response?

With cardiology professor Dr Alexandra Lucas, Dr McFadden is now looking for the answer. A positive one would offer a big advance in the treatment of blocked arteries. ◆



Justice for All

A criminal justice system that works and does not trample on the rights of individuals in the future: a pipe dream?

Philosophy professor Roger Shiner thinks not.

Dr Shiner has studied the way the law treats the mental state of intoxicated defendants. The work has convinced him that restrictions on what defendants can say in court violate their rights. It's widely believed that if these restrictions were not in place, intoxicated defendants would have to be acquitted. Dr Shiner's research shows that would not be the case — the supposed conflict between the individual and society is false.

"As a philosopher of law, my interest is in having a well-founded and well-reasoned criminal justice system," says Dr Shiner. "When one group is treated differently than another for inadequate reasons, the system isn't coherent." ◆

Roger Shiner

Alex Rabinovitch

Experimental Transplants Succeed

For Greta Nakonechny, medical research is the reason she now needs to take only minimal doses of insulin — after 30 years of being a diabetic. And it all happened in Edmonton.

In April 1992, Nakonechny received a kidney transplant and a transplant of islets (the cells in the pancreas that make insulin). The success of the islet transplant (a procedure still considered experimental) is the result of years of work by diabetes researchers Ray Rajotte, Norman Kneteman and Garth Warnock at the University of Alberta.

It's for such achievements that the University was chosen as a Centre of Excellence in Diabetes Research by the Juvenile Diabetes Foundation International.

"We've brought together a group of nine individuals — experts in their own areas of medical science," says Alex Rabinovitch, director of the Centre and professor of medicine and immunology. "The team approach is vital to our work."

Focus of research at the Centre is insulin-dependent diabetes, an autoimmune disease that occurs when the body's immune system mistakenly attacks its own insulin-producing islet cells in the pancreas. The researchers' goal is twofold. To prevent insulin-dependent diabetes by modulating the immune response. And to treat with islet cell transplants those patients whose islets have already been destroyed.

Islet transplants are experimental and limited to selected patients who receive kidney transplants. But the hope is that with more research the treatment will be available to more people. ◆

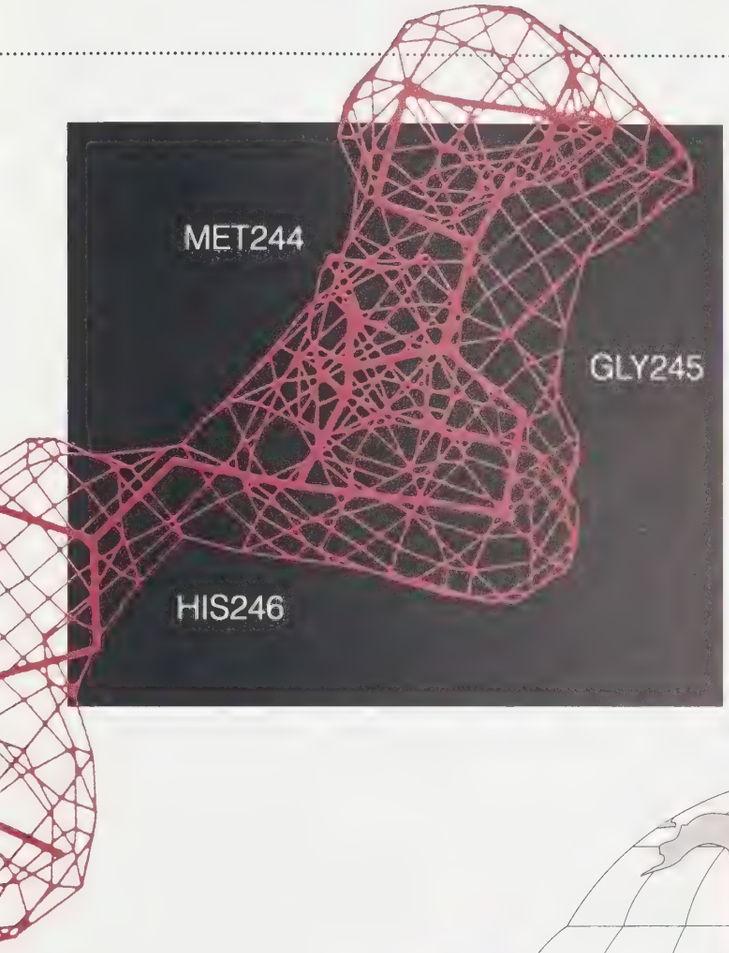
Janet McElhaney

Beat the Flu Bug

Research by geriatrics specialist Janet McElhaney has proven the effectiveness of annual flu vaccinations for people over 65.

Her studies showed that after vaccination, immunity levels in older people rose to the same level as in a younger control group.

Influenza has serious effects in the older age group. People over 65 account for close to 90 per cent of the 5,000 influenza deaths in hospital every year in Canada. And some older people who have been able to get along on their own may be tipped into dependency by a flu attack. ◆



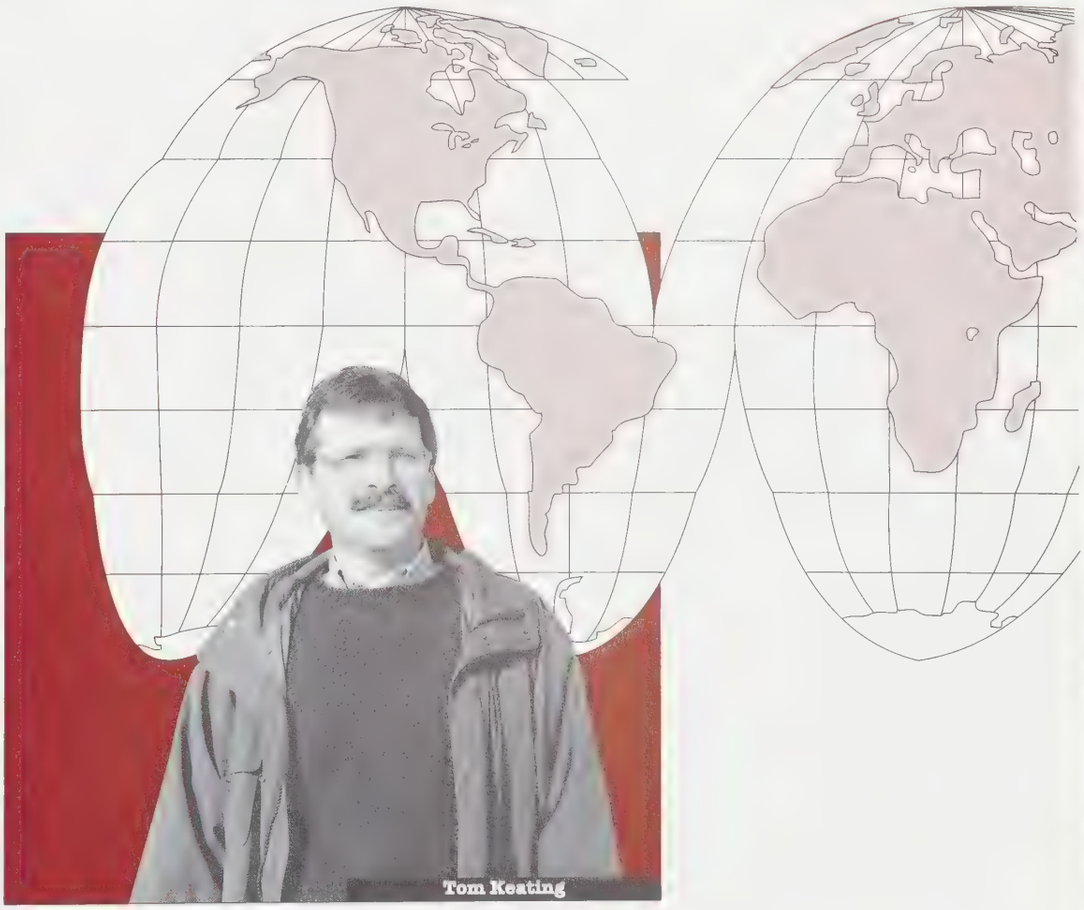
New Drugs and Improved Vaccines

Mapping the three-dimensional structures of proteins is like solving a puzzle. But for medical microbiology professor Randy Read, his work doesn't stop when the puzzle is solved.

A major focus of Dr Read's work is finding new ways of using this information, gained from protein crystallography, to design new drugs that lead to better treatment for certain diseases.

His team is part of a collaborative effort to improve the whooping cough vaccine. In another project, he says, the team's basic research has a good chance of helping improve the effectiveness of the treatment for hamburger disease, developed by Glen Armstrong. ◆


Randy Read


Tom Keating

Canada's International Role

According to political science professor Tom Keating, it's a Canadian tendency to regard our foreign policy as a reflection of U.S. policy. He believes this preoccupation with the U.S. has obscured the international connections that are an important, yet neglected, part of Canadian foreign policy.

Dr Keating's research deals with Canada's interests abroad and our contributions to international organizations such as the UN, NATO and the Commonwealth. In the future, Canada's role as a facilitator will be more important than ever, he says. ◆

Making Sense of Our Problems

Susan Jensen

The Penicillin Connection

Most of us take antibiotics like penicillin for granted. Microbiology professor Susan Jensen does not. She's very interested in how microbes, especially the common soil bacteria *Streptomyces*, make penicillin.

"Although penicillin is only a small molecule, more than a dozen genes and a whole series of enzymes are involved in making it," Dr Jensen says. A related penicillin-like compound that's used to fight penicillin-resistant infections is also under investigation.

Being a streptomyces specialist has led to an interesting spin-off for Dr Jensen's research. She's now involved in a collaborative research project with scientists from the Provincial Environmental Centre studying an antifungal antibiotic that may help combat blackleg disease of canola.

The aim is to identify the antifungal antibiotic and conduct field trials to find out whether the antibiotic itself or the *Bacillus* that produces it can help control this serious plant disease. ◆

Tee Guidotti

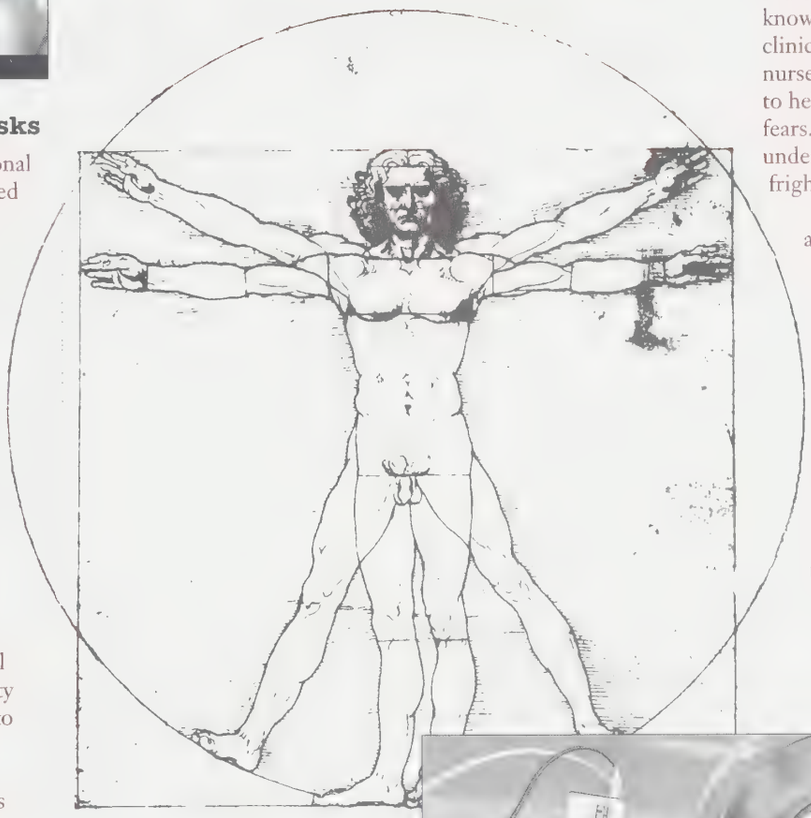
Assessing Health Risks

The University's Occupational Health Program has achieved a great deal in a short time. Established in 1984, the program now offers the largest and one of only three residencies in occupational medicine recognized by the Royal College of Physicians and Surgeons.

"We're very proud of having accomplished this in such a short time," says program director Tee Guidotti.

While the program's research team studies the entire range of occupational heath problems, its speciality is environmental exposure to chemicals.

The team is part of an international effort to assess cancer risk in the pulp and paper industry. As well, it is active in studies of air quality and the education of physicians in environmental issues. ◆



What a Patient Wants to Know

Kind words are not enough to ease most patients' fears. Nursing professor Terry Davis knows this from first-hand clinical experience. She believes nurses are in the best position to help patients cope with their fears. But first, nurses need to understand what it is that is frightening patients.

Although much is known about patient anxiety in general, very little has been done to pinpoint the specific fears activated before, during, and after an invasive medical procedure.

Dr Davis's research is aimed at understanding those fears and developing and evaluating nursing practices to relieve patients' anxiety. ◆

Muscle Matters

Muscles are the focus of animal science professor Vickie Baracos' research program. In particular, it's the complex processes of muscle growth and wasting, and the hormones and signals that control them, that interest her.

"It's basic research that has many applications," Dr Baracos says.

As she points out, "Muscle is good to eat, and learning about every aspect of muscle growth can help improve animal production."

As well, understanding how muscle takes in and makes use of nourishment can help us understand more about diseases such as diabetes and cancer. At the end of a bout of cancer, for example, a patient can lose 75 per cent of the muscles they had in the first place. ◆

Vickie Baracos

Clothes That Save Lives

Saving lives is what human ecology professor Betty Crown's research is all about.

Her research team has developed a system for assessing thermal protective clothing for the oil and gas industry and other sectors. Using the system, firms can determine the clothing needs for particular jobs, then select the most appropriate garments for each of them.

Because flash fires are a serious hazard in the oil and gas industry, work clothes must give adequate thermal protection. Working with mechanical engineering professor Doug Dale, the team developed an instrumented mannequin for testing entire garments in a simulated flash fire. The clothed mannequin is engulfed in flame, sensors connected to a computer measure the rate of heat transfer, and a computer program then estimates the likelihood and degree of skin burn. Firms and government organizations around the world have used the system to evaluate their work clothing.

Betty Crown

"Developing protective clothing sounds simple — just find a material that will protect against a hazard," says Dr Crown. "But it's quite another matter to develop garments that are both functional and comfortable enough that people will wear them." ◆

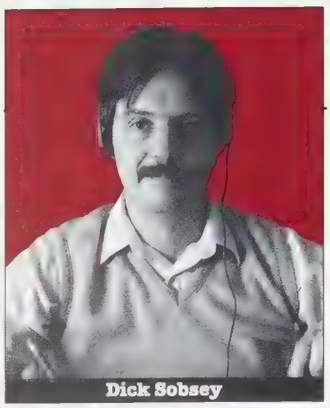
When Cultures Clash

A clash of cultures is at the root of anthropology professor Milton Freeman's research on small whaling villages in Japan.

In these villages, an entire social, cultural and economic system is built around whaling. Efforts to ban whaling threaten their centuries-old way of life and distinctive culture. Dr Freeman has found indications that the ban is already creating serious community problems as the local economy unravels.

"When we attack people by saying, 'But you're just like us. Why do you need to hunt whales?' it's a damaging attack on a people's cultural traditions and identity," Dr Freeman says. "We have to ask, 'What right do we have to change a society that's different from ours?'" ◆

Milton Freeman



Dick Sobsey

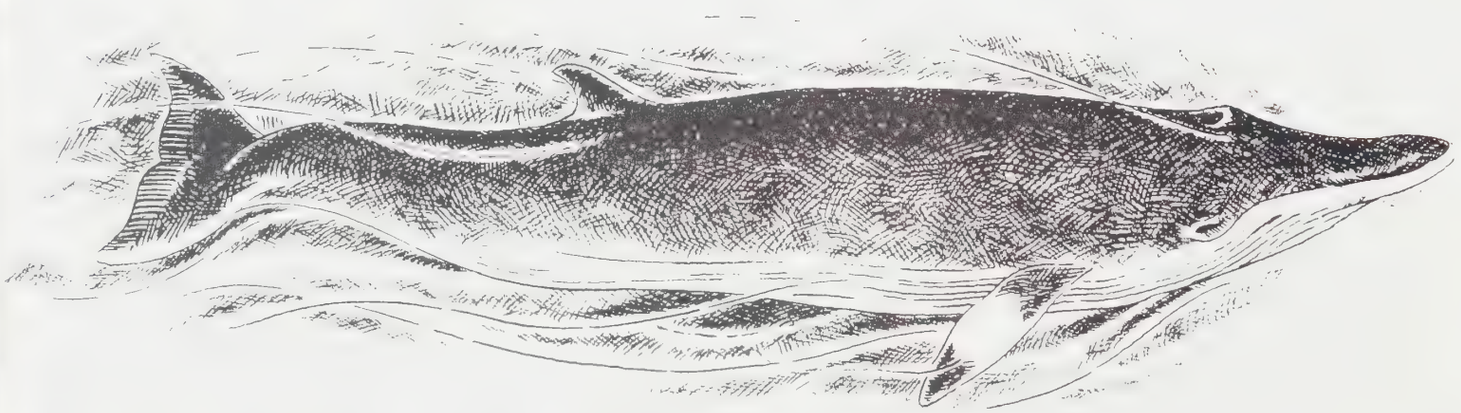
Making a Better Life

Educational psychology professor Dick Sobsey was one of the first researchers in Canada to document, in a systematic way, the sexual and physical abuse of disabled persons.

However, the Canada-wide study was not an end in itself. Rather, it was a starting point for Dr Sobsey to look at specific prevention and treatment strategies.

"I believe we're only justified in doing this research if it makes life better for disabled persons," Dr Sobsey says.

Part of making life better means controlling the risk of abuse from caregivers. Better screening of caregivers has already been implemented in many provinces. Legislative changes are also under way to protect those who report abuse from harassment or withdrawal of services. ◆




Dru Marshall

Learning How to Move

Obesity has been called a major public health problem. Nearly everyone agrees that early treatment and prevention is key. But physical education professor Dru Marshall suggests we should be careful how we go about this with children.

"About 95 per cent of treatment programs for obesity are unsuccessful," she says. "Should we put kids in a cycle of failure at such a young age? There's so much we don't know and should find out."

Dr Marshall is studying childhood obesity in a number of collaborative research projects. She has looked at obesity rates in public school children, noting major differences in rate increases between sexes over the last decade.

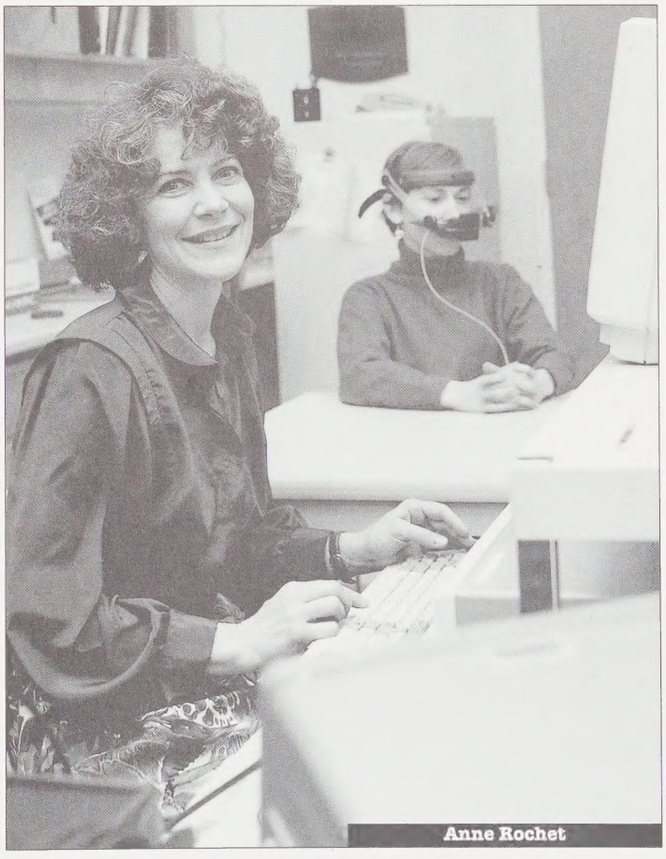
She's also examining the role of physical activity in standard treatments for obesity. Results from this research suggest that instead of taking typical fitness classes, obese children should be enrolled in motor skill classes in which they're taught how to move. ◆

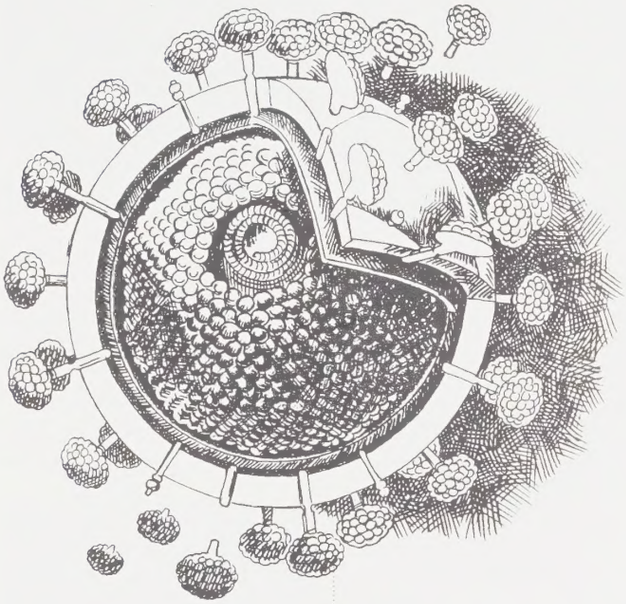
Smile, Wink, Whistle and Speak Again

For people who must learn to make their faces work again after facial nerve damage, the prescription is exercise — retraining the muscles that control the mouth, the eyebrows, and everything in between. Determining which kinds of exercise are most effective is the focus of Anne Rochet's research.

The professor in speech-language pathology has been evaluating two major retraining methods. One involves having patients do facial exercises while looking in a mirror; in the other method, electrodes placed on the face pick up the muscle activity during exercise and show it to the patient on a screen.

"There are still many questions to be answered about facial muscle retraining," says Dr Rochet. "By shedding some light on them, we hope to devise more effective treatments for the future." ◆


Anne Rochet



Neutralizing the AIDS Virus

They are blazing a trail for the world in virology research at the Glaxo Heritage Institute for Virology. The Institute is dedicated to basic research on viruses, especially HIV/AIDS, hepatitis B and herpes.

Glaxo Canada Inc made the Institute possible with an initial $800,000 for construction, $550,000 a year for operating expenses, and $15-million over 10 years for research. The Institute is also supported by the Province of Alberta, the Alberta Heritage Foundation for Medical Research, and the University of Alberta Hospitals Foundation.

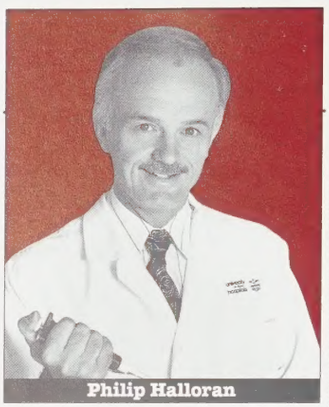
Medical microbiology professor Lorne Tyrrell, whose research team developed the

Lorne Tyrrell

world's first anti-hepatitis-B drug, heads the Institute.

"We have an excellent group of scientists working on major viruses that cause chronic or persistent viral infections," says Dr Tyrrell. "Success in one system may provide clues on how to treat other such viruses."

Dr Lung-Ji Chang came from the National Institute of Health and will lead the team working on HIV/AIDS. Drs John Elliott and Bruce Malcolm are working on a way to inhibit the hepatitis C virus. ◆



Philip Halloran

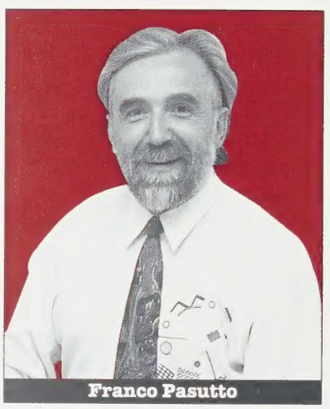
Monitoring a Drug's Effects

There's one goal for immunology professor Philip Halloran's research — better treatments for transplant recipients and patients with inflammatory diseases.

Dr Halloran heads the University's Clinical Molecular Immunology Group.

One of the group's recent successes involves research on cyclosporin, a drug that suppresses the body's immune system and is commonly used to prevent rejection in transplant recipients. Building on basic research done at the University, which demonstrated how cyclosporin works in the test tube, the team was able to demonstrate how the drug works in people.

The finding will allow doctors to monitor the actual immunosuppressive effect of cyclosporin, not just the level of the drug in a person's body. ◆



Franco Pasutto

Satisfactions of Research

A self-confessed dabbler, pharmacy professor Franco Pasutto is interested in all kinds of problems. "It's a real head rush — being presented a problem and finding an answer that's applicable and useful," he says.

Dr Pasutto's major research focus is collaborative work on the development of methods to look at biological fluids such as blood, and analyze drugs and their by-products in the fluids.

He's also involved in the design, synthesis and evaluation of drugs to treat asthma and other respiratory problems.

A third project is investigating the use of microorganisms, particularly fungi, to evaluate how drugs are taken up and used by the body. If successful, this method would be complementary to testing on animals. ◆

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