ChE educator

RA of Minnesota

Prepared by his
Minnesota Colleagues
University of Minnesota
Minneapolis, Minn. 55455

JUST ABOUT EVERYONE with an interest in the subject, both in and out of Who's Who, knows that Aris Rutherford is a mythical character; created as a well-deserved admonishment to a pompous bureaucracy by a gentleman and scholar named Rutherford Aris. The more serious matter to anyone who takes on the task of describing him is to recite the facts and still convince the reader that Rutherford Aris is not himself mythical.

In the 23 years since he first came to Minnesota, Aris has compiled a record of scholarship which has few equals in chemical engineering. Nine texts and monographs, several book chapters, and over 150 journal articles attest to the quantity of the record; the spate of awards he has received, the special lectureships to which he has been appointed, and his membership in the National Academy of Engineering attest to its quality. But impressive as this record is, it tells only a small part of the story of a man who has been variously described by his colleagues in and out of ChE as ". . . a saintly genius in the secular domain of scholarship and seminal research . . .," ". . . the most scholarly chemical engineer I know . . .," ". . . one of the last remaining polyhistors . . .," ". . . one of the few university professors today who master the nearly lost art of speaking correct English. . ." and ". . . my one colleague in chemical engineering who shares an interest in Real Tennis. . . ."*

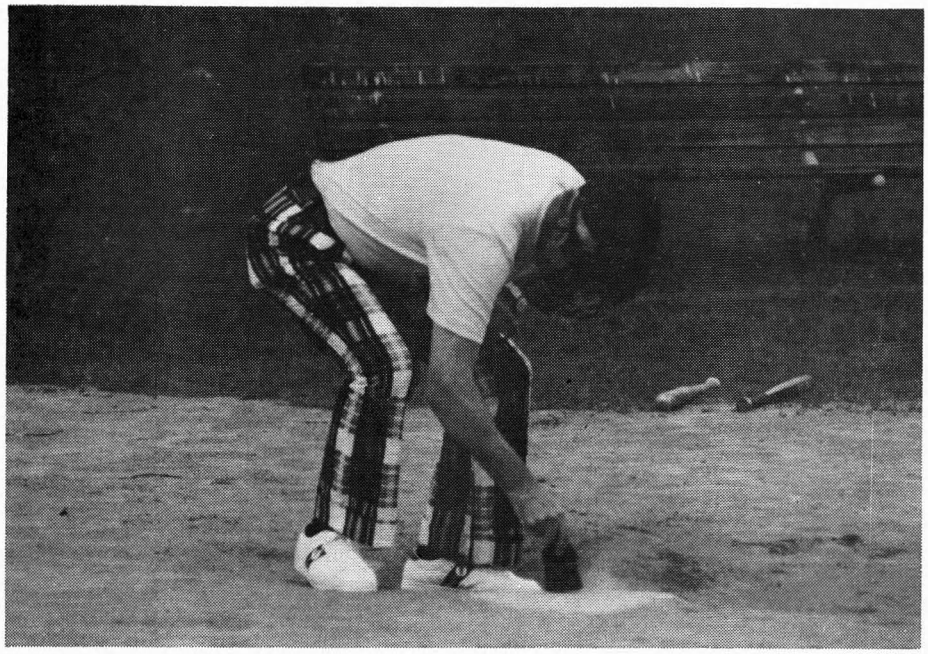
Fulsome praise? His colleagues at Minnesota, where he has recently been made a Regents' Professor—one of 15 among the faculty of some 3000—would not think so. For in the institution at which he has spent his entire teaching career, Gus Aris *is* something of a Renaissance man. It will undoubtedly come as no surprise that he offers courses in Chemical Reactor Analysis and in Mathematical Methods; elegant, axiomatic renditions of the principles which have attained a central role in ChE today. But he has also frequently offered courses and lectures on Medieval Manuscripts and The History of Latin Handwriting and is working on a monograph on medieval paleography. He is involved in collaborative research with a colleague in History on developing mathematical techniques for dating documents of the period from 900-1150 A.D. and he has played a role in the evolution of courses in Science and the Humanities. In fact, these kinds of contributions have become so regular that this fall the University formalized the arrangement by making him a *de facto* University Professor, freed half-time from his ChE responsibilities to follow his inclinations in these other fields. Thus, for the very unmythical Aris, there is now a new beginning—which, naturally, stimulates recollections of his first beginning.

. . . he . . . earned an external degree (B.Sc. in mathematics) from London after two years of spare-time study at the ripe old age of 19.

ENGLISH BEGINNING

RUTHERFORD ARIS WAS BORN in Bournemouth, on the south coast of England, in September of 1929, a fact that 20 some odd years in the upper midwest, marriage, baseball, basketball, and football have absolutely failed to overcome in any way.

*The authors of each of these documented quotes will remain anonymous, but several can be guessed. It is a game Gus Aris would enjoy. Four out of five correct answers rates an A and the Exxon Suite Award.



As an Englishman, Aris does not claim a deep knowledge of baseball, but he knows where to begin.

According to authoritative family sources, young Rutherford, the second of four children, first exhibited his interest in abstract quantitation by taking charge of the family shopping list. With that to build on, he went on to Canford, an English public school, and earned an external degree (B.Sc. in Mathematics) from London after two years of spare-time study at the ripe old age of 19. He had already joined Imperial Chemical Industries as a "technical officer" and was working in Edinburgh with C. H. Bosanquet, one of Britain's early engineering scientists, when Neal Amundson, on sabbatical, arrived on the scene in 1955. In the classic paradigm of the graduate student recruiting we all know so well today, he convinced Rutherford to come back with him to Minnesota, where Amundson was then beginning a building program.

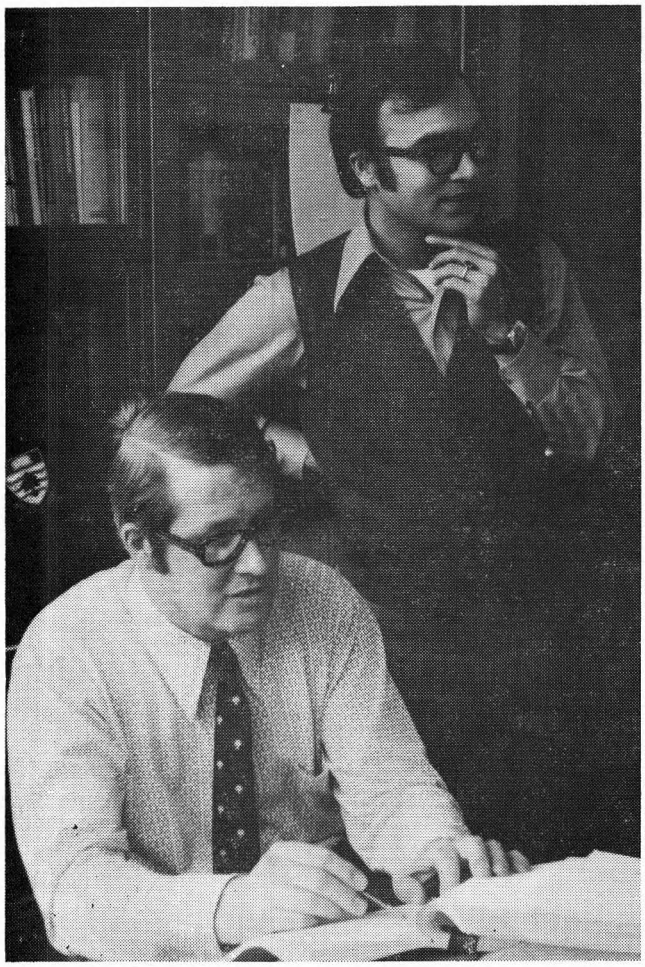
Rutherford accepted, came to the United States, became "Gus" Aris and spent a year. Not a bad one, at that. He wrote what has become a classic paper on Taylor dispersion, which was published in the Proceedings of the Royal Society. He also published the first of what would be many collaborative efforts with Amundson on reactor stability. Most importantly, he met and subsequently married Claire Holman, a Minneapolis native, with whom he has shared his life since. With those ties established, he returned to Britain for a year, earned another external degree from London—this time a Ph.D. in Mathematics and Chemical Engineering—and crossed the Atlantic once again in 1958 to accept an Assistant Professorship at Minnesota. Since 1963, the title has been Professor and, from the Fall of 1978 onward, Regents' Professor.

AND MINNESOTA DIVERSITY

GUS' CHEMICAL ENGINEERING scholarship has, of course, focused on the effective application of mathematics to the description, understanding, and control of reacting systems. In the early years the applications were primarily in reaction engineering-control, stability, optimization. But that changed as he and his collaborators began to look at a number of other areas. They laid a strong, analytical foundation for multicomponent chromatography, and Gus began to work on biological problems of several kinds: microbial population dynamics; enzyme kinetics; membrane transport; chemotaxis. Today, he is as active in biological applications as in any other single area.

One of the reasons that Aris has been able to work effectively in a number of fields is the ease with which he is able to enter into collaborations with colleagues. No doubt the longest and closest collaboration was with "The Chief," Neal Amund-

Aris' ability to write is remarkable. Many of us have watched him sit at lunch and, in the calligraphic hand which is something of his trademark, pen the draft of a paper which, with few changes, will be sent off as a finished work.



Aris with Arvind Varma, one of his many Ph.D. students who have gone on to productive academic careers.

son, with whom Gus has coauthored almost two dozen articles and a monograph. But he has also worked at one time or another with four or five other colleagues at Minnesota and as many or more elsewhere.

Aris' ability to write is remarkable. Many of us have watched him sit at lunch and, in the calligraphic hand which is something of his trademark, pen the draft of a paper which, with few changes, will be sent off as a finished work. It is tempting to explain this ability as arising from the capacity of a mathematician for ordered thinking, but those who know him are more likely to agree that it is his love of and constant immersion in words and language that accounts for it.

This facility with words not only produces papers; it produces an array of rhymes and limericks, aphorisms and patter songs for every occasion. His specialty is the reworking of well known (or not so well-known) poems and arias to fit more appropriately the topic or occasion at hand. When Skip Scriven was feted as Lacey Lecturer at Cal Tech last year, the Cal Tech men's chorus treated him to a rendition of "Now I am the lecturer of Cal's Lacee . . ." with suitable apologies to W. S. Gilbert and credit to R. Aris. When a lunchtime conversation on coal liquefaction turned to the use of the word liquefaction in a 17th century poem by Robert Herrick, the poem was updated by Gus. . . .

Whenas in silks my Julia goes,
Then, then methinks how sweetly flows
That liquefaction of her clothes.

Next, when I cast mine eyes and see
That brave vibration each way free,
Oh how that glittering taketh me!

Robert Herrick

Whereas in gases fled its moles,
Now, now methinks research controls
The liquefaction of my coals.

I'll do it first by Fischer-T,
Take lots of points, then wait and see
Oh how that sells with D. O. E.!

Rutherford Aris

And recently, when he was asked to attend a quasi-social meeting with some state legislators, quite aside from what the meeting may have produced for the University, the following plaint was found afterwards:

It was just as I feared it w'd be
When I went to the lawmakers' tea,
Their rumblings abdominal
Were simply phenomenal
And they slashed both the budget and me.

WIDE RANGING INFLUENCE

ARIS' INFLUENCE AT and on Minnesota has been broad and deep. Some elements of that influence are in the areas in which one would expect them: new course development, graduate student thesis advising (indeed, he has directed

He played a significant role in the development of programs in Religious Studies and in the History of Science at Minnesota, both large issues to him, and well worth the price of the many hours spent on small ones whose greatest value is as subject matter for quatrains and limericks.

He is as comfortable with English literature and poetry as he is with reactor analysis. . . . He is a religious man, deeply so and privately. But even that he finds a way to share with his friends at many levels—historical, philosophical, moral.

RUTHERFORD, ARIS MACPHERSON, educator; b. Strath Spey, Scotland, Apr. 10, 1930; s. Archibald MacPherson and Ephygeneia (Aristeides) R.; diploma Strath Spey and Glenlivet Inst. Distillation Engring., 1948; B.Tech., Billingham Coll. Engring. and Tech., 1952, D.Eng., 1955. Came to U.S., 1956, naturalized, 1961. Chief design engr., tester Strath Spey Distillation Co., Ltd., 1955-56; chem. engrin. cons., Chgo., 1956-60; vis. prof. distillation practice Tech. Inst. of the Aegean, Corinth, 1960-64; prof. chem. engring. U. Minn., Mpls., 1964—. Mem. County Commn. for Local Industry, Speyside Area, 1955-56. Trustee, Scottish-Greek Friendship Found., Edinburgh, 1960-64. Served with Argyll and Sutherland Regt., 1948-50. Mem. Burns Soc. Mpls., Distillation Club Edinburgh. Presbyn. Clubs: Hellenophilic (Mpls.); Woods (Gleneagles, Scotland). Author: Sampling Techniques, 1957; American Football-A Guide for Interested Scots, 1960; Distillation Procedures, 1963. Office: U Minn Sch Chemistry Minneapolis MN 55455

The infamous Aris Rutherford as advertised in *Who's Who,* 38th Edition, 1974-5.

the Ph.D. theses of 25 students thus far, several of whom, like Mort Denn of Delaware, George Gavalas of Cal Tech, and Harmon Ray of Wisconsin have already become influential in their own right). But, beyond that, Aris has interwoven his own sense of eclecticism into the fabric of the department. For example, in the early 50's he initiated a tradition in which, once every three years, the graduate seminar program for an entire quarter is devoted to topics outside of the normal purview of ChE. Lecture topics have ranged from Scandanavian literature to Brazilian folk culture; from anthropology to stage movements with many stops between. Every Ph.D. student has the opportunity to be involved with at least one such series. While several people have helped in these, it is primarily Aris who organizes them, introduces them, and ultimately oversees their publication in volumes with such titles as: *The Scope of Scholarship; Varieties of Academic Experience;* and *Catastrophes and Other Important Matters.*

When Amundson decided to step aside from the headship in 1974 after 25 years, Aris was the unanimous choice of the departmental faculty to take over. It was not the kind of a position that a man like Aris would relish, but it was clear that he was the right person to lead the department through a difficult transition in a time of economic contraction. He did just that for four years, with his good sense and his scholarly sense, his patience and his wit. The evidence is, that upon stepping aside from the post in 1978, all four remained intact.

Gus has also been one of the most active faculty members in the University in faculty governance, a tribute to his sense of charity (*agape,* he would explain). Foraying into the Byzantine intracacies of University committees, using a cultivated innocence as shield and weapon (". . . But, Mr. President, since the NCAA is such a problem, is this not a splendid opportunity simply to leave it, to abandon intercollegiate football and basketball. Surely we'd be better off for it and could concentrate on more important things . . ."), he has consulted, advised, adjudicated, and resolved his way through untold issues, large and small. He played a significant role in the development of programs in Religious Studies and in the History of Science at Minnesota, both large issues to him, and well worth the price of the many hours spent on small ones whose greatest value is as subject matter for quatrains and limericks.

THE RENAISSANCE MAN

AND WHAT IS ARIS LIKE outside of the context of the University? Very much the same. A man of books—books of every sort. He is as comfortable with English literature and poetry as he is with reactor analysis. He will show you his volumes of etchings and line drawings of European birds. He will leaf through a fine edition of T. S. Eliot with you. He is a man of languages—classical ones, particularly Greek and Latin, but with more than a passing interest in Norwegian and Danish. He is a religious man, deeply so and privately. But even that he finds a way to share with his friends at many levels—historical, philosophical, moral.

Then there is the Aris wit. Dry, you might say, and perfectly suited to the art of dealing with dehumanizing bureaucracies, overinflated egos, and the other social ills to which we are too often ex-

posed. Aris' particular English background recognizes class, but does not confuse it with worth nor stand in awe of it. Perhaps that explains some elements of the Who's Who story*, which, for those who don't know it, began with a letter from those good people to one Aris Rutherford inviting him to submit a biography. As one used to such errors, he wrote back kindly, explaining that he was not Aris Rutherford, but Aris (comma) Rutherford, and under that latter name, he was already a biographee in their prestigious publication. In response, he was informed by some automatic typewriter that individuals could not buy their way into Who's Who. Thus challenged, Aris Rutherford, the Scottish inversion of our English colleague, was born and given a history.

And is Aris still an Englishman? Well, there is this trouble he has understanding American football—(time outs? cheerleaders? platoons?—Whatever for ?)—and these peculiar misspellings (behaviour, colour).

Finally, how, you ask, did he come to be called Gus? That has to do with India and bath water—well, not exactly bath water . . . Really, it's a long story. You'd better ask him when you next see him. □

*Editors note: See CEE, Vol. IX, No. 3, page 119, for feature article pertaining to this.

ChE stirred pots

THE REYNOLDS' NUMBER SONG

(Contributed by Peter Harriott, Cornell University)

Sir Osbourne Reynolds was a man of yore
Who liked to play with symbols that you might think a bore
But he figured out a problem and aquired some fame
And now the Reynolds number bears his name

Chorus
Take a d times a v and a rho by mu
Put them all together with a little bit of glue
Then you've got a number that will see you through
And tell you what the fluid's going to do

Does the syrup in the pipe flow as smooth as can be
Or is it all mixed up like in a cup of tea
Enter all the numbers and press the little key
Laminar or turbulent, the answer will be

Now lots of other numbers may come to mind
Prandtl, Schmidt, and Grashof, and more of that kind
But when you've got a sticky problem and are getting in a bind
The old Reynolds' number is the first one to find

It's really very simple, so the profs all say
But the gol-darn dimensions keep getting in the way
The old English system has had its day
So better switch over to SI today

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