

THE 1988 DEXTER ADDRESS

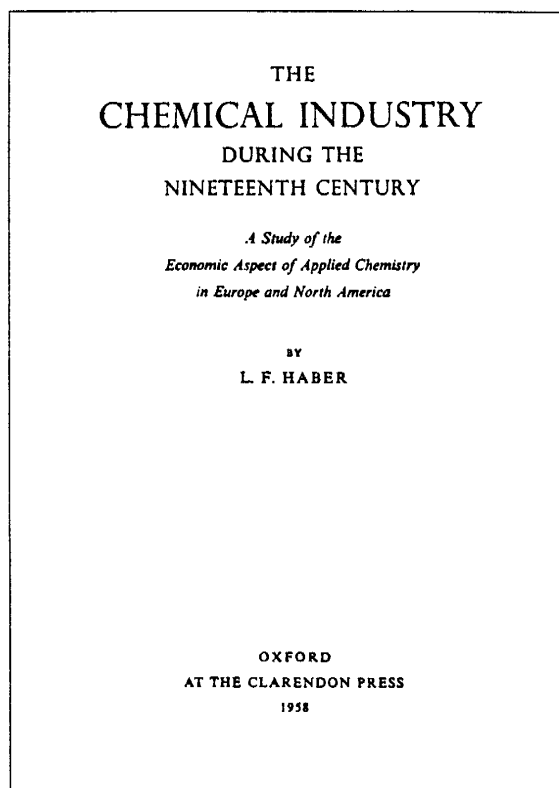
Historians and the Chemical Industry

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A few personal reminiscences will serve to introduce the subject of my lecture. My education did not lead me, half a century later, to the Dexter Award. At school I began with the classics, and later turned to history. While at college, the London School of Economics, I read some economics (now mostly forgotten) and rather more economic history. I noticed that industrial history, naturally British only, was a minor subject and restricted to the mainsprings of the Industrial Revolution: coal, iron and steel, textiles. I did not think that was the complete story.

As the son of a well-known chemist, I was supposed to have "science in my blood", though a geneticist might not believe this. At any rate, my first job was in a lubricating oil refinery! I'll spare you the details of my clerical duties, nowadays performed more quickly by IBM or National Cash machines, but they left me with enough spare time to become familiar with the surroundings. I learned about the equipment and materials - the refinery used acids and alkalis to produce high grade oils. I also did a spell in the laboratory and taught myself some elementary chemistry in the evenings and on weekends. Manchester, where I worked, was not a cheerful place towards the end of the war and so, perhaps for want of something better to do, I began to write a dissertation on *The Growth and Development of the Chemical Industry*. I hoped, as they say, to fill a gap, and I wrote in the Introduction: "... this study is not a chemist's history of chemical technology, but an economic historian's attempt to cut a path through a neglected aspect of industrial history."

As soon as practicable, I went to consult Williams Haynes (1886-1970), without doubt *the* authority on the American chemical industry. This small, dapper man of just over 60, lived in a beautifully restored colonial house near Stonington, Connecticut, and had recently finished two volumes of his six-volume history. It was completed in the early 1950s, and he received the second Dexter Award, in 1957, for his monumental *American Chemical Industry*. Bill, as everyone called him, was immensely knowledgeable, had excellent contacts, and went out of his way to be helpful and encouraging. He was sure I was working along the right lines. There was, as he saw it, nothing mysterious about the phenomenal growth of the industry, which - in his lifetime - had become an important and dynamic part of the American economy. His job was to describe these developments and write history. Haynes was not a scholar, but a publicist and a pioneer in what is nowadays called cross-disciplinary writing; he combined history with industrial chemistry. I followed his advice and persevered with the dissertation. I got my Ph.D. and shall always be



grateful for his help then and later.

I resigned from the refinery, which was turning to petrochemicals, and then worked for many years with I.C.I. and rather more briefly with Exxon (in the oil as well as in the chemical branches of the company). My jobs, which were on the planning and marketing side, provided a "feel" for modern chemical manufacture which those who work as teachers or in academia may not have had the good fortune to acquire. Certainly this practical experience of chemical business was of great value in my spare time activities as author and lecturer. The latter eventually, and well past middle age, became a full-time job teaching applied economics in an English "technological university", where cross-disciplinary research was highly regarded.

Despite Haynes' books, my own efforts and those of a small number of academic and business historians, I still think that the history of chemical manufacture is neglected by comparison with that of other industries or of services. To ensure that this was not an unfounded assertion by an out-of-touch retired British university teacher, I turned to the *Journal of Chemical Education* and looked at every number from 1983 to mid-1988. There are, as one would expect, scores of entries in the index under "History", but I found only two articles which had a predominantly industrial content (1). Further search among the 66 issues consulted by me showed that only three publications were reviewed which had an industrial connection, and only one of them had a specifically historical approach (2). I

do not claim that this quick literature survey, deliberately restricted to a single publication, though an important one in chemistry education, is necessarily conclusive. But the results are interesting and they reinforce an opinion I have long held - chemistry and history do not make good bedfellows.

Why should that be so? And why should "cross-disciplinary" work, which many people consider extremely valuable, have only such modest achievements to its credit in this area? Historians of industry, economic historians, or indeed any historian interested in science and technology, explain this by their lack of a technical background and their ignorance of chemistry. Chemists, on the other hand, profess ignorance of history and lack of time so that in practice they are restricted to biographical studies or the description of a particular discovery. I have some sympathy for them and can understand their reluctance to tackle a difficult objective. Nevertheless, I do feel they both underrate their capabilities, and the schoolmaster's traditional comment on the unwilling pupil sums up the situation perfectly - "Could do better if he tried harder!"

It is now time to step down from my lofty perch and face up to the nitty-gritty of the situation. Among the many problems confronting the enterprising researcher, whatever his particular educational background, is that industrial history must deal with the proliferation of sectors or sub-sectors, their uneven growth and the varying structural patterns which have emerged in the principal countries. What of it? In these respects industrial chemistry, treated historically, is not so very different from, say, the development of urban transport, joint stock banking, or (in the 20th century only) aircraft engine manufacture. All three have their technical aspects (often very complex), are subject to constraints specific to them, and are characterized by differing evolutionary patterns in different countries.



Recrystallizing alum, circa 1850 (4)

That being so, where does the particular difficulty of dealing with the history of chemical manufacture lie? I should like to suggest that it is, above all, not a straightforward sort of history which fits snugly into an uncomplicated chronology. It is, on the contrary, a topsy-turvy sort of growth, difficult to come to grips with and impossible to reconcile with the historical determinism of Marx and of those who look at the course of events with his eyes. Furthermore, at the national level, the industry's development does not usually accord with that of the country or of one of the regions. In short, it would appear that the growth of chemical manufacture is not directly related to the general environment (economic, social or political), but follows a course dictated by research and development and by the vagaries of a particular market sector. The listing of research achievements and the analysis of patents can yield some valuable insights, but that is not enough. More work needs to be done to explain the interval between discovery and industrial scale production which is puzzling by its variability. And just to complicate matters further it may well be true that some chemicals, or products made by the industry, have that remarkable economic characteristic of supply creating its own demand.

Practicing chemists, on the other hand, may be less handicapped by these difficulties. After all, they will be familiar with failure at an early stage of their work, and also with serendipity which has been the origin of so many important advances. They will not be surprised by the delays between laboratory success and market success. Above all, scientists, academic or industrial, cannot fail to be aware of technological change and its jerky progress. Their problems, as industrial historians, are the result of their training and their working methods: they are not encouraged to pursue subtle associations or to engage in speculative interpretations of an event. They are better at describing *how* things happened than *why* they happened. In an effort to compensate for these weaknesses, historians, like other writers, pile detail on detail. The relevant is overwhelmed by the "nice to know" (as they used to say at Exxon): no stone is left unturned, there is confusion and the author cannot see the wood for trees, while the reader soon becomes bored.

All this does not add much to our understanding of the industry's development. There is also, in my opinion, a surfeit of studies on the 18th and 19th centuries, interesting, but archaic rather than modern. We now have the distance and also much data to examine events from the outbreak of the First World War to the removal of European tariff barriers in the late 1960s. These 50 years or so have witnessed the development of contemporary chemical technology and its proliferation throughout the world. Hence, if we want to understand change and to orientate ourselves, we need a different perspective. In particular, the traditional approach of recording events and of analysis based on the experience of a few firms or of a single country no longer suffices. It leads to a kind of chemical

jingoism which, like political jingoism, is usually wrong as to facts and generally misleads. It does so for two reasons: by preventing us from observing what goes on elsewhere, and by its blinkered approach which fails to spot turning points of potentially great significance. An example will illustrate my point: wartime circumstances operated like a forcing house on plastics manufacture and use in Italy and France. German technology and know-how (promoted by I. G. Farben) were introduced and adapted to replace materials no longer available. After 1945, the wartime stimulus, often pretty crude, continued, but gradually became more sophisticated. In continental Europe it influenced production and foreign trade in the late 1940s and during the 1950s to a much greater extent than was the case in Britain. The study of a single country or of one firm would therefore not shed light on the experience of others and would fail to identify factors making, on the one hand, for growth and, on the other, for retardation. Naturally, if the change can be quantified and statistics produced to show the scale, so much the better. But quantitative industrial history can lead to the building of econometric models based on a weak foundation of unreliable and incomplete data. Far better in that case to make a qualitative judgement and interpret change descriptively. In the process much detail will be lost. But that is acceptable, provided a general comparison is attempted and, with hindsight as well as judgement, the principal turning points are identified.

Although there is no perfect method of writing history, a good approach would be one which combines technical change with economic and social developments. For practical reasons the time span should be restricted and the product range limited (though plastics, fibres and agricultural chemicals must be included). But I would not confine the story to a single country - on the contrary I would aim to cover the world. Descriptions will be supplemented by analysis and, at all times, comparisons play an essential role. Some of the work calls for cross-disciplinary expertise, some for the careful collation of available trade and production statistics. The project will fail unless the authors (the plural is deliberate!) ask the right questions and ruthlessly cut irrelevancies. In short, we have here the job description of a major enterprise. Is it worth the considerable effort in terms of resources, thought and time?

I am sorry to have to ask this question at all; I am convinced that it is worthwhile, but nowadays individual endeavor will not succeed without the material blessing of those in charge of money. I managed without funding and in my own time (except for a month's special leave), but that is no longer possible, and scholarly initiative has to be justified by future benefits.

It is, I know, a platitude, but one that needs to be repeated - anything which helps people better to understand change is worthwhile. Where ignorance prevails, there misconceptions flourish and remain uncorrected. This is not controversial stuff. But my next argument may be; a history which com-

pares, even if the comparison is incomplete and only partly numerical, is useful because it enables people to relate developments in one sector or one country with another sector or country during a given period of time. And that may lead to action. Although history does not invariably have lessons for the future, there have been occasions in my experience where it has helped to change attitudes. For example, almost 30 years ago when I was at I.C.I., I read an investigation of the growth of new products (notably fibres and plastics) which compared them with the company's traditional products - alkalis, other inorganic chemicals, dyestuffs and explosives. The former had been held back by cautious investment policies, a tendency to go for small unit sizes and inadequate technical sales service. By contrast the latter had benefitted, perversely, from the inertia that afflicts many large enterprises. The case was presented so convincingly that the report contributed within less than ten years to the implementation of major policy changes. This shows that past failures or missed opportunities can serve as signposts to alternative developments.

An argument applicable to a company or even a sector of the chemical industry cannot simply be extrapolated to the situation of the entire industry at national level. It has and continues to be done by journalists and brokers' analysts more often than by serious historians. There are, however, good reasons for dealing with industrial history on a national, indeed international, scale. One is the benefit to administrators, the other the needs of educationists and of those they teach.

The advice given to legislators (who are politicians and therefore partisan and superficial) is often incomplete and wrong, and affords every scope for argument and special pleading. But at the end of the day, the laws and regulations, once made, have to be implemented. The officials do their best, but their knowledge of the industries with which they deal is often minimal. Anyone who has looked at tariff history in Britain in the 1930s and 1940s cannot fail to have noticed that the "national interest" so often referred to in public was, in fact, the particular interest of producers which rarely coincided with that of their customers or the public at large. The manufacturers prevailed because those who administered the legislation did not know enough about the industry. Do they now?

And then there are the teachers and their students - if only the former would get away from the "Great Chemists" and their deeds to the development of the chemical industry, the latter might be rather better informed about their future employers. Cross-disciplinary means spanning the gap between the disciplines of chemistry and history. It does not mean the odd lecture on the founding fathers. Nor does it mean (as far as historians are concerned) a short course on "major industries" which ends abruptly in 1914, given by lecturers who would not recognize technical change if they saw it. It is in their educational role that historians have failed most signally to convey the significance of change in the modern chemical industry. What is the evidence that a more realistic message is

getting across to students?

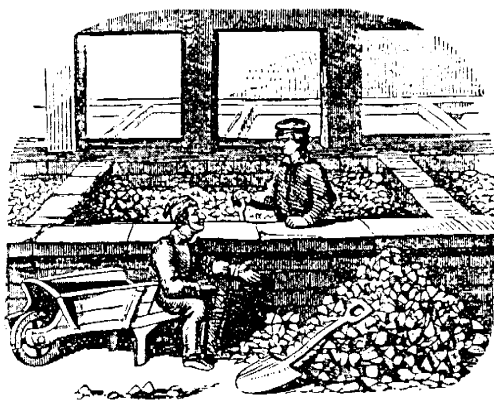
I have spiced my talk with personal reminiscences, general criticism and well-meant advice which will be difficult to implement. But I feel strongly about the neglect of industrial history and would like to see more of it along the lines I have suggested. *The Chemical Industry* books have caused me a lot of work, but they have also given me much personal satisfaction. Rather late in the day I have come to recognize that they could have been done better. Last, but not least, the books have led, quite unexpectedly, to the Dexter Award which gives me very great pleasure.

Dr. Sydney Milton Edelstein, the founder and head of the Dexter Chemical Corporation, has sponsored the award since the 1950s (3). I am proud to have been the recipient for 1988, and I take this opportunity of thanking him through the History of Chemistry Division of the ACS. I hope that in the future, others will be honored for work leading to a better understanding of those two great disciplines - history and chemistry.

References and Notes

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3. A. Ihde, "The History of the Dexter Award. Part I", *Bull. Hist. Chem.*, **1988**, *1*, 13-14 and *Dexter Chemical Corporation: A Company Documentary*, n.d.
4. Anon., *Encyclopedia of Chemistry*, Vol. 1, Lippincott, Philadelphia, 1877, p. 168.

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Alum manufacture, circa 1850 (4)

BOOKS OF THE CHEMICAL REVOLUTION

Part I: Méthode de Nomenclature Chimique

Ben B. Chastain, Samford University

Though we celebrate 1989 as its bicentennial, the chemical revolution was actually a complicated process which extended over many years. In this new series, Dr. Chastain provides the modern chemist and teacher with an introduction to some of the key books of the revolution.

In the spring and summer of 1787 a group of statesmen met in Philadelphia and, after much discussion and compromise, produced a document which, despite some early opposition and a continuing series of minor modifications, has become the foundation upon which this nation has been built. We celebrated, and continue to celebrate, the bicentennial of our Constitution's creation (1787), ratification (1788), and implementation (1789).

In Paris, that same spring and summer of 1787, another series of meetings took place which, after discussion and compromise, produced a document - a document which, despite some early opposition and a continuing series of minor modifications, has become one of the foundations upon which our science is built. Its title page reads: *Method of Chemical Nomenclature, proposed by Messrs. de Morveau, Lavoisier, Berthollet, and de Fourcroy; together with a new system of chemical characters [symbols], adapted to this nomenclature, by Messrs. Hassenfratz and Adet. At Paris, the house of Cuchet, bookseller, rue and hotel Serpente, 1787. Under the privilege [sponsorship] of the Academy of Sciences.*

Is a book on nomenclature really as important to chemistry as the Constitution is to the United States? Almost. In 1787, chemistry was in the midst of a revolution (the bicentennial of which we celebrated, and continue to celebrate). Lavoisier and his disciples were winning more and more converts to the "new" chemistry. And contrary to the sentiments expressed earlier by a Miss Juliet Capulet - "that which we call a rose by any other name would smell as sweet" - the leaders of the revolution were convinced that chemical names must be carefully chosen, and that they should convey information about the substances named. The Abbé Bonnot de Condillac, a philosopher who greatly influenced Lavoisier, put it very strongly: "We only reason well or reason badly insofar as our language is well or badly constructed ... The progress of the sciences depends entirely on the progress of their languages" (1). A brief look at the state of chemistry's language in the late 18th century would seem in order.

We can hardly fault the ancients for giving substances names which convey no information on composition; they had no information on composition. They had enough problems