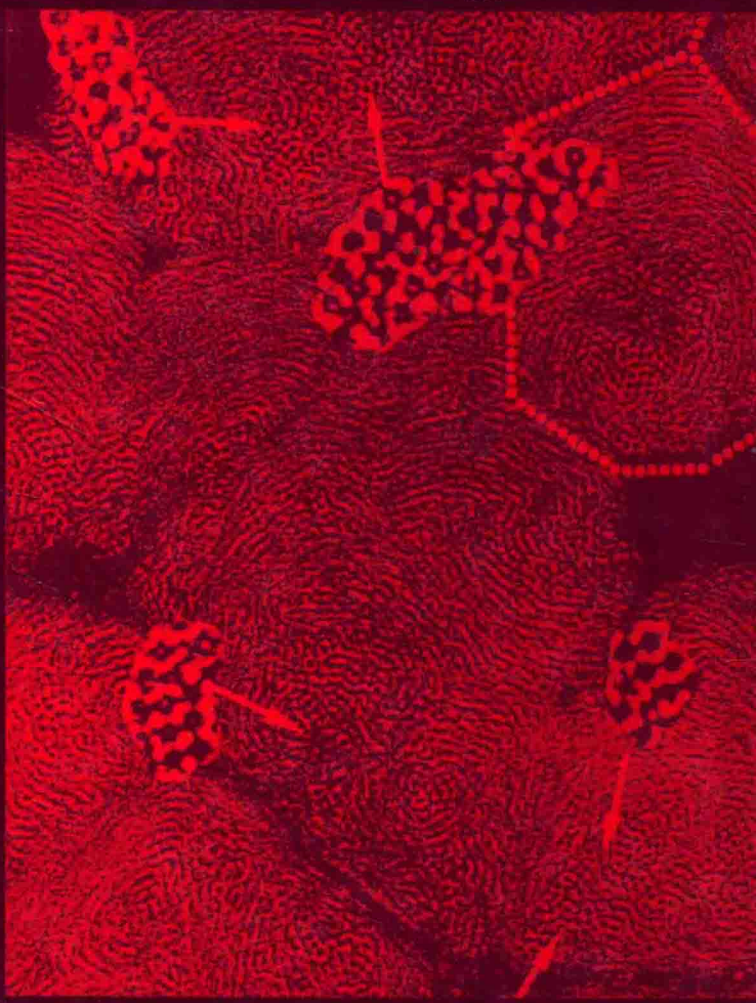
Wool:

Science and technology



Edited by **W S Simpson** and **G H Crawshaw**

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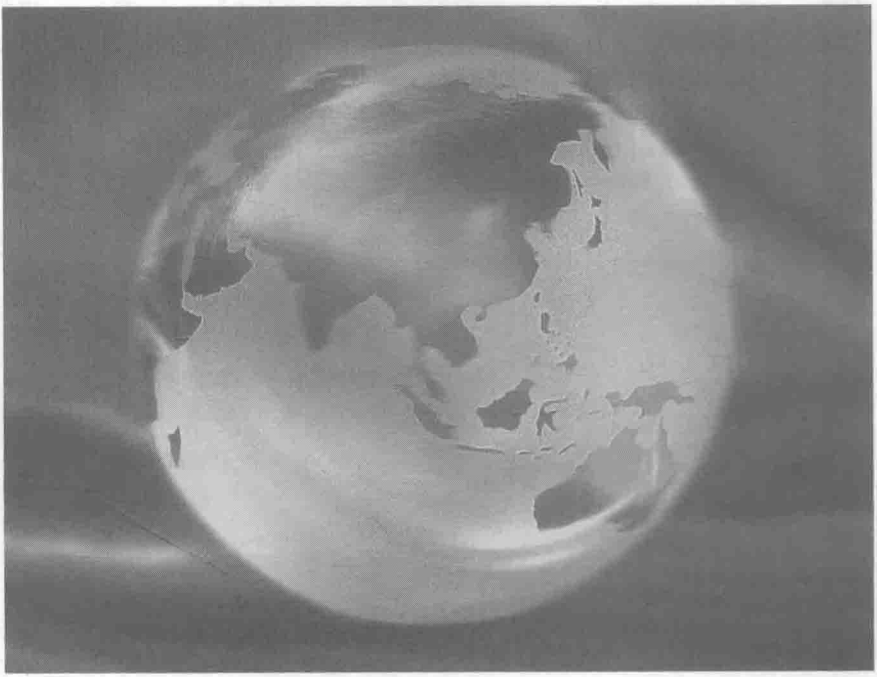

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Preface

Werner von Bergen and his collaborators released Volume 1 of their *Wool Handbook* in 1963, and two further volumes followed soon after. This series was unique in presenting a broad-spectrum description of every pertinent aspect from sheep-raising to wool consumer products. These texts were subsequently enlarged and reprinted in several editions.

Another notable previous publication was *Wool. Its Chemistry and Physics* by Alexander and Hudson, first published in 1954. More recently, two more narrowly focused texts have appeared, both highly valued in industry and academia. They are Maclaren and Milligan's *Wool Science. The Chemical Reactivity of the Wool Fibre* (NSW Science Press 1981) and Lewis' *Wool Dyeing* (Soc. Dyers and Colourists, Bradford, 1992).

The present text is therefore the first attempt in almost 40 years to present a comprehensive view of the wool industry from fibre marketing through to manufacture of consumer products.

In Chapter 1, I briefly describe a major overhaul that has occurred of the methods of trading wool, basically moving the entire system from one of individual intuitive skill to one based on laboratory measurements of sale lots.

Wool-scouring also has improved enormously in efficiency with a host of small and a few large innovations. Chapter 2 describes this modern technology, which reflects a strong emphasis on environmental concerns such as treating effluent discharges and energy conservation, coupled with far better quality control and capabilities for new add-on processes.

Chapters 3, 4 and 5 describe the principal sectors of current wool science. Understanding of wool fibre morphology, and of physical and chemical properties continues to progress and, in doing so, highlights just how intricate and complex is the wool fibre. Instrumentation, now available for isolating and sequencing wool proteins and for determining their structural arrangement, is beginning to offer a better-informed basis for technologists to devise improved wool products and processes.

Chapters 6 onwards deal in turn with each major aspect of wool pro-

cessing technology. I have to say the contributing authors have been, and in most cases still are, working in the heartlands of these industries. Spinning, weaving and knitting are the three really major physical processes. The Chapter on wool carpets exemplifies how one particular consumer product may be woven, tufted, knotted, or needled to create a great variety of pattern and texture.

Chemical processes that improve appearance or performance of wool products have been brought together in Chapter 7 to better highlight the technical options available to meet special specifications. The development of synthetic fibres with specialised performance features, allied with higher expectations of consumers, has been a strong motivation for creative new processes for wool. Flameproof protective clothing and antistatic carpets are just two fairly recent examples where wool products meet the most demanding requirements.

Wool dyeing innovation is similar to wool-scouring in some respects in that it has been driven by a greater emphasis on energy conservation, shorter treatment times, and better management of effluents, in addition to the publicly more visible competitive demands for high standards of stylish and stable colouration of wool products. The final chapter is intended to put these modern developments in the wool industry into a global context amongst other fibres and textile technologies.

I wish to sincerely thank my co-authors for their efforts to make available an up-to-date text for wool technologists, textile students and so many others interested in this old, yet modern, industry.

W S Simpson

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Contents

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1 Wool production and fibre marketing

W S SIMPSON

1.1 General introduction

Sheep husbandry is an important pastoral activity across most of Europe, the Americas and Asia. Its purpose nowadays is primarily meat production, although the wool harvest has for centuries been an important basis of local textile industries. European colonisation of large areas of the southern hemisphere suitable for pastoral production led to much larger numbers of sheep and a more dominant emphasis on wool production.

A large proportion of the wool harvest from Australia, New Zealand, South Africa, Argentina and Uruguay is exported to textile manufacturers in the northern hemisphere. For about a century (from 1860–1960) these manufacturers were almost entirely to be found in Western Europe. Since 1960, wool manufacture has declined in some of these countries and more volatile trading patterns have emerged. Russia, Japan, Iran and China are some of the countries that have fluctuated between minor and major importers of southern hemisphere wool.

Another trend, which gathered momentum since the end of the 1939–45 war, has been the drive for greater productivity from textile machines and consistent high-quality standards for textile products, so that standardised raw material is demanded. This turned the spotlight on wool marketing practices. Competition from synthetic fibres intensified. Their prices were usually stable, or actually reduced as the scale of production increased. Particularly important were technological advances in converting petroleum gases into reactive monomers suitable as starting materials for synthetic fibre production. Moreover, the consistent and precisely specified properties of synthetic fibres were very much in harmony with the ability to fine-tune textile machinery for high production rates.

In the face of this growing competition it was inevitable that the historic reliance of buyers and sellers of raw wool on intuitive judgement and experience in making trades came under pressure for change. Basically, the onus for developing, testing and implementing more sophisticated wool

marketing systems fell mainly on Australia and New Zealand. Australia is by far the dominant producer of fine Merino wool and accounts for almost half the quantity of wool worldwide that comes onto the open market. The Australian Wool Corporation (AWC), over the approximate period of 1950–1990, chaperoned the wool producers towards more efficient fleece preparation, and the wool trade into more efficient wool handling, packaging, transportation and sale methods. The AWC would also fund a considerable portion of the R&D efforts of Australian CSIRO scientists who were to verify new test methods and develop equipment for wool-brokers and test houses. In Australia, numerical specification of wool would focus on those measurements of most importance to the worsted industry.

New Zealand had a closely parallel responsibility as the predominant producer of crossbred wool for open sale. These wools, in many respects, posed a greater problem in sampling and testing because of the greater variability within and between sale lots and the diversity of end-uses. Although carpets were mainstay products after the 1939–45 war, considerable segments of the crossbred wool clip were destined for woven and knitted clothing, blankets, furnishing fabrics and many other products. In similar fashion to the AWC role in Australia, the New Zealand Wool Board (NZWB) encouraged the wool trade to participate in trials of new marketing procedures, and contributed a high proportion of funds to enable scientists at the Wool Research Organisation of New Zealand (WRONZ), formally incorporated in 1961, to develop sampling and testing methods and equipment, as well as scientific, manufacturing and product research relevant to coarser wools. The numerical specifications would emphasise those features of most importance for spinning on the woollen system.

By about 1990, almost all the testing and marketing procedures had been implemented in both Australia, New Zealand and South Africa. The last had a very similar fine wool profile to that of Australia and co-operated very closely in all aspects of wool testing, adoption of standards and marketing procedures. The regular meetings of the International Wool Textile Organisation (IWTO) meant reviews of outstanding concerns to the wool textile industries could be aired and responsibility for redress taken by the appropriate research laboratories, test houses, or trade committees.

Representatives of long-established wool manufacturers could expand their historic emphasis on such things as tariffs and regulation of trading in woollen goods to participate in IWTO sub-committees examining the technical and practical issues involved in routinely using the proposed new wool specifications. These were not all the problems to be addressed. Not only were the major traditional wool manufacturers confronting stiff competition from a burgeoning type of new textile industry featuring relatively cheap synthetic fibre products, but consumer interests increasingly required proof of product performance. On the one hand, the primary fibre needed

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