

The 62nd John Arthur Wilson Memorial Lecture

Retelling “Viewing Leather Through the Eyes of Science” A Century On

Mike Redwood

Introduction

In the U.K. they say if you remember the sixties you weren't there. But I do and I was. Nearly sixty years ago, still a teenager, I caught a train south from Scotland to the city of Leeds, made my way up the hill to search out the old red brick Leather Industry Building in the University of Leeds. I was directed to the small departmental library with its glass fronted bookcases lining the walls and dominated by a single large table where I was interviewed about joining their undergraduate course in Leather Science.

I was unaware that fifty years before me, a 23-year-old Chicago born graduate of New York University, recently engaged as a chemist in a Milwaukee Tannery also arrived in Leeds by train and made his way to the same red brick Leather Industry Building to be met by staff in that very library. This was 1913 and John Arthur Wilson was there to learn from and work with Professor Henry Procter.

In thanking the Chair and members of the selection committee for the honour conferred upon me by inviting me to give this 62nd John Arthur Wilson Lecture I have discovered that Wilson was a most illustrious alumnus from my own University. I worked in laboratories and sat in lecture theatres and offices unchanged from the ones he used, probably frequented many of the same pubs and travelled in and out of town on the same number one bus route.

The prolific research and writing that Wilson did in those years at Leeds and after his return to Milwaukee culminated in two notable publications. *The Chemistry of Leather Manufacture* was published exactly 100 years ago this year and then in 1924 the Shoe Trades Publishing Co. produced “Viewing Leather Through the Eyes of Science”, mostly based on essays he had written for “American Shoemaking” and “The Leather Manufacturer” and it is this which forms the basis for this lecture. Looking at the current landscape what would Wilson be working on if a 2nd edition were being prepared for publication in 2024?

“Viewing Leather through the Eyes of Science”¹ was about communicating the science to a wider audience, nearly all of it established in only the previous 40 years, a lot of that in Leeds. Wilson was convinced that knowledge should not be held by the elite but shared in normal language with others outside the industry. This

meant primarily those who used leather in their products, but also those curious about the science involved in the articles of everyday life.

At the start of the 20th century the UK leather industry was slipping behind both the USA and Germany in size but it was still leading in terms of research, with Leeds at the centre.

In Leeds Wilson met Joseph Turney Woods whose work in his tannery laboratory in Nottingham had led to replacing dog dung in bating. Woods was a member of the leather industry advisory board for the University and an external examiner. Edmund Stiasny had moved to Leeds from the Vienna Imperial Research Institute in 1909 in preparation for taking over the department when Procter retired in 1913. In January 1913 Professor Stiasny launched Nerodol, with a lecture in London. It was the first ever synthetic tan based on Stiasny's patent and produced by BASF². Procter had redirected his retirement gifts to fund a research laboratory where he stayed on as an Emeritus Professor³. According to Ward, the last leather Professor at Leeds, this was the most prolific research period in the near hundred years of leather at Leeds University⁴.

The following year Wilson was reminded of the strategic importance of leather when the Great War erupted. Stiasny did not make it back from a trip to Austria and Procter was asked to return to head the department. The CEO of the Booth Group, George Booth, agreed to become the Director General of the newly formed Ministry of Munitions at the request of Lloyd George who thought The Booth Group had the logistics skills missing in the Ministry of Defence. They owned a shipping line and had decades of experience moving semi processed and finished leather back and forth across the Atlantic. His father Charles Booth returned from a private meeting with Theodore Roosevelt on Long Island to take back control of the Booth leather business. Roosevelt had asked him to come to discuss trade unions.

From Stiasny's arrival through to the end of the War Procter was able to bring to fruition researches he had begun in the 1890s on the swelling of skin and gelatine⁵ aided by R. A. Seymour-Jones, Atkin, Burton and of course Wilson. Each one a well-remembered leather scientist. Wilson was in Leeds during momentous times for both the world and the leather industry.

Shortly after the end of the war other external matters beset the leather industry, with major destocking in the USA starting almost at once. According to Watson⁶ demand for cattle hide leather declined considerably from 1920 because of:

- technological change
- the appearance of substitutes
- new modes of living
- economic weakness, finally ending in the Great Depression

Watson says: “*as far as is known, this was the most important shrinkage in demand ever experienced in the industry*”. You might think you are reading about today with so many similarities. Wilson understood technological change, new materials, geopolitics and societal evolution as the constants we work with.

In the opening lines of “Viewing Leather Through the Eyes of Science” Wilson says: “That leather is the most suitable material known from which to make shoes is so obvious from everyday experience that any argument brought forward would seem to be an unnecessary waste of words.” Amazingly this was an industry tale you could still hear until recently.

Wilson’s responded by pointing out “it is not so widely understood just why leather is the ideal shoemaking material. Knowledge of the wonderful structure and delicate mechanisms of the skins are too often left to specialists” and he wanted to make this information fully available.

He was of course right that leather was the best material for shoes at that time. For footwear and many other sectors leather was essential, even strategically so, as he had harshly been made aware of during the war. Today there are no such areas where leather cannot be replaced by alternative materials. The competitive environment today necessitates full and continued communication.

This business and technical landscape that we have today, so similar in many ways with that Wilson was dealing with, means we have many major areas of concern. I will use three linked and overlapping leather science topics that I am sure John Arthur Wilson would be wanting raised at this 117th Annual Convention to try and do them justice. These are research, biomaterials and chromium.

Research

Wilson often told his audiences the chemistry of leather had not yet overtaken the art in large aspects of leather making production. He was determined to enlarge the area of fully understood science as he saw the requirement to move leather towards an engineered product, which customers of every sort could always rely on to meet specifications.

To achieve this and to advance leather science Wilson was strongly invested in the vital role of research.

His dedication to research hit me strongly when I returned to Leeds earlier this year. The University Archivist carried out a large open notebook on an even larger soft grey cushion. She put in front of me Wilson’s laboratory notebook, written entirely in his own hand, where 381 pages detailed his research work in 1915 and into 1916.

Leather Science might no longer be taught at Leeds, the old leather buildings might have been demolished but I did feel as though I was in the room with John Arthur Wilson. He was sitting opposite in his double-breasted suit and colourful tie explaining the effect of acids on chrome tanned leather he had cut neatly into 8 square inch pieces.

As well as looking at chrome tanned leather he continued the work on the effects of acids on the swelling of protein to build a picture of the main features of the changes in volume of hides and skins through the wet stages of the leather production.

His Laboratory Notebook includes notes of a lecture he read to the Nottingham section of the Society of the Chemical Industry. He described theoretical problems he had found while seeing if he could strip the chromium out and then quickly moved to a long list of what he termed “Possible Practical Uses”. These included extracting chromium from shavings for glue stock and stripping chromium from splits to make tanning with quebracho easier.

Chairing that meeting in December 1915 was Joseph Turney Wood, who had just learned of the death of his only son. The machine gun post he was commanding had been overrun and no one survived. War was never far away in those years.

As Ward⁷ explains Wilson and Procter jointly produced the full formulation of what became known as the Procter-Wilson theory. Wilson did most of the practical work for two papers they subsequently published in 1916^{8,9} setting out the theory and its experimental confirmation. Further work was done in conjunction with Loeb¹⁰ on the swelling of gelatine in acid. Some years later we have the Donnan Equilibrium which probably better explains the overall picture. This is based on the swelling being mostly due to the unequal distribution of the ions of the acid inside and outside the gelatine.

According to Ward this work “formed a fitting intellectually satisfying and practically valuable achievement to crown Procter’s scientific career”. Having played such a central role Wilson will have returned to the Chief Chemist post at A.F. Gallun in Milwaukee proud of what had been achieved and energised by the importance of research.

Research is integrated throughout his book. Knowledge of the structure of skin is vital to anyone who makes or uses leather, he says, so the Gallun tannery had “equipped a laboratory devoted to studies of the composition and structure of animal skin”. The entire

5th floor of the large main building at A.F. Gallun and Sons were occupied by this and other laboratories.

These covered all materials entering the tannery, checks on hides and liquors during process, bacteriological work and the study of microorganisms, with another holding the most advanced testing and control equipment. The final laboratory was a small-scale tannery, not for samples but for testing new processes

Wilson thought laboratories had to cover:

- eliminating problems from variations of incoming materials
- preventing deterioration in the established operations
- advancing the science of leather manufacture

During Wilson's time advancing leather science and work on the structure of skin slipped away from the tannery. Most fundamental work transferred into national research laboratories or moved to the leather chemicals industry. Turney Wood successfully collaborated with German chemical companies to obtain commercially viable bates and Stiasny pushed the concept of academic/industry collaboration further when he took his "super patent" to BASF and persuaded them only a well-resourced company could successfully exploit the many products that could be evolved from it.

In the second half of the 20th century the research organisations lost their local industrial base and most sources of government finance. With only a few exceptions they switched into testing and consulting houses. Universities have also suffered. Chemical companies have been reorganising and consolidating to meet new competitive challenges including the costs of servicing a more dispersed customer base and have had to divert major resources to comply with new regulations such as REACH. All this has made doing fundamental research more difficult.

Research is complex. I was reminded recently that we still wash our clothes in a drum. Fair enough, but is it not wise to question why we continue to depend on aqueous solutions with rapid uptake in the first hour, then hang around endlessly for the last few per cent to get taken up, and still end with dirty water? And should we still be using difficult chemicals like sulphide?

The machinery side has given us many advances in recent times. There are several far thinking companies investing considerable sums searching for not just the known unknowns but the unknown unknowns. And Kanigel¹¹ explains that one of the reasons nonwovens improved in the 1990s was that collaboration with Italian tanners found that dyeing and fatliquoring in drums gives a much better touch and feel. I am not necessarily opposed to drums.

I do not intend to demean the new materials that have come to market in the last few years; nor the current work ongoing to deal with some

of those in current use that are problematic. But I think it is a valid question why we continue to use far from perfect processes for so long and have not jumped far ahead with our product and process thinking. Rather too many items in the agenda of this 117th Meeting feel as though they should have been dealt with a long time ago.

And the work that Procter and Wilson were doing on raw material still feels incomplete even one hundred years and 62 JAW Lectures on.

I have been a Trustee of the UK Leather Conservation Centre since 2005 and a marvellous quote by the Scottish writer and poet Kathleen Jamie came up when we did a recent residential course for international conservators and curators. It fits alongside new thinking that is going on to understanding how humans and their predecessors have made use of hides and skins for most of the last two million years.

Jamie had been looking at ancient cave paintings of horses, cattle and other animals deep underground in Spain:

"There was a time – until very recently in the scheme of things – when there no wild animals, because every animal was wild; and humans were few. Animals and animal presence over us and around us. Over every horizon, animals. Their skins clothing our skins, their fats in our lamps, their bladders to carry water, meat when we could get it." Kathleen Jamie, *Sightlines*¹²

Because of global warming artefacts that have been buried without air for thousands of years are now being unearthed. Work done by the Leather Conservation Centre and others has made it possible for these to be properly conserved and available for study.

We see that hides and skins were effectively used by humans in every state from raw onwards. They might be totally raw, as parchment, sometimes treated with "leathering" oils which protect but do not tan, and then brain and smoke treated. All appear to have played a more significant role in our history than the fully tanned items that crowd our museums.

Even with no or minimal treatment they functioned perfectly well in the prevailing conditions.

When Rawasami gave his JAW lecture in 2001¹³ searching for Wilson's dream of a unified definition of tanning he looked at measures such as shrinkage temperature and structural stabilization amongst other more complex ideas. Later Eleanor Brown¹⁴ suggested that tanning might be better viewed in terms of protein modification than as simple crosslinking, hence the more general term of stabilisation of the collagen structure I have taken from recent correspondence with the Director at the New Zealand Leather and Shoe Research Association.

Rawasami put it simply that in the "new material world, leather needs to perform. While mankind has striven to design and make

materials with similar molecular assemblies and network structures, Nature has provided the leather chemist with an architectural marvel in the form of skin.”

Central to Wilson’s work and consequently to many JAW lectures is this collagen structure – and increasingly we look at its architecture as much as its chemistry. Tanners do not make leather through assembly or synthesis. They do it through conditioning, that is making changes, to the material to make it fit for purpose. With hides and skins that is usually best achieved by doing as little as possible, and history is now showing us that nothing more than cleaning and drying often worked. Perhaps this interface between what is raw and what is tanned is less important than we imagine and is even restricting our ability to seek out creative solutions for maximising this marvelous material.

The measure is more will the leather be fit for purpose than can it stand the boil.

What’s more do we consider that our approach to some grades push us too far towards a commodity? Might it be better while looking for new ways to stabilise collagen as leather and to use some hides and skins for other purposes altogether?

Back in the 1980s the late Bob Higham and I started an abortive attempt to look at whether the bottom 10 per cent of hides and skins could be taken out of leather making and used in other ways. This would expand the arrangements some tanners have to send limed splits to the casings market. The project did not go far; those already using hides and skins for products like casings wanted to avoid scar tissue. But times have changed, technology has advanced, more tanners are working with protein for various uses and climate change has rewired the economics.

Currently we have unwanted hides and skins being thrown away around the world at a level no one expected or likes. A way needs to be found to get them back into the chain, but should every hide and every skin end up as leather?

Over and beyond looking at collagen in modern times every researcher must consider the impact of leather manufacture on the planet’s resources. Not only hides and skins but water and many other items tanners make use of are in limited supply.

In recent years tanners have reduced the footprint of leather in terms of water, energy, chemicals and all types of waste as a result of a remarkable effort. Wilson wanted well managed effluent and hated waste, even in the 1920s. He was the director of research for the Milwaukee Sewerage Commission as well as Chief Chemist at Gallun when he gave the Chandler Lecture for 1928. His citation¹⁵ talked of his work to improve Milwaukee’s sewage plant and to make it “operable in such a way that it may soon be returning revenues to the city”.

The work and the associated investment by most tanneries in all environmental areas has been large and consistent. As an industry we can now honestly say that we go beyond complying with legislative demands and are searching out levels of best practice that allow us to face the world of materials with some pride. We have tanneries and organisations that have completed their own Life Cycle Analysis and as well as using them with key accounts have made them public. This has been in stark contrast to the Higg Index, now rebranded Worldly, whose opaqueness led to its own downfall, after many years of doing great harm to natural materials and especially leather.

This hard work never reaches an end point, and we need to keep advancing to stay ahead of competitive materials and be confident we are doing our best. We need our research bodies involved.

It would be incredible to see our few remaining research hubs across the globe obtaining the funding needed to increase their work in all these areas, most of all in fundamental longer-term research. Perhaps also working with some of the new generation of talented leather scientists now working as consultants. If we could get collaborative initiatives funded this could elevate leather to the next level. Eliminating some of the difficult chemicals, making better use of the collagen that enters the tannery, finding new ways to stabilise the collagen structure for leather, and imbuing leather with advanced properties that would make it a genuine competitor with other materials. A material willing to challenge conventions at every step; adapting to changing times as it has all through its long history.

Biomaterials

The argument that more fundamental research is required in the leather industry to stay ahead of competitive offerings flows into discussion of biomaterials where large amounts of finance have been steadily put into research for many years.

Despite this leather has proven difficult to match and we have seen a decade of failure. Currently only Piñatex, a cellulosic non-woven derived from the discarded leaves of pineapples appears to have reached bulk and it has a very distinct aesthetic that is not to the taste of all consumers. A mycelium production can be expected in 2024 and there will be another presentation during this convention. The work is very committed and relentless so it is obvious that before long the gap will be jumped and my argument would be to switch biomaterial producers from enemies into potential partners.

Allied to this the structure of the livestock industry has meant that meeting the demands of a growing population for meat and dairy products does not of necessity lead to an increase in long-term per capita availability of leather. Fewer but larger animals, greater efficiency in raising milk yields and greater consumption of white meat like poultry all mean that the growth of hide supply and thus leather production has been very low for decades.

The simple fact that no one keeps livestock for leather has been obvious throughout the last 100 years and was the major driver for another sixties event – the 1963 announcement by Du Pont that their new material called Corfam that was going to replace leather¹⁶. We should remember what this caused in the leather industry at the time.

There had been a host of materials such as vinyl, leatherette and leathercloth offering low-cost coverings for books and boxes made to look superficially like leather, but this was the first carefully constructed poromeric (short for porous polymer), supposedly breathable material designed with performance characteristics hoping to match leather.

Corfam failed with amazing speed. No one who bought a first pair ever bought a second. They were too uncomfortable. Corfam was expensive to produce and shiny so put into the more formal footwear category. These were the shoes of the office and the commute where foot comfort mattered.

Apart from creating a textbook marketing disaster Corfam showed how difficult it is to copy leather and how necessary it is to understand how consumers perceive complex subjects such as comfort.

The synthetics industry then searched for other routes into the materials covering markets by offering good properties at low prices, in a process well described by Christensen in the Innovators Dilemma¹⁷. The introduction of sneakers helped a great deal, while also supporting the split market. Improving generations of synthetic materials could be combined with leather and textiles to make attractive, comfortable footwear. Little mention was made that sneakers were never repaired. The synthetics then began to relentlessly grow market share in all areas.

This century synthetics have gained ground every time raw materials rose in price but not retreated when prices fell as they have before. Their growth in share in footwear alarmed the leather industry who particularly objected to some of their advertising, complaints that have shifted to several biomaterials. Several recent JAW Lectures have discussed this point in detail, particularly well covered by Gustavo Gonzalez-Quijano in the 60th Lecture¹⁸.

The good qualities that made plastic ubiquitous in 20th century life have now been tarnished by critical failings that impact climate change and rapid loss of biodiversity. We should remind ourselves of them:

- They are based on fossil fuels.
- Their useful life is very short and they cannot be repaired
- They shed or degrade into microparticles in ways not previously understood, particularly in salt water.
- In landfill the plastic element will take between 500 and a million years to biodegrade
- They are very hard to satisfactorily recycle.

It is not leather that needs replacing but all these plastic materials. Since there can never be enough leather to fill the gap then biomaterials are the best bet to move into the immense space held currently by Petro-fibres of all types.

So to me it has for some years made sense to support the development of biomaterials and urge that the leather industry should increase the collaboration that has already begun. If we engage with them and share expertise I am confident we have the combined skills to create the best portfolio of materials originating essentially from nature.

Biomaterials would have our knowledge of non-woven fibre structures, on how to refine products for different end uses and access to markets where it is already clear there is interest with the brands. But they would bring expertise and skills of their own.

I should declare an interest here as I have given advice to companies in the sector based on my belief that we need good materials to fight the plastics and to give vegans a better plastic free offering.

Before we go further let me also address a related matter which all partners will have to agree. When people sell something which they say is essentially biobased they need to be honest and transparent about it. The discovery by shoemakers, confirmed later by laboratory test¹⁹ that many materials have close to 50% polyurethane demonstrates a level of deceitfulness. It is nothing to do with marketing. Similarly saying that cows are saved from slaughter by replacing leather is not marketing either, it is a lie. These are areas, along with that of the accurate description of leather, where we must support our national associations to improve the laws and put more effort into enforcing existing laws. And we must police our own industry and ensure our partners adhere to promoting science-based truths.

We should remember that while bioplastics are a major improvement on fossil fuel plastics they are still plastic, so the longevity in use and end of life issues still exist. This can be a problem for leather as well as biomaterials according to a recent study by Carcione et al. Some heavily coated leathers are not much better than many biomaterials²⁰. Perhaps tanners should revisit linseed oil and the other natural treatments that were used in patent leather production before the age of plastics.

I also believe that amongst the best biomaterial producers there is full commitment, along with the necessary research funding, to complete the journey to a fully-fledged material suited to work alongside leather.

A collaboration with biomaterials that supported all these objectives would mean that centuries of building product knowledge, process knowledge, market knowledge and our historic understanding of the Circular Economy can be usefully applied in an overlapping area. And I do not believe this will damage leather.

I believe such a move could unlock access to research capital and creative thinking that is so badly needed and even more offer the leather industry future growth potential far beyond the one or two per cent we have had to battle with for so long.

To push plastics out and make a significant difference to the disposable consumer attitude to products would be our target.

Chromium

Today all leathers and biomaterials that the leather industry has a hand in, must consider Circularity.

The main concept behind the Circular Economy, twenty years before Braungart and McDonough's 2002 book *Cradle to Cradle*²¹, came from Walter Stahel's Mitchell Prize winning paper in 1982²². He argues that we need to keep goods longer and repair them. His Product Life Extension concept, now sometimes called the Value Retention Process, says we should make articles that last for longer and consumers will want to keep. Using resources for the longest time possible and then repairing and refurbishing them would reduce emissions and the new materials consumed. "A new relationship with our goods and materials would save resources and energy and create local jobs"

Stahel has lately been working with the Ellen MacArthur Foundation and has updated his thinking in several books plus a 2016 article in *Nature*²³ which emphasises that taking used goods back for recycling is costly in resources and should be delayed as long as possible.

Stahel's paper could have been written with leather in mind. Not all items worked on at the Leather Conservation Centre suddenly appear when glaciers shrink and permafrost melts. Most are centuries old items that have been well used and kept. Many carry initials showing they have passed through generations. Wall coverings last for centuries and the UK has four original copies of the Magna Carta. Often items were repurposed if they ever did reach end of life.

To maintain and improve this longevity and circularity philosophy a barrier for the leather industry exists with the continued use of chrome. I want to commend those who have put so much effort into producing viable alternatives for replacing chrome. But let me expand on why we must do more and move faster to eliminate chromium from leathermaking.

Amongst the press articles I keep is one from the Financial Times in 1994 entitled *Green Leather in Fashion*.²⁴ It is an environmental piece promoting the concept of wet white and intended to start the transition away from chromium.

Thirty years on chromium still predominates. It has been the subject of major research projects to bolster its defence and for much of that time I joined that defence, but now I think change is imperative.

Chromium is undoubtedly an excellent tanning material when managed properly in the tannery. That fact has not been enough to reverse the irretrievable damage created by the 1990s briefing against it. The target was to persuade the automobile industry to switch but it simultaneously created a consumer fear over chromium in leather which got linked to popular movies and legal cases about chromium VI. This has dogged the reputation of leather since, and all the statements, academic papers and research produced have failed to move the dial. Our industry does not have funding to defend chromium as well as to fight for leather. And it should not be trying to do so.

Beyond the well managed tannery the baseline arguments for chromium have changed. Few if any of the analyses of the different tanning methods, or current LCAs consider leather after it leaves the tannery, yet for the circularity to be complete it is one of the key areas. It is an area where leather offers magnificent benefits to society but it highlights the difficulty with chromium.

Some of the sizeable problems with chromium tanned leather can be demonstrated in shoemaking. Footwear companies find it hard to manage shavings and trimmings that contain chromium when trying to move towards circularity. There are also problems when the consumer is finished with the shoes. Incredibly large numbers of pairs are disposed of annually. Collection is hard and very few schemes have so far been successful.

So nearly all shoes are discarded, ending up incinerated, in landfills, or shipped to developing countries in Africa with unmanaged landfill that is always alight. The footwear industry has a big task ahead to become circular given most shoes are multi component. But if the tanning industry can offer a good chrome free biodegradable leather it would make life a lot easier, and replacing difficult plastic linings and footbeds with suitable leathers their circularity task gets easier and the consumer's foot more comfortable.

In addition, the California Proposition 65 and other new regulations to reduce the maximum chrome VI permitted in consumer goods add an extra layer of difficulty, exacerbated by costly penalties and contested test methods. Pyrolysis can deal with chrome leathers and pieces but there are very few plants in the world. Using chromium will continue to be fraught with difficulty. It is time to move on.

We do have better alternatives now in the market after concerted efforts in the past few years, although some older ones use worrisome chemicals. But until recently apart from some hydrothermal stability gains in the automobile sector new leathers without chromium have been mostly uninspiring and not been in easy to manage in areas formerly working with wet blue.

Footwear producers have largely stayed with chromium while many leather goods manufacturers have returned to vegetable leathers. We now need to see more support for a wholesale move away from chromium.

It took decades for the right processing parameters to be set for chromium along with the correct choice of fatliquors and retanning agents. When Wilson was worried about the performance of chromium uppers he had almost no options for retanning or fatliquoring. With a multitude of products today some committed collaboration with chemical companies should be able to fast track products with even better good aesthetics and performance. A much stronger uptake should also dispel the overblown fears about cost as volume benefits come through and development costs get paid off.

And I think the wet blue industry is big and strong enough to make and even to lead that change if they push harder with chemical industry suppliers and their own technical teams to get the technology perfected.

Conclusion

As the last century ended our trade organisations appeared in disarray. The International Council of Tanners of the 1990s was a far cry from the well represented body that filled the hall in Buenos Aires in 1978 for a big agenda. That was my first ICT meeting with the industry still talking about what if Corfam had succeeded.

In the last decade all our institutions appear to have transformed. Image, thinking, narratives are totally refreshed. Great moves are being taken to promote leather solely based on proven facts and science. We have even re-remembered longevity as a feature and a benefit – one of those givens that Wilson thought we had talk about more. But too many countries are still missing from the ICT and we need them involved and participating. There is so much to be done. We cannot drive our industry forward if we do not join and support or national, regional and voluntary bodies and get them collaborating. And making better leather through great research and manufacturing requires the full support of strong institutions.

At his Chandler lecture Wilson was commended for his “researches in physical chemistry, colloid chemistry, and the chemistry of proteins; his application with great daring and acumen of wide and exact knowledge of the most modern advances in chemistry to the complex problems of leather chemistry have resulted in valuable improvements in processes.”

Wilson crossed the Atlantic, he corresponded globally and worked with intense application to take leather into a new more scientific era. He was able to handle multiple challenges at once. He helped the industry make huge progress and his thought processes continue to help us now. I am proud to have got to know him these last few months.

References

1. Wilson, J.A. Viewing Leather Through the Eyes of Science, Shoe Trades Publishing Co., Boston, Ma 1924
2. 50 years of synthetic tannins, BASF, 1963
3. Henry Richardson Procter, 1848-1927 Obituary Notices of Fellows Deceased. Royal Society <https://royalsocietypublishing.org/> downloaded 24 March 2023
4. Ward, A. G. Henry Richardson Procter—His Life and Contributions to Science. *JALCA*, 1976, 59, 61
5. Ward, A. G. Henry Richardson Procter—His Life and Contributions to Science. *JALCA*, 1976, 59, 61
6. Watson, Merrill A.(1950). Economics of Cattlehide Leather Tanning. Rumpf Pub. Chicago Page 50
7. Ward, A. G. Henry Richardson Procter—His Life and Contributions to Science. *JALCA*, 1976, 59, 61
8. H. R. Procter and J. A. Wilson, *J. Chem. Soc.*, 1916, 109, 307.
9. H. R. Procter and J. A. Wilson. *JALCA*, 1916, 11, 399.
10. Loeb, J., *Proteins and the Theory of Colloidal Behavior*, McGraw-Hill. New York, 1924
11. Kanigel, Robert Faux Real: genuine leather and 200 years of inspired fakes, Joseph Henry Press, Washington DC. 2007
12. Kathleen Jamie, *Sightlines*. Sort of Books, 2012
13. Ramasami, T.; Approach towards a unified theory for tanning: Wilson’s dream. *JALCA* 96, 290-304, 2001
14. Brown, E.M Collagen - A Natural Scaffold For Biology And Engineering. *JALCA*, Vol. 104,2009
15. Wilson, J.A. Chemistry and Leather, Chandler Lecture for 1928 Industrial And Engineering Chemistry Vol. 21, No. 2, 1929
16. Kanigel, Robert Faux Real: genuine leather and 200 years of inspired fakes Joseph Henry Press, Washington DC, 2007
17. Christensen, Clayton M. The Innovator’s Dilemma: When New Technologies Cause Great Firms to Fail. Boston, MA: Harvard Business School Press, 1997.
18. Gonzalez-Quijano G. The 60th John Arthur Wilson memorial lecture: a future for leather! *JALCA*, 2019;114:244–55.
19. Meyer, M.; Dietrich, S.; Schulz, H.; Mondschein, A. Comparison of the Technical Performance of Leather, Artificial Leather, and Trendy Alternatives. *Coatings* 2021, 11, 226. <https://doi.org/10.3390/coatings11020226>
20. Carcione, F.; Defeo, G.A.; Galli, I.; Bartalini, S.; Mazzotti, D. Material Circularity: A Novel Method for Biobased Carbon Quantification of Leather, Artificial Leather, and Trendy Alternatives. *Coatings* 2023, 13, 892. <https://doi.org/10.3390/coatings13050892kk>
21. McDonough, William and Michael Braungart. *Cradle to Cradle: Remaking the Way We Make Things*. New York, North Point Press, 2002.
22. Stahel, W.R., 1982, The product life factor. An Inquiry into the Nature of Sustainable Societies: The Role of the Private Sector, Houston Area Research Center, 1982
23. Stahel, W. The Circular Economy. *Nature* 531, 435–438 (2016). <https://doi.org/10.1038/531435a>
24. Larsson, T. Green Leather in Fashion, *Financial Times*, September 7, 2004