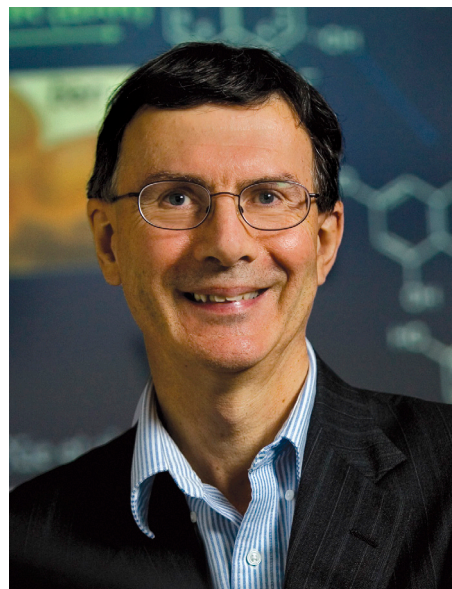


## Richard A. Dixon

### How did you spend your career?

I studied biochemistry as an undergraduate at Oxford University in the U.K. and continued in the lab of Keith Fuller, in what was then the Botany School, to do my PhD on the induction of antimicrobial natural products in plant cell cultures. I then did my postdoctoral work in Derek Bendall's lab in the Department of Biochemistry at the University of Cambridge. Derek worked on photosynthetic electron transport but also had an interest in plant phenolic compounds. I was very fortunate that he was able to provide me with a fellowship to carry on the work I had started in Oxford and to delve further into the biochemistry of inducible isoflavonoid defenses in plants (this continuity really helped me get my career launched).

It was during this period that I began what was to be my long-term collaboration with Chris Lamb. Chris had come to the Botany School in Oxford from biochemistry in Cambridge—we essentially swapped institutes and overlapped in Oxford by only about six months. I started my own research group as lecturer in the Department of Biochemistry at Royal Holloway College, University of London, in 1979, and Chris and I collaborated on cloning and studying the regulation of key genes involved in the phenylpropanoid pathway, as well as the role of active oxygen species in plant defense. After promotion to reader in plant biochemistry at the University of London, I took



six months sabbatical leave, split between the lab of Jos Mol in Amsterdam (flavonoid genetics in petunia) and Chris's new lab at the Salk Institute in La Jolla, California.

Experiencing these stimulating labs made me restless to find opportunities for expanding my research horizons, and in February 1988 I took the most decisive step in my career and became the founding director of the Plant Biology Division at the Samuel Roberts Noble Foundation in Ardmore, Oklahoma. I was drawn both by the promise of funding to bring together a world-class cadre of scientists working on basic plant biology to underpin important traits such as forage quality and disease resistance and by the can-do attitude of the foundation's president and board of trustees. To tempt high-quality scientists to move to a part of the country with little reputation for plant science research, I negotiated a joint postdoctoral program with the Salk Institute.

Successful recipients spent 18 months in each location. This worked very well, and by around 2010, there were more than 100 postdoctoral fellows and visiting scientists working at the foundation. Many of these people, including Maria Harrison, Ken Shirasu, Ken Korth, and Guodong Wong, have gone on to become leaders in their respective fields.

My move to Oklahoma was the start of 25 years in which my own program began a focus on the biosynthesis and engineering of lignin and condensed tannins, initially targeting forage quality and later bioenergy crops. Through a long-term collaboration with Forage Genetics International, we were instrumental in developing reduced-lignin alfalfa, now sold as HarvExtra, as probably the first commercialized transgenic output trait. One morning in the spring of 1976, I received a phone call from Bob Goldberg, who told me that he was on the steps of the NAS building in Washington, DC, and that I had been elected a member; I had to check to be sure it wasn't April 1!

All good things come to an end, or, better phrased, things change and new opportunities arise. So in February of 2013 I left the Noble Foundation and moved "down the road" to the University of North Texas (UNT) in Denton, bringing several of my postdocs and support staff with me. My work with Forage Genetics continued, this time in the direction of introducing tannins into alfalfa for pasture bloat protection. My work on lignin also moved into new directions; we had discovered

*continued on next page*



## ASPB Legacy Society Founding Member

C-lignin, a linear lignin homopolymer, in 2012. We have been actively involved since then in understanding its biosynthesis in seed coats (where it is naturally made, but only in relatively exotic species) and attempting to engineer it in stems of bioenergy crops to provide a new, high-value biomaterial.

In the spring of 2017, I was informed that I had been elected a fellow of the Royal Society of London. Coming from the U.K., this meant a huge amount to me. Signing the fellows' book containing the signatures of Newton, Darwin, and Stephen Hawking at the new fellows inauguration in the summer of 2018 was a wonderful moment. Being invited back later that year to my alma mater Brasenose College for a dinner to recognize me and two other alumni elected to the Royal Society made me think how fortunate I had been over the years since I first set foot there as an undergraduate in 1969. I have achieved my dreams largely through the hard work of numerous excellent postdocs and students, and I hope that many of them will continue to pursue the research areas that so excited me from my earliest days as a plant biologist.

### **What do you consider to be your most important contributions to plant science?**

My early work with Chris Lamb was pioneering as we were among the first to ask how plants activate pathways of specialized metabolism. But I think that the major contributions I can claim are in the discovery of new pathways, or key

genes in "old" pathways, of specialized metabolism. My lab led or was involved in the molecular cloning of a number of enzymes in isoflavone, lignin, and flavonoid biosynthesis. With Chris's team, we were the first to clone L-phenylalanine ammonia-lyase in 1985. Thirty-three years later, my lab discovered the importance of L-tyrosine ammonia-lyase for lignin biosynthesis in grasses! Our work on condensed tannin biosynthesis finally provided enzymatic and genetic understanding of an area of chemistry that had been fraught with controversy. Our recent discovery that the epicatechin starter and extension units of condensed tannins are synthesized by different pathways was particularly satisfying in highlighting the amazing biosynthetic capabilities of plants. An even more recent paper in which we "rediscovered" the coumarate hydroxylase of the monolignol pathway took me back to my Oxford days, where this enzyme was being chased by students in the lab where I did an undergraduate project. Another important contribution was the discovery of C-lignin I referred to above. This molecule has advantageous properties as a source of carbon fibers and high-value chemicals and as such shows great promise as a coproduct in biorefining for liquid biofuels.

I have always been interested in combining basic research with its translation to real-world problems and must therefore also list my group's involvement in the development of HarvExtra alfalfa as an important achievement. This transgenic, reduced-lignin forage,

commercialized by Forage Genetics International, not only improves animal performance but also yields increased forage biomass with fewer cuttings, thereby reducing the carbon footprint of forage production.

### **When did you become a member of ASPP/ASPB?**

As soon as I moved to the United States in 1988.

### **How did the Society impact your career, and what motivated you to become a Founding Member of the Legacy Society?**

My first experience of ASPB was in attending the annual meeting in Fort Collins, Colorado, in 1983. I was visiting the Salk Institute at the time, and I drove with Chris Lamb's family from La Jolla to Fort Collins. This was my first trip to the United States, and the scenery was overwhelming. I also wasn't used to such large meetings. I met a lot of people I would subsequently interact with in my future research. I think that the positive impressions from that meeting went some way toward tipping the balance in favor of my deciding to move to the United States to work at the Noble Foundation. Knowing that there was a vibrant plant science community out there gave me confidence that I could develop relationships with established scientists as I set out to put together my own team in Ardmore.

I decided to become a Founding Member of the Legacy Society for several reasons. As ASPB president in 2015–2016, I had been aware of

*continued on next page*

the need for the Society to move to a new budget model and generate more revenue from sources outside of the journals and annual meeting. Starting a culture of giving seemed like an excellent new avenue for helping the Society financially. I also believe that the older members of the Society bring a huge amount of experience that can sometimes get lost in this age, when all information is “just a click away.” Documenting their expertise and lab family trees will hopefully provide a resource for the younger members of the Society so they can follow up with Legacy Society members at the annual meetings. And then, of course, there’s the free dinner with old friends!

### **What important advice would you give to individuals at the start of their career in plant science?**

One piece of advice I always remember came early in my tenure at the Noble Foundation from a member of the Plant Biology Division’s board of nonresident fellows (external advisers). I was trying to establish the best metrics for promotion of new faculty. Bill Dawson (University of Florida) expressed the opinion that there were many qualities that were important for being a successful independent scientist, and that failure in just one of them could be a fatal problem. Being an excellent scientific thinker and experimentalist was obviously necessary for

success, but it wasn’t sufficient. Being an articulate communicator (both written and oral), being well-organized, and having good interpersonal skills are also critically important. Failing badly in just one of these areas can bring the whole house down. I advise younger scientists to pay attention to all aspects of their trade and to take time to seek advice from successfully established scientists as to how to improve in those areas, beyond the science itself, that are important for being able to communicate to a wide audience and bring others along with you.

### **Academic Family Tree**

<https://academictree.org/plantbio/tree.php?pid=795146>