Real-Life Research

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Get hands-on with real-life science

A story of gel electrophoresis

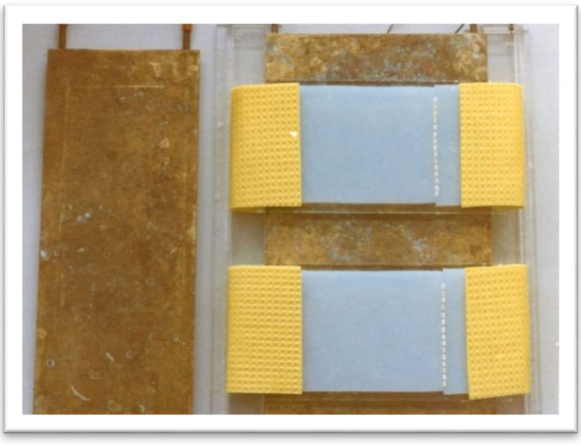
Alan with colleagues from the Roslin Institute at Lairg Crofter s Show

Alan Archibald | Professor of Mammalian Molecular Genetics

Alan is a professor at The Roslin Institute and Royal (Dick) School of Veterinary Studies at the University of Edinburgh. He is internationally recognised in the field of farm animal genetics and genomics research.

His research focuses on understanding the genetic control of complex traits, including production efficiency, product quality and host response to infectious disease, mainly in pigs and cattle.

When I started my research career last century in 1973 I ran a lot of **starch gel electrophoresis** (STAGE) experiments. I made the gels by boiling partially hydrolysed potato starch in buffer and pouring the mix into homemade glass moulds and waiting for the mix to cool and set. I made a cut across the gel near one end and inserted samples of cattle serum on small pieces of thick filter paper.



I closed the gap and placed the gel on a brass cooling plate that was then rested on two Perspex tanks filled with buffer and with an electrode running along the bottom of the tank.

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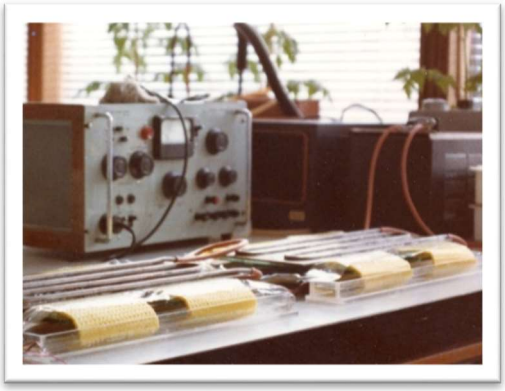
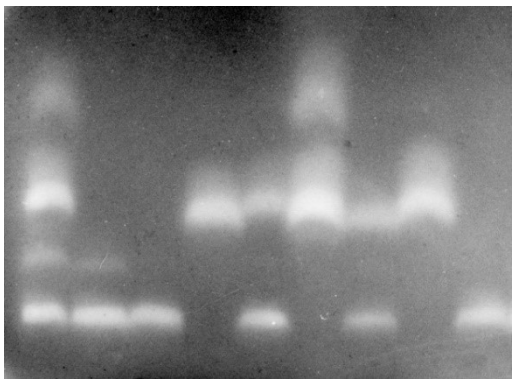
I then used sponge cloths to connect the buffer in the tanks to the surface of the gel. After covering the gel with clingfilm a second brass cooling plate was placed on top of the gel. The electrodes were connected to a power supply with the negative (cathode) terminal at the sample end of the gel and the positive (anode) terminal at the other end.



Over the next few hours, the proteins in the serum samples were separated as they moved through the gel from negative to positive under the influence of the electric field. Later I dismantled the gel and placed it carefully in a box of buffer and incubated it overnight at 42°C.

After I separated proteins by gel electrophoresis the next step was to visualise the proteins. We usually do this with a chemical that stains/dyes the proteins, but the protein that I was studying was an enzyme called amylase and because the gels I had used were made of starch I did not need to stain the gels! Instead I simply put the gels on a light box and I could see where the amylase molecules were by the clear patches where they had digested the starch.



The different patterns of amylase detected in the starch gels are determined by different forms of the Amylase 1 gene.

I originally thought that the different forms of the Amylase 1 proteins were separated in starch gel electrophoresis because of differences in their overall electric charge, but I didn't see the same separation when I used gels made of agarose or acrylamide- *what was going on?*

Years later (in the 1980s) I solved the puzzle, I was able to show that the separation by starch gel electrophoresis was in fact the result of the different forms of Amylase 1 proteins having different affinities for the starch gel, i.e. some forms 'liked' the starch better and as a result moved through the gel more slowly.

Alan made this gel electrophoresis system himself, using the tools he had around him. Being a research scientist is all about being creative and finding innovative ways to answer your scientific questions! To see how Roslin Institute researchers carry out gel electrophoresis today, watch our *Gel Electrophoresis in Action* video.

Glossary

partially hydrolysed- when a protein is only partly broken down into its component parts
buffer- a solution used to regulate pH
serum- a yellow coloured liquid separated from blood
amylase- an enzyme that catalyses the hydrolysis of starch into sugars

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