The Crabtree Foundation (Australian Chapter)
1986 Annual Oration
Crabtree – The Practical Man

W Roy Jackson
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Gentlemen (and absent Ladies),

it is my great honour to appear before you this evening to deliver the 11th oration in honour of Joseph Crabtree. In the next few short moments I will endeavour to persuade you by word and by demonstration that Crabtree was a "practical man".

First, a rather wordy, tedious, introduction to set the scene for 'new chums' and 'old faithfuls'. I have been privileged to hear several past orations, and on the day after one of these magnificent contributions to Crabtreeology an event took place which stimulated the research which led to the content of this humble oration. I happened to be invited to lunch with members of the Oakleigh Council, that august body of intellectuals who are responsible for much of our physical wellbeing as we toil every day in this our work place. The conversation ranged widely from the likelihood of BLF deregistration to sources of cheap motor car tyres. However, one distinguished Councillor noted •my somewhat listless air and asked me for the reason. I explained that during the previous evening I had been present at a Crabtree Oration. The effects of the revelations, the company (and possibly the munificence of the flow of liquid refreshment) had led to my somewhat lethargic air by noon on the morrow. This explanation led to searching questions as to 'who was Crabtree?' It struck me at that moment that if fate were ever to condemn me to become a Crabtree orator my mission would be to rationalise how the name of Crabtree, whom we all know to be a man of incredible influence in many diverse areas, could not be known to such a distinguished group of intellectuals as the Oakleigh Council.

Gentlemen, the evil hour has arrived and I will endeavour to demonstrate to you the conclusion that I have arrived at which shows clearly that Crabtree was a practical man who, for reasons that will become obvious, shunned publicity. Earlier orators have enunciated his genius in many literary and social fields. In these fields it was easy for Crabtree to find appropriate 'front men' to allow his genius to be appreciated without exposing himself to the glare of publicity he was so anxious to avoid. In the area of politics —Arthur Wellesley, Duke of Wellington. He is once reputed to have said (Croker Papers (1885, Vol. III, p.276) "All the business of war and indeed all the business of life is to endeavour to find out what you don't know by what you do; that's what I call 'guessing.what was at the other side of the hill'." In the scientific area there was Michael Faraday — a genius who claimed that he felt no ill feeling when he learnt that Sir Humphrey Davy, who owed much of his continuing scientific reputation to Faraday, had tried to use his influence as President of the Royal Society to blackball Faraday's proposed election to the Royal. In Engineering there was Brunel, renowned for his Pneumatic railways and 7' 1/2" gauges. Gentlemen, it is obvious that such men were putty in the hands of our inspiration.

In this rather rambling introduction I hope I have set the scene for the major portion of this oration. Crabtree's brilliance shone in many fields and he was always able to find some weaker—willed soul through whom he could express his talents while retaining his anonymity. In chemistry it was a lot more difficult than in other fields. Modern chemistry was planted, took root and flowered during Crabtree's lifetime. It was the growth area, the biotechnology of today, and fortunes were there to be made. Crabtree was never one to let such opportunities slip. In previous centuries much of 'chemistry" or "alchemy" was concerned with colour, combustion (including explosives) and with the precious metals. Naturally, as the discovery of scientific explanations for natura1 phenomena began to be realised in the 18th century, attention focussed initially on these areas of wide interest to the general public.

Crabtree realised at an early age that as gold was a great source of revenue for alchemists so it was to be for him. The general public was no more informed in the 18th than in the 17th century. He thus was able to persuade the gullible public into investing in his alchemist's stones. These consisted of a mixture of colourless inorganic materials which, when mixed, even in the solid state, led to a golden colour. My colleague, Doug Rash, has kindly consented to help bring some of Crabtree's works to life and will demonstrate some of Crabtree's modest achievements. Colour was an area of widespread interest at the turn of the 19th century. Sir Humphrey Davy (after a visit to Rome in 1813) reported at length on the colour used in the ancient paintings which remained in the baths of the Emperor Titus. Crabtree in his early impecunious days would have been in an excellent position to exploit the public's fascination with colour and its origins. Using the readily available starch — iodine, co1our end a knowledge of concentration he could have created delayed colour changes as illustrated by Mr. Rash. This must have been a source of some confusion to the uneducated public of the day and obviously represented a source of income for a gambling man.

Just to show that we have advanced slightly since Crabtree, we have set up an oscillating colour reaction — an academic curiosity, now but one which I am sure Crabtree would have been able to extract profit from had it been available to him. However, I believe that one of Crabtree's greatest intellectual contributions was to the problem that was central to the development of systematic Chemistry - the structure of the simple gases and the nature of combustion. During the earlier part of Crabtree's life the major simple gases were obtained in a fairly pure state - hydrogen, oxygen, carbon dioxide, nitrogen. Of the hydrocarbon gases, methane was available and to a lesser extent ethane and acetylene, though in a less pure state. The chemists principally responsible for the experiments leading to the discovery of these gases were Joseph Black, Henry Cavendish, Antone Lavouisier Sir Humphrey Davy and Joseph Priestley. John Dalton contributed to the atomic theory, which helped to set chemistry on a firmer theoretical basis, but Crabtree could afford to ignore him. By visiting their homes and laboratories and by listening to lectures given by these scientists, Crabtree would have been able to put together the simple experiments we are about to demonstrate to you. These experiments clearly show that it is the reactions of oxygen, especially with hydrogen and hydrocarbons which lead to much of what was known as combustion in those days. Phlogiston, which involved the intervention of an essential element called phlogiston during combustion, was a red herring. The phlogiston theory was the cause of enormous confusion for several decades. This confusion must have been of tremendous assistance to Crabtree but it was not enough. Sir Humphrey Davy, a self—made man like Crabtree, was as hard as nails and was as we've heard, prepared to blackball his protegee's (Faraday's) election to the Royal Society. Lavoisier was of

the same ilk. He invited Priestley to his home (in 1774) and observed Priestley prepare oxygen by heating the red oxide of mercury. Lavoisier in a later paper claimed to have discovered the reaction itself. Crabtree obviously had to be very careful with such men about. However, by that may not be a coincidence, all of these experimenters dropped out of science at a relatively early age and left their knowledge for Crabtree to use. In a previous oration it has been revealed that.. Crabtree was almost certainly involved in the Birmingham riots of 1791 which led to the precipitate emigration to the U.S.A. of Joseph Priestley. Cavendish, always somewhat of a recluse, dropped out of chemistry after his papers describing "Experiments on Air" had been published in 1785. Black, always a sickly man, died in 1799, while Lavoisier lost his head in 1794 having fallen foul of Citizen Robespierre. Sir Humphrey, probably the biggest threat to Crabtree, went from strength to strength with the men about town and their ladies until he suddenly became ill and died in 1829 after one of his many visits to the Continent.

Is there any evidence that Crabtree was involved in the sudden departure of all of these scientists from this area of research? In addition to his encouragement to Priestley I've found only one piece of possible evidence. Thomas Thomson who lived from 1773 to 1852 was Professor of Chemistry in the University of Glasgow. He describes the death of Joseph Black in the second volume of his *History of Chemistry*. I quote:

"On the 10th November 1799 in his 71st year he expired without any convulsion, shock, or stupor, to announce or retard the approach of death. Being at a table with his usual fare, some bread, a few prunes and a measured quantity of milk diluted with water, having the cup in his hand when the last stroke of his pulse was to be given, he set it down on his knees, which were joined together and kept it steady with his hand in the manner of a person perfectly at ease; and in this attitude expired without spilling a drop, and without a writhe in his countenance; as if an experiment had been required to show to his friends the facility with which he departed."

His servant opened the door to tell him that someone had left his name, ... Who was the caller? Would the premonition of a visit from Crabtree be sufficient to precipitate the unusual death so graphically described by Professor Thomson? We don't know.

We do know what was available to Crabtree in chemical knowledge and will now try to demonstrate to you the power of this information. Crabtree, Black and their colleagues used the "allentois" of calves to contain the gases. Our store didn't have any allentois so you will have to excuse the anachronism of rubber balloons.

In the first balloon — air

In the second balloon — oxygen

In the third balloon — hydrogen

In the fourth balloon — methane

On applying each of these to a candle we see that nothing much happens to the first two and that the last two burn with varying degrees of violence. Crabtree realised that for combustion to occur the reactive hydrogen and methane require oxygen which is not too readily

available from the air when the balloon burst. When these gases are premixed with oxygen and the balloons then placed over the flames much more vigorous reactions ensure.

5th balloon — hydrogen and oxygen

6th balloon — methane and oxygen

7th balloon — acetylene and oxygen

Crabtree seeing the concentrated energy which ensued from these reactions was capable of designing the forerunner of the modern oxy—acetylene torch. His strong desire for annonymity may have come from the Crabtree firm's motto which is reputed to have been •'Nobody's safe is safe from Crabtree".

I would like to conclude this oration with two pieces of rank speculation.The first is in the area of explosions.

Crabtree must have become aware that explosions, such as the ones you have heard, are caused by the instant adiabatic expansion of compressed gases. In the combustion' reactions the energy to cause this expansion comes from reactions between the gases themselves. This need not be the case. In the final demonstration we have sealed 3 cubic centimetres of water in a thick walled glass tube and we are applying heat externally. When it explodes in a few moments, it should produce an ear—shattering noise. This noise arises from the instantaneous expansion of 3 cubic centimeters of water.

Imagine what the noise must be like if 3 cubic miles of water were to be vaporised. This is what happened in 1813 when the volcanic island of Krakatoa exploded. The explosion was certainly heard three thousand miles away some four hours later. The explosion (26 times greater in energy than the largest H—bomb so far detonated); the largest this millenium, was on a scale appropriate to be associated with Crabtree. Did he visit Krakatoa on his way to or from Australia? Could he have laid a delayed fuse which triggered the volcanic eruption some decades later. Possibly some vulcanologist amongst you may provide the answers.

Finally, I have always wondered why the name of Crabtree has not become better known in experimental science. Genes weave their spell and it struck me that Crabtree's children may well have chosen unspectacular but remunerative areas of science in which to demonstrate their competence. Accordingly, I was not too surprised when I consulted Chemical Abstracts and in one of the early editions found a reference to the works of a James Crabtree.

James Crabtree chose not to publish in the Transactions of the Faraday Society or the Proceedings of the Royal Society. He published in the Engineering Contraction section of the proceedings of the Royal Sanitary Institution, 1913, 40, 273, a typical down-to-earth Crabtree type journal. I quote the abstract in full:

> *Contact filter beds treated with toluene to destroy protozoa gave poorer results than similar beds not treated. Crabtree concludes that the animal population of the bacteria (contact) bed is entirely advantageous, by maintaining the capacity of the bed and*

probably by keeping down extraneous bacteria and thus assisting purification.

Could this James Crabtree, working in the area of applied microbiology, have been influenced by or even related to Joseph? Could either of them have had a direct connection with the end products of this Crabtree oration? I contacted the M.M.B.W. and their helpful archivist told me that the systematic treatment of Melbourne sewerage commenced in 1890 with the completion of the initial stages of the Werribee sewerage farm. Prior to 1890 the night soil carts collected Melbourne's offerings and dumped them in the Yarra. It was then common practice to pick up fresh vegetables from the nearby market in the same carts and return to the more remote areas of the city - 'which was, not surprisingly, the typhoid centre of the world.

Do we owe yet another debt of gratitude to Crabtree as we digest our lightly—cooked vegetables? I look foward to a definitive answer in some future revelation, where I am sure that Crabtree's attributes as a practical man will be further exemplified.

Gentlemen, I would like 'to conclude by thanking Doug Rash for his invaluable assistance and you, sirs, for your attention.

I also wish to thank my immediate predecessor, Gordon Taylor, for his detailed proof reading of this manuscript.