Abstract for Weizmann STS Topic

HISTORY AND CHEMISTRY: FERMENTATION, BRITISH NAVY MODERNIZATION FOR WW I, WINSTON CHURCHILL, CHAIM WEIZMANN AND ESTABLISHING THE STATE OF ISRAEL.

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In preparation for WW I, 1914-18, the guns of the new dreadnought battleship series of modern warships and the continuing evolution of navel warfare tactics required the use of the new smokeless gunpowder developed by the French. Acetone was a key ingredient.

In 1915, Churchill gave carte blanche to Weizmann to scale-up his special laboratory fermentation process for producing a few hundred milliliters of acetone to 30,000 tons / year [or about 35 billion milliliters or a 173 million scale up]. [p89, Rhodes] A special bacterial microorganism, *Clostridium acetobutylicum*, that Weizmann had discovered on an ear of corn. during his research between 1912-14, was found to improve the yield of the fermentation of corn starch to a mixture of acetone, ethanol and butanol [3:1:6]. [p88, Rhodes] The many local Irish distilleries were enlisted for the two distillations required for separation and purification. When corn became scarce, school children were sent into the country to gather plentiful local horse chestnuts as another source of starch for this process.

This was the first use of bacterial fermentation for large scale production of the industrial important product acetone [213, Kauffman]. Within 6 months he had obtained 0.5 ton quantities of acetone. [p89, Rhodes] After only 1 year, by 1916, Weizmann succeeded in planning this required massive scale-up of his fermentation process.[[page 212, Kauffman]. 11 tons of acetone could be obtained from 100 tons of grain. [p89, Rhodes].

The historic 1917 Balfour Declaration with respect to establishing the State of Israel has been attributed to the British desire to thank Weizmann for his tremendous contribution to modernizing the British navy and to the eventual winning of WW I. He later became the first President of the State of Israel.,

The government took notice of the dramatic, practical impact science could have on improving industrial technology competition and modern warfare. Science also took noticed of their new found power and influence.

Specific details will be presented on the actual industrial fermentation process itself and why it dramatically affected the modernization of the British navy

Comparisons and similarities will be made with the war related experiences of Otto Hahn, Fritz Haber [p92, Rhodes], Albert Einstein, the Manhattan Project and other subsequent significant and historical government - science “partnerships,” especially with respect to the belief that new scientific discoveries could shorten the duration of wars and save lives.

In the second half of the 1800’s, Pasteur [1822-1895] had predicted that fermentation using microorganisms would be employed on an industrial scale to make numerous organic compounds. [page 77, Dubos]

The initial commercial development on an industrial scale of petroleum products was just beginning with the drilling of the Pennsylvania Drake Oil Well about this same time in 1859.

Thus, on the eve of WW I, fermentation was still a main source of large volumes of organic compounds, including acetone. Other large scale production methods of acetone involved inefficient and cumbersome distillation of wood and the decomposition of calcium acetate, made from acetic acid [vinegar, also from distillation of wood and fermentation] and calcium oxide [lime].

Fermentation today not only remains of interest with respect to gasohol, but it is a very significant component in the pharmaceutical and other industries.

During WW II, 1939-1945, Weizmann continued his research in England with respect to the fermentation processes, but concentrated on the then much needed high-octane aviation fuels and synthetic rubber for the allies. [p213-4, Kauffman]