JOHN R.G. BRYCE

George Herbert Tomlinson
1912-2010

Dr. George Herbert Tomlinson died on March 16, 2010, at the age of 97. He was born on May 2, 1912, in Fullerton, Louisiana, of Canadian parents while his father, also George Tomlinson, was leading a project to hydrolyze wood carbohydrates to their component sugars. The family returned to Canada when he was about two years old. George had his early education in schools in Montreal and Cornwall, Ontario. In 1928, George entered Bishop's University in Lennoxville, Quebec, from which he graduated in 1931 with first class honors in Chemistry. He won both the Governor-General's Medal and the Lieutenant-Governor's Medal for his undergraduate work.

In 1931, George entered the graduate school of McGill University and studied under Dr. Harold Hibbert, a well-known wood chemist of that era. He completed his PhD requirements in 1935, and remained with Dr. Hibbert as a Research Associate for another two years. In 1936, he accepted a position with Howard Smith Chemicals as Chief Chemist at the Cornwall Mill with the mandate to commercialize the production of vanillin from sulfite spent liquor, and in 1940 he became Research Director of the parent company, Howard Smith Paper Mills. He remained in that position for over 20 years.

In 1961, Howard Smith was merged with Dominion Tar and Chemical, a diversified company with major interests in chemicals and construction materials, and with St. Lawrence Corporation, another pulp and paper company, to form the present Domtar. George was appointed Director of Research, and was asked to assemble an enlarged staff to serve the technical needs of the new company, and to build a new Research Centre in the Montreal area for this activity. As a result, the Domtar Research Centre in Senneville, Quebec, was opened in September 1963. It became one of the outstanding industrial research establishments in the country; the staff at the time of the opening was about 90 scientists and technicians and it peaked at about 140 in the 1980s. It was one of George's greatest achievements.

In 1970, George was appointed Vice-President of Research and Environmental Technology for Domtar, giving him responsibility for dealing with the environmental aspects of the company's operations. He remained in this position until he retired in 1977. On his retirement, he was appointed Senior Scientific Advisor for Domtar, and held that position until 1990.

Throughout his long career in pulp and paper research, George Tomlinson made many significant contributions which improved the processes and products of the industry. His career spanned the time when the industry was changing from an empirical one to one based on scientific and engineering principles. He had a remarkable command of the fundamentals of science, and he applied that knowledge to whatever problem he was investigating. A major part of George's success in developing new commercial processes was his confidence in his judgement, and his strong advocacy for the proposed processes.

George's doctorate work at McGill had involved the oxidation of various forms of lignin. In one of his experiments, he made spent sulfite liquor alkaline, then treated it with oxygen. The resultant solution had a characteristic odor, which George recognized as vanillin, the principal ingredient of vanilla extract, a widely-used flavoring in the food and confectionary industries. He worked out a process for isolating this material in crystalline form and, when he moved to Cornwall, he supervised the construction and start-up of a commercial plant to produce the material in sufficient purity to be used in food products. Later, several other sulfite mills adopted

the process and now lignin-derived vanillin has largely replaced the natural product in the flavoring field.

During World War II, phenol was in short supply and became very expensive. This put into doubt the company's plans to build a laminate operation using sheets impregnated with phenol-formaldehyde resin. George realized that the lignin residues in spent alkaline pulping liquors had a significant content of free phenolic groups and could possibly replace all or part of the phenol in this application. He precipitated lignin from the spent liquor, purified and dried it, and then spread the product between the impregnated sheets prior to laminating. A plant was built using this technique, and the product, which was sold under the name Arborite, received good market acceptance. The process was run in this way for many years until, in the late 1960s, phenol from petrochemical sources became available at very low cost, and the use of alkali lignin in this product was terminated.

George was one of the first to introduce black liquor oxidation to the alkaline recovery cycle in order to reduce the odor release during evaporation. By contacting the hot liquor with air (or oxygen), sodium sulfide is converted to thiosulfate, and no longer releases hydrogen sulfide during processing. Also, mercaptans are converted to less volatile forms, and the less odorous compounds are released.

George also pioneered the use of liquid hydrocyclones (centricleaners) for removing contaminants in the pulp supplied to the paper machines. This device could separate foreign particles on the basis of specific gravity or shape, depending on the dimensions of the cyclone. Its use made a quantum improvement in the removal of bark particles, incompletely digested fibre bundles (shives) and inorganic particles from the fibre supply. A very low contaminant level became important as paper users adopted the use of automatic reading devices such as optical character readers and magnetic and electrical scanning devices to retrieve information from paper. Today, virtually all mills making market pulp and quality printing papers employ these devices.

Perhaps the most significant contribution George Tomlinson made to the industry was the development of magnesium-based sulfite pulping, the Magnefite process. In this process, the digestion is performed just below the bisulfite level, at a pH between 3.0 and 4.0. At this level, the bisulfite is unbuffered, and the acids generated rapidly reduce the pH to an unacceptably low level. George developed the technique of controlling the differential between the steam and the digester pressure by removing a controlled amount of sulfur dioxide from the gas space at the top of the digester. This withdrawal of acidic sulfur dioxide permitted the digestion to take place within the desired pH range. Thus, a pulp of noticeably higher quality was produced than would be the case with the standard sulfite process. By using magnesium as base, the spent liquor could be incinerated to produce magnesium oxide and sulfur dioxide, the raw materials for preparing the bisulfite cooking liquor. Although the sulfite process today is in decline because of wood species limitations, the majority of the mills still using the process employ the Magnefite technique.

George also developed a significant variation to the process for producing kraft pulp; he gave the process the name Alkafide. In this modification, the digestion was carried out using sodium

sulfide as the sole pulping chemical. When the spent liquor from this process was incinerated in a regular kraft recovery furnace, the resultant smelt was a mixture of sodium sulfide and carbonate. When this mixture was dissolved in water, the bulk of the sodium carbonate could be removed by crystallization, and the remaining solution, mainly sodium sulfide, was returned to the digester as fresh cooking liquor. The crystallized sodium carbonate was dissolved in water and used to remove sulfur compounds from the recovery furnace flue gas. The pulping aspect was well-established in a mill-scale operation but mill studies on the recovery system were terminated due to industry-wide financial difficulties before some of the operational problems were resolved.

As a retirement project, George decided to explore a topic which had concerned him for many years. He was aware that the sulfur dioxide emitted from industrial operations resulted in acid precipitation which, in forest areas, wound up in the soil. He postulated that the acidity of the soil inhibited the uptake of vital elements, such as potassium, calcium and magnesium, by the roots to a point where the health of the trees was adversely affected. As he traveled in North America and Europe with his wife Frances, he observed the conditions of forests. When he found signs of forest decline, they took photographs and collected soil and foliage samples for analysis. The results of these studies confirmed George's hypothesis on the subject. He corresponded with and visited scientists in Europe, particularly in Germany and Scandinavia, who were working on similar problems, and presented papers in both North America and Europe on his findings. He summarized his work in a book, co-authored by Frances, entitled *Effects of Acid Deposition on the Forests of Europe and North America*, published in 1990. He continued to pursue this work until his death. Their work in this field led McGill University to dedicate a chair, the George and Frances Tomlinson Chair in Forest Ecology, at its MacDonald College campus.

George Tomlinson received many awards and honors during his long career. In 1991, he was awarded the John S. Bates Gold Medal by the Canadian Pulp and Paper Association; this is the highest honor that the Section bestows on its members. Earlier, he had been made a Life Member of the Technical Section. In 1947, he was awarded the Weldon Medal by the Association for the best technical paper of that year. The Technical Association of the Pulp and Paper Industry in the United States awarded him its Gold Medal in 1969. He was a Fellow of the Royal Society of Canada, The International Academy of Wood Science, The American Society for the Advancement of Science, and the Chemical Institute of Canada. He was a member of the American Chemical Society and the Chemists' Club of New York. In 1952, he was the Canadian Delegate to the FAO/UNESCO meeting in Rome on forest resources of the world. In 1968, 1974 and 1978 he visited the USSR as part of the Joint Canada/USSR Working Group on Forest-Based Industries. He represented Canada for a number of years on the Scientific Advisory Board of the International Joint Commission. He was a member of the U.S.-Canada-Mexico Tri-Academy Committee on Acid Deposition. In 1987 he was named the Laureate of the United Nations Environmental Program (UNEP) Global 500. He was a member of the International Prize Selection Committee of the Marcus Wallenberg Foundation (Sweden), which awards a prize to an outstanding scientist working in the Forestry, Wood Science and Pulp and Paper Fields. In 1986, his alma mater, Bishop's University, awarded him an honorary DCL Degree; he was a member of the Bishop's Corporation from 1960-79.

In 1937, George Tomlinson married Frances Fowler (also a chemist and a PhD) and they had

three children, Peter, David and Susan. Frances predeceased him in 1997; they are survived by their three children, 10 grandchildren and 10 great-grandchildren.

George Tomlinson was a man of great vision, an innovator, a major force in the technical aspects of the pulp and paper and forest industries, and a wonderful man to be associated with, and to have as a friend. Many people worked with him for a period of time and then went on to become leaders in science and industry. Our society needs more people with his wisdom and strength.

John R. G. Bryce, PhD
Retired of Domtar Inc.

(Author's title given as of the time of writing)