lyzing neutral fats. Darby discovers erucic acid.

1850 First imports of palm oil arrive in Europe. Jesse Fisher of Birmingham, England, invents the extraction process for oil recovery.

1851 Milly constructs the first autoclave for the saponification of fats.

1852 Maumené publishes a description of the test bearing his name.

1853 Wool fat is investigated by Chevreul.

1854 Williamson and Kay synthesize glycol. Tilghmann and Berthelot discover that fats can be hydrolyzed by water alone at temperatures between 180 and 200 C.

1855 S. M. Kier of Pittsburgh, Pennsylvania, begins small-scale refining of crude petroleum. Milly discovers that a very small amount (10% of theoretical) of lime suffices to saponify fats under pressure. Wilson and Payne, in London, England, attempt to distill glycerol with superheated steam.

Award of Merit

The AOCS Award of Merit is presented annually to the person or persons selected for productive service to AOCS. Leadership in technical, administrative or special committees and activities, outstanding service that has advanced the society's prestige, standing or interests, and service not otherwise specifically recognized are considered.

The award was established in 1967, with the first recipients recognized in 1969. Recipients of the Award of Merit to date are:

1969, W.T. Coleman and D.L. Henry
1970, Richard T. Doughtie and Robert A. Burns
1971, Eric Jungermann
1972, Don S. Bolley and Thomas J. Potts
1973, Arthur Rose and Edward Hahn
1974, R.G. Krishnamurthy and R.A. Reiniers
1975, Lois S. Crauer and H.G. Salomon
1976, Samuel F. Herb and Marion E. Whitten
1977, Leo A. Goldblatt and Frank Naughton
1978, Nicholas Pelick
1979, Frank G. Shea
1980, Orville Privett and Harold Dupuy
1981, Peter Kalustian and John Monick (posthumously)
1982, Lars Wiedermann and Arthur Wrigley (posthumously)
1983, Robert Burton and Lloyd Smith
1984, Frank Luddy and James Ridlehuber
1985, Frank Khym
1986, Lloyd A. Witting
1987, Robert L. Ory

1856 Borax is discovered in California. Deiss obtains an English patent for the extraction method of obtaining oils.

1857 Cailletet suggests the determination of bromine values.

1858 In analyzing fermented mashes, Pasteur discovers that about 3.5% of the weight of the sugar in the mash is present as glycerol. Bareswil deacidifies oils and fats with 30% caustic soda.

1859 Voelker describes injurious effects from the feeding of cottonseed meal to cattle.

1860 Walton obtains an English patent for the production of linoleum from linseed oil. Philadelphia at this early date has 17 establishments making perfume and fancy soap valued at $710,000 annually, and 45 factories producing soap valued at more than $2,000,000 annually. Berthelot synthesizes monoglycerides by heating fatty acids with an excess of glycerol in a sealed tube.

1861 The Solvay ammonia-soda process is invented. It is adopted in 1874 in England at Brunner, Mond & Co.'s works.

1864 A Mr. Atkins of Brooklyn, New York, is said to have built the first soap press about this date. Philadelphia Quartz Co. starts manufacturing soluble silicates.

1866 Jünnemann shows that mutton tallow can be hydrolyzed by cold water alone (auto-hydrolysis).

1867 G.M. Mowbray begins manufacturing nitroglycerol at North Adams, Massachusetts. W. Gossage & Sons of Widnes, England, exhibits a soap containing 30% of a 20° Be. solution of sodium silicate.

1868 Strecker prepares lecithin from brain tissue.

1869 Mège Mouriés obtains an English patent for the production of oleomargarine.

1870 Oleomargarine is produced in Poissy near Paris by Mouriés. The first U.S. patent is issued for the recovery by distillation of glycerol and salts from spent soap lyes.

1871 Oleomargarine production begins in Holland.

1873 Oleomargarine production starts in Austria. Silicate solutions are popular in France for making rigid surgical bandages. Light-colored clay of soapy feel and possessing detergent properties is used at Hudson Bay posts for washing blankets. Later, in 1888, similar material from the Fort Benton formation in the Rock Creek district of Wyoming is called "bentonite."

1874 E. Abbe announces a refractometer with heated prisms.

1875 Walter Crum prepares sulfonated castor oil. Braun advocates the use of carbon tetrachloride in fat extraction. Carbon

tetrachloride had previously been discovered by Regnault in 1839. Larkin Co. is established in Buffalo, New York. The manufacture of mottled soap is patented in England.

1876 Oleomargarine production begins in Germany.

1878 Candles are made from palmitic acid derived from oleic acid by Varrentrapp's reaction exhibited at the Paris Exhibition of 1878.

1879 Koettstorfer describes the "saponification value" of fats and oils.

1880 W. B. Albright develops the manufacture of lard substitutes from cottonseed oil. Mineral oils in Pennsylvania are first used as lubricants. W. B. Albright and H. Eckstein of the N. K. Fairbanks Co., Chicago, Illinois, introduce fuller's earth for refining cottonseed oil. Cottonseed oil production reaches 27,000 tons.

1881 The Solvay process for soda is put into operation in Syracuse, New York.

1882 Armandy distills glycerol under vacuum.

1884 The Association of Official Agricultural Chemists organizes and begins publication of its Proceedings. Hübl describes the "iodine number" of fats and oils.

1885 The Castner-Kellner electrolytic manufacture of caustic soda is introduced.

1888 C. Engler produces "synthetic petroleum" by the effect of heat and high pressure on fish oil.

1889 Blyth and Robertson demonstrate the existence of mixed glyceride in cow's butter.

1890 Castner commences electrolytic manufacture of metallic sodium.

1891 Spitz and Hoenig describe their method for the determination of unsaponifiables in fats and oils. Eckstein develops deodorizing process (steaming) for cottonseed oil.

1893 The "Estrayer cylinder" is used in Marseilles to express oils. Fuller's earth is mined in Quincy, Florida. E.A. Le Sueur begins manufacturing caustic soda and bleaching powder by the electrolytic decomposition of sodium chloride at Rumford Falls, Maine.

1896 The Hargreaves-Bird electrolytic soda process is introduced. Heise isolates oleodistearin from the fat extracted from the seeds of the tallow tree, thus being the first chemist to separate and identify a mixed glyceride.

1897 Geitel advances the theory, subsequently confirmed, that during the saponification of triglycerides with alkali, mono- and diglycerides are formed. Sabatier and coworkers start research on catalysis, thus laying the foundation for fat hardening by hydrogenation.

1898 The Wijs method for determining iodine value is described, and the Twitchell process is discovered. Mathieson Alkali Works at Niagara Falls, New York, and Dow Chemical Co. at Midland, Michigan, begin manufacturing bleaching powder from electrolytic chlorine. Bömer publishes his analytical method for the detection of phytosterol. Hehner and Mitchell describe their hexabromide test for drying oils.

1899 Gossypol is isolated and named by Marchlewski.

1900 to 1930

1900 David Wesson introduces his improved vacuum process for deodorizing cottonseed oil.

1902 Connstein discovers the fermentation process for hydrolyzing fats in which an enzyme (lipase, occurring in castor beans) is employed. Normann applies the Sabatier process of catalytic hydrogenation to liquid oils permitting preparation of fats of any desired hardness.

1904 Polenske describes his method for estimating the volatile insoluble fatty acids (Polenske value) which distill in the determination of the Reichert value.

1906 The Federal Food and Drugs Act is enacted. M. Tsujimoto discovers clupanodonic acid in the mixed fatty acids from Japanese sardine oil.

1909 Charles Baskerville and W. A. Hamor investigate oil shales in America. The first plant of Lever Bros. Ltd. for commercial hydrogenation of liquid oils goes into regular operation at Warrington, England. The first step in what later is to become the American Oil Chemists' Society (AOCS) is taken when nine chemists attending the annual meeting of the Interstate Cotton Seed Crushers' Association in Memphis, Tennessee, decide to form a group.

1910 Proctor & Gamble introduces the Sabatier-Normann-Kaiser process for hydrogenating vegetable oils. First example of a poisonous fat is discovered through poisonings in Germany resulting from the use of margarine to which Indian maratti oil (chaulmugra fat) has been added. AOCS founders name their organization the Society of Cotton Products Analysts.

1911 Procter & Gamble offers Crisco for retail trade. Soybeans are first processed in the U.S. by Herman Meyer in Seattle, Washington, using a hydraulic press; the plant later is known as Pacific Oil Mills.

This marks the first appearance of Duren disease, killing large numbers of cattle

in Scotland, due to feeding cows soybean oil meal prepared by extraction with trichloroethylene.

1913 The Mellon Institute of Industrial Research in Pittsburgh is established.

1914 Connstein and Lüdecke investigate the production of glycerol by fermentation.

1915 Withers and Carruth discover the toxic properties of gossypol. Domestically grown soybeans are processed by the Elizabeth City Oil and Fertilizer Co., Elizabeth City, North Carolina.

1916 Experiments are conducted by Lagmuir on mono-molecular films of fatty acids. M. Tsujimoto establishes the composition of squalene found in shark liver oil.

1917 Soybeans are crushed by expeller press at the Chicago Heights Oil Manufacturing Co., a linseed mill.

1917-19 Cellulose acetate is made into a synthetic fiber manufactured from cotton linters in the U.S.

1919 German patents are issued to Hermann Bollmann for continuous solvent extraction of fats, as well as British patents for a continuous oilseed extractor.

1920 The refractometer is suggested as an aid to rapid analysis of oil-bearing materials; its use later is expanded to include methods of control for various processes. Steenbock develops a method of treating foods (mainly fats) by UV irradiation for anti-rachitic potency.

1921 The Society of Cotton Products Analysts is renamed the American Oil Chemists' Society (AOCS).

1922 Large-scale soybean processing is undertaken by A.E. Staley Manufacturing Co. at Decatur, Illinois, marking the real beginning of the soybean processing industry in this country. Drummond and Watson demonstrate that colorimetric chemical tests for vitamins in liver oils show a correlation with vitamin activity.

1923 Interesterification is discovered and reported by W. Normann. Funk Bros. Seed Co. at Bloomington, Illinois, begins permanent soybean processing operations, using equipment from Chicago Height Oil Manufacturing Co. The first processing of soybeans by batch solvent extraction is undertaken by Piatt County Soybean Cooperative Co. at Monticello, Illinois, a short-lived operation. The first "bible" of the soybean industry, *The Soybean*, is published by William J. Morse (who had studied soybeans in Manchuria and brought samples of varieties to the U.S.) and Charles V. Piper, publisher of McGraw Hill Book Co. of New York. Duren disease reappears in the Rhineland.

1924 Eastern Cotton Oil Co. in Norfolk, Virginia, begins solvent extraction of soybeans in a continuous Bollmann extractor obtained from Germany. AOCS begins publishing the *Journal of the Oil and Fat Industries*.

1925 Cottonseed hulls are used in constructing numerous miniature golf courses in the U.S. Thiocyanogen value is proposed by Kaufmann.

1926 Vitamin D preparation is made by the irradiation of ergosterol. The Hanus method of iodine absorption becomes official in Germany. Milk fat of the monotreme is found to be a simple pure triolein. T.P. Hilditch is appointed to the chair of industrial chemistry at the University of Liverpool.

1927 The AOCS' publication is renamed *Oil and Fat Industries*.

1928 Cellulose acetate from cottonseed linters is used for manufacturing automobile safety glass. The first commercial unit for manufacturing tung oil opens in Gainesville, Florida. The ninth conference of the International Union of Pure and Applied Chemistry at The Hague officially adopts the Wijs method for iodine absorption.

1929 Autoxidant action is reported by Alyea in the *Journal of the American Chemical Society* (*JACS*). George and Mildred Burr publish their study showing essentiality of polyunsaturated fatty acids (*Journal of Biological Chemistry*). The first measures of surface tension of free fatty acid are published by Hunter in *JACS*.

1930 Fatty acids converted to alcohols are sulfated and neutralized to produce alkyl sulfates. Sodium and ammonium lauryl sulfates are highly efficient detergent and wetting agents. Long-chain alcohol sulfates are introduced as detergents in Germany. Higher fatty acids are prepared by reducing starting fatty acid with hydrogen, halogenating, reacting with hydrogen cyanide and hydrolyzing.

After 1930

1931 Malonic ester is used to prepare a fatty acid with two more carbon atoms than the original acid. Polymorphism of fats is reported. Ralston initiates a vigorous program of research on fatty acid derivatives and their properties at Armour; subsequent work by Potts and colleagues leads to processes for making nitrogen derivatives including amides, nitriles and amines.

1932 The AOCS' publication is renamed *Oil and Soap*.

1933 "An Accelerated Stability Test Using the Peroxide Value as an Index" is published by A.E. King, H.L. Roschen and W.H. Irwin in *Oil and Soap 10*:105 (1933). The Sharples Rotojector centrifugal machine for refining vegetable oils is

introduced commercially. Also, petroleum-derived synthetic detergents are introduced into the U.S. Prostaglandins are discovered; independently, M.W. Goldblatt and U.S. von Euler find that extracts of human seminal plasma stimulate a number of smooth muscle organs and cause a drop in blood pressure.

1934 E.M. James reports on a continuous centrifugal caustic refining process for vegetable oils. A British patent is given in 1934, followed by a U.S. patent in 1936. The expeller by V.D. Anderson is patented in the U.S.

1935-37 Potts and coworkers develop a method for the fractional distillation of fatty acids.

1936 A laboratory is established at the University of Illinois for studying the industrial utilization of soybeans and soybean products.

1937 Crystallization of fats is reported by Brown in *JACS*. Cottonseed oil displaces coconut oil as the most important ingredient of margarine. Allis-Chalmers obtains a U.S. patent for a continuous oilseed extractor. Between 1937 and 1943, J.B. Brown and coworkers describe the application of fractionation of fatty acid mixtures from solvents at low temperature.

1938 USDA's Regional Research Centers are established. At the Northern Regional Research Center, William J. Sparks recognizes the potential value of the dibasic acid which could be produced by the dimerization of linoleic acid. This forms the basis of a research program leading to procedures for producing dimer acid and polymeric derivatives with glycol and diamine. Work at the Southern Regional Research Center develops the characterization of acetoglycerides or acetin fats, which can be either waxy flexible products having potential value as coating for food products or liquids that modify the properties of plastic fats. The principle of thin-layer chromatography is described by Izmailov and Schraiber Farmatsiya.

1940 First edition of *The Chemical Constitution of Natural Fats* by T.P. Hilditch is published. A U.S. patent is issued for a horn-angle flaker for flaking soybeans and other oilseeds.

1941 A.J.P. Martin and R.L.M. Synge pioneer partition chromatography; they go on to win the Nobel Prize in Chemistry in 1952.

1942 Continuous splitting of fats is developed. The Emersol industrial process of solvent fraction is placed in operation by Emery Industries Inc. This process is used to produce oleic acid.

1943 In work by E.H. Farmer and D.A. Sutton, all hydroperoxides are first recognized as the primary products of autoxidation of unsaturated acids.

1944 The production and reactions of epoxy acids are developed by Daniel Swern and his colleagues, T.W. Findley and J.T. Scanlan. Other developments include metal catalysis in autoxidation and countercurrent fractionation.

1945 "Determination of Monoglyceride in Fats and Oils by Oxidation with Periodic Acid" is published by W.D. Pohle, V.C. Mehlenbacher and T.H. Cook in *Oil and Soap*.

1946 Edward J. Dies, board chairman of the National Soybean Processors Association, summons the Soybean Research Council to the first of what was to become annual conferences on the Flavor Stability of Soybean Oil. The meeting is a deliberate move to bring together the best research minds in the nation engaged in work on flavor stability of soybean oil.

1947 AOCS' journal *Oil and Soap* officially is renamed the *Journal of the American Oil Chemists' Society*.

1948 AOCS' first short course in fat and oil technology is held at the University of Illinois.

ca 1948 The Votator process is introduced for the continuous soap manufacture directly from fatty acids and lye.

1949 A British patent is issued to DeSmet for a continuous deep-bed extractor. The necessity of a fatty acids distribution theory is recognized in an article by Hilditch, *J. Am. Oil Chem. Soc. 25*:41 (1949). Activity of prostaglandins is identified by Bergstrom, who later will receive the Nobel Prize, in *Nord. Med. 42*:1465 (1949).

ca 1950 Van der Wal and Van Akern develop a method for molecular rearrangement of fats and oils using sodium methylate.

1951 In what is now a classic experiment, 9% linolenic acid is interesterified into the glyceride structure of a "non-reverting," nonlinolenic acid oil, namely cottonseed oil. The taste panel identifies cottonseed oil interesterified with linolenic acid as a soybean oil. Duren disease strikes again, this time in the U.S., due to feeding cattle with soybean oil meal produced by extraction with trichloroethylene. First finding of the glycolipid containing sialic acid nominated "hematocide" from the horse erythrocyte by Dr. Yamakawa.

1952 The first volume of *Progress in the Chemistry of Fats and Other Lipids*, edited by R.T. Holman, W.O. Lundberg and T. Malkin, is published. This later is named *Progress in Lipid Research*. Application of gas chromatography to fatty acid analysis is published by James and Martin in *J. Biochem.* 1952.

1953 Enzymatic selective deacylation (lipolysis) is applied to glyceride analysis, as reported by B. Borgstorm in *Acta Chem. Scand. 7*:557 (1953). The Northeast Oil Chemists' Society, the first section of the AOCS, is established.

1954 Gunstone discovers the first seed oil containing an epoxy acid, and Tsuchiya gives the first description of orizanol.

1956 Gas liquid chromatography (GLC) is invented, as reported by Martin in *J. Biochem. 63*:138 (1956).

1957 The first continuous commercial miscella fractional crystallization of cottonseed oil is processed by Cavanagh, and patented in the U.S.

1959 Gas chromatography is applied to glyceride analysis (Huebner, *J. Am. Oil Chem. Soc.*, 1959). Dr. Scott McMichael discovers the first glandless (gossypol-free) cotton plant in Mexico.

1960 Thin-layer chromatography methods are applied to lipids.

1962 Silver ion chromatography is applied to lipids (L.J. Morns and B. de Vries, *Chem. and Ind.*, 1962).

1964 Crepenynic acid is discovered in a seed oil (this acid later is recognized as a significant intermediate in the biosynthesis of a wide range of polyacetylenic compounds), by K.L. Mikolajczak, C.R. Smith Jr., M.O. Bagby and L.A. Wolff.