

Membrane Model Systems

*A Symposium of the American Oil Chemists' Society
held at San Francisco on April 22-24, 1969*

A year is past, new meetings have dissolved, numberless journals have rolled new questions into the hands of the incessant librarians, and the San Francisco meeting is still resounding with the echoes of the discussions and the spirit of the proceedings.

In welcoming speakers and guests to the "San Francisco Membrane Festival," Giuseppe Colacicco said "we gather not only to report on our professional achievements but also to honor the landmarks and the celebrities." With the outline of the methods that would not miss a lipid, in 1963 George Rouser opened the lipid shop in which we tool up differently to isolate and study the properties of membrane lipids. As we observe the behavior of lipids at water interfaces, we appreciate the vision of Danielli (1935), the measurements of Robertson (1955), and the elegant reflections of Vandenheuvel (1966), but we also stare gratified at the revolt of the non-Danielli's: Sjostrand (1963), Benson (1966), Lenard and Singer (1966), and Green (1966).

In the general introduction, Dr. Sjostrand remarked that the complexity of membrane structure may make it an awesome task for one to discern any of its neutral details. However, studies of membrane functions may suggest and reveal to us the principles of corresponding structures.

In the absence of Dr. Tien, Colacicco made some points concerning lipid monolayers, black lipid films and lipid vesicles. The usefulness of these models rests on the concept that they may mimic the most important feature of the molecular organization of membranes *in vivo*, namely the orientation of membrane components at water interfaces. Thus we can probe the interaction of the latter with ions, organic molecules, sugars and proteins. Monolayers are more versatile for we can measure and work at any surface concentration or film pressure including the ones which may be more relevant to biological systems, and we can introduce soluble protein, and membrane proteins as these become available. The classical black lipid films at the orifice between two water compartments can provide useful information about the electrical and some transport properties of the lipid-water interface. However, because of the high film pressure, this bilayer is impotent for studying penetration of protein into the lipid film, which is a fundamental postulate of the non-Danielli models and probably of the membrane itself. The discovery of the spherical bilayer in Dr. Thompson's laboratory opens new horizons in the bilayer field. Vesicles thus far could mimic a more natural state of lipid in water. However, studies of lipid-protein interactions in vesicles have not yet materialized except for those regarding the destructive action of lytic agents. But they could become useful systems for revealing specific vesicle-protein interactions and for studying tissue and membrane lipoproteins of the type found presumably in lysosomes, mitochondria, osmiophilic bodies.

Surface science is the science of impurities. First we clean the surface, water, lipids and proteins, otherwise we cannot make meaningful measurements; then we must add impurities to our purest specimen in order to peek into the finest mechanisms of biological surfaces. Some components which occupy strategic positions on the membrane surface are in such small quantities that we either lose them, cannot measure them, or we throw them away. When we can study them we may marvel at the revelations. For instance the lactose moiety of ceramide lactosides extends into the aqueous phase from mixed films with phosphatidyl choline and interacts specifically with an antilactoside antibody. The latter is so inhibited in the penetration of the lipid monolayer. When lactose, however, was present in the subphase, it interacted with the antibody, which lost its specificity and behaved as an ordinary γ -globulin in the penetra-

tion of the lipid film.

Against Colacicco's emphasis of the hydrophilic specificity of both lipid and protein in this and other interactions at water interfaces, Dr. Cadenhead remarked that most substrate additions influence the physical state of lipid films such that, in the presence of glycerol the alkane-glycerol interactions were favored by increasing glycerol concentrations of the subphase. A modification of the original Danielli-Davson membrane model is called for, to include lipid-protein hydrophobic interactions.

The message of Danielli (in absentia) to the Symposium, "Phospholipid Membranes are Necessarily Bimolecular," stimulated the discussion of phenomena of film penetration resulting in hydrophobic lipid-protein association typical of the non-Danielli models. In this regard, S.J. Singer pointed out that the problem is not if the bilayer exists, but how it interacts with protein.

Unless lipids are properly purified, measurements of surface potential may be misleading. A few per cent of an acidic impurity lowers the surface potential of neutral phospholipids on water and raises it on $\text{NaCl} < \text{CaCl}_2$. The Ca^{++} effect disappears after removal and reappears after readdition of the anionic impurity. A fraction of 1% of some contaminating amines confers sphingomyelin a cationic character, which raises its surface potential. Under no circumstances did surface potential measurements show an interaction of dipalmitoyl lecithin, several other lecithins, or sphingomyelins with Ca^{++} at 25 C. The effects that were attributed to ion-dipole interactions are instead due to the interaction of Ca^{++} with the acidic impurities which are present in ordinary preparations of such lipids.

While reporting studies on black lipid films with Dr. Ohki, Papahadjopoulos showed that cholesterol reduces the permeability of phospholipid vesicles to Cl^- and Na^+ and enhances the d.c. resistance and capacitance of phospholipid bilayers. Interaction of cholesterol with the phosphate group (?) of phosphatidic acid inhibits the ability of the latter to bind Ca^{++} .

The electron-microscopy images of freeze-fracture of bulk-phase lipid by Daemer showed that fractures in lipid systems may occur along non polar planes and produce complex crystalline structures. Lecithin, stearic acid, Ca-stearate and oleic acid reveal lamellar structures; lecithin-cholesterol mixtures, Sr-laurate, and cardiolipin showed hexagonal phases.

Physical Chemistry of Lipid-Protein Interactions

The second session dealt with the physical chemistry of lipid-protein interactions and was chaired by S.J. Singer. After discussion of the relevant theory of optical rotatory dispersion and circular dichroism, Dan Urry presented evidence for the fact that some ORD data and the red shift in circular dichroism mean light scattering by aggregating particles rather than pure rotatory power of simple protein structures. The results of the above considerations indicate that in membranous systems there is a higher degree of ordered protein than previously thought.

Reinforcing Urry's conclusions, Dr. Singer reassured the curious audience that Urry's discovery of artifacts in the red shift of CD spectra of membrane protein would not change things much. The spectra of intact red blood cell membranes are clearly not markedly distorted by such artifacts and the helical content, about 30% to 40%, calculated from the CD spectra cannot be far from right. Concerning lipid-protein arrangements in membranes, NMR studies in collaboration with Glaser and Simpkins, from La Jolla and

(Continued on page 432A)

(Continued from page 423A)

for this, including: the beginning of cultivation of new Russian sorts resistant to some diseases from which the previous sorts very often suffered; the remarkable improvement of the production process of sunflower, with regard to agrotechny and mechanization; very high and constant yield, and the payment for the sunflower seed on the bases of the oil content.

For the production of sunflower the most important territory in Yugoslavia (which gives about 70% of the total production) is Vojvodina. This country has very convenient agroecological conditions for the cultivation of sunflower. Besides, the intensive investigation carried out in this country, especially by the Institute for Agricultural Investigations at Novi Sad, greatly contributed to the improvement of the production of sunflower. The results obtained by the research work of the Institute completely vindicated the investments. Considering the results obtained in the course of the last eight years, the areas sown with sunflower increased 320%, so that in Vojvodina, in 1969, there were 169.213 ha sown with sunflower. The yield of sunflower in Vojvodina, within the last few years, is among the highest in the world. In 1968 the average yield in this country was 21,1 mc/ha, and in 1969 it was 18,8 mc/ha. In 1968 the highest yield was marked 28,8 mc/ha, while in the same year the lowest was 17,1 mc/ha. A satisfying average yield of sunflower in Yugoslavia in 1968 was 19,5 mc/ha. According to the statistical data of FAO, Yugoslavia, next to Bulgaria, Austria and Italy, ranks among the countries with the highest production of sunflower.

An expert's opinion is that optimal results still have not been reached; therefore, the investigators continue in order to work out in detail technique of sunflower cultivation for each area, independent of agroecological conditions. In order to get maximal yield, the corresponding sort of sunflower has been strictly determined by means of investigations. From the new Russian sorts of sunflower, the most cultivated cultures in Yugoslavia are Vnimk 8931 and Peredovik, because they proved the most convenient.

The sort Peredovik was discovered in 1960 by the Russian academic Pustavojt, and the sort Vnimk 8931 was admitted in 1953, also created by the same scientist.

The sunflower oil content varies from year to year, and depends upon many factors. A primary factor is rain and temperature during the months of July and August. During the last eight years the highest oil content was in 1968. Some sorts showed the maximal oil content in this year. The sunflower with oil content of 52% calculated on dry matter was not very rare in that year. The best results were obtained with the sort Peredovik. The oil content in seed in 1969 was somewhat lower than in 1968. The year 1969 is the most important for the production of sunflower in Yugoslavia; about 400.000 tons of sunflower were produced. It is reasonable to expect that the following years will give higher production of oil, because new investigations should contribute to both an increase in seed yield and an increase in oil content in the seed.

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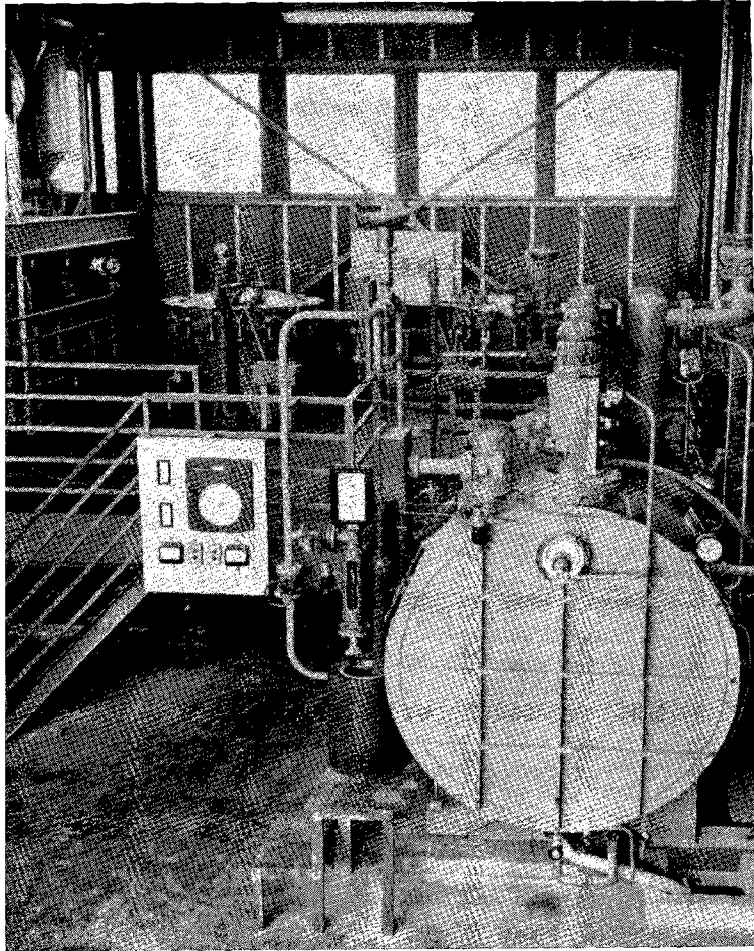
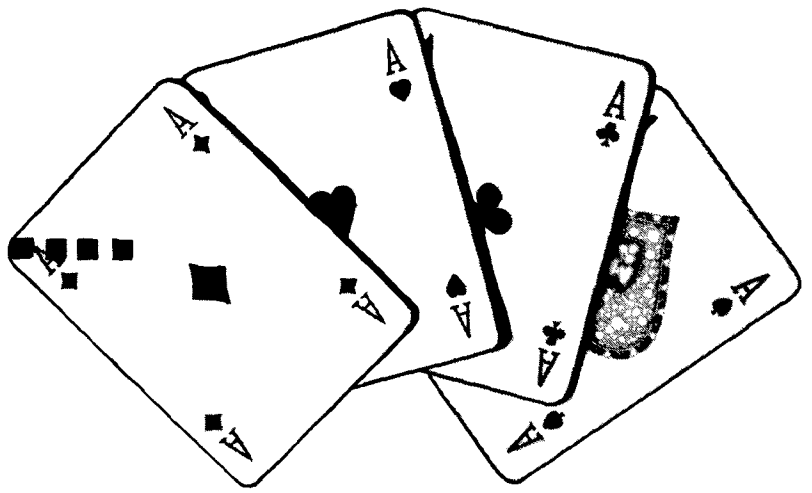
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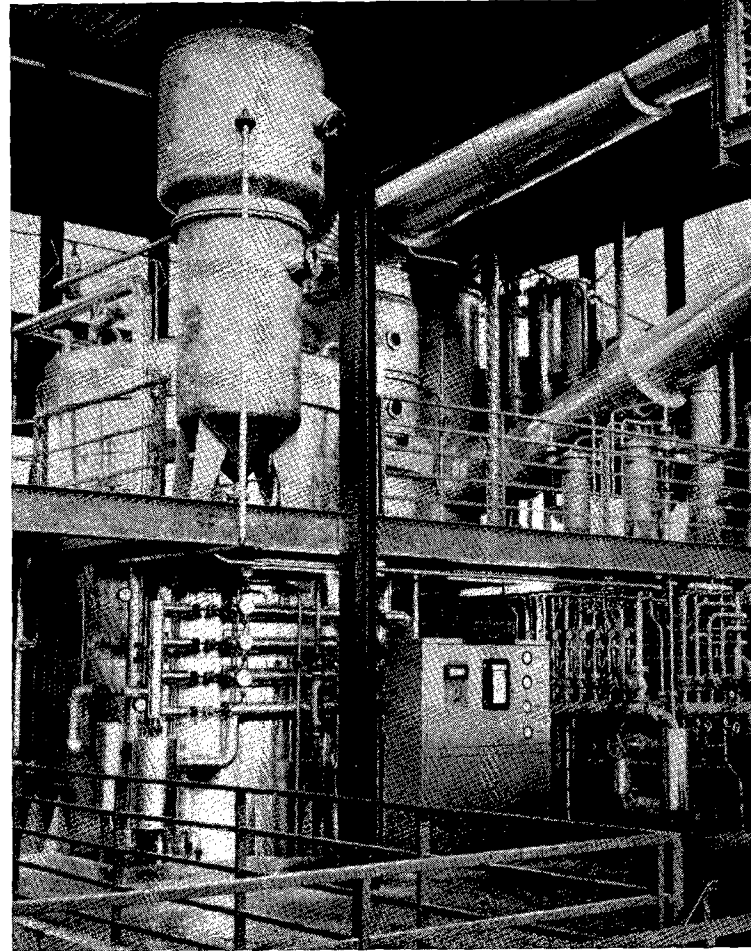
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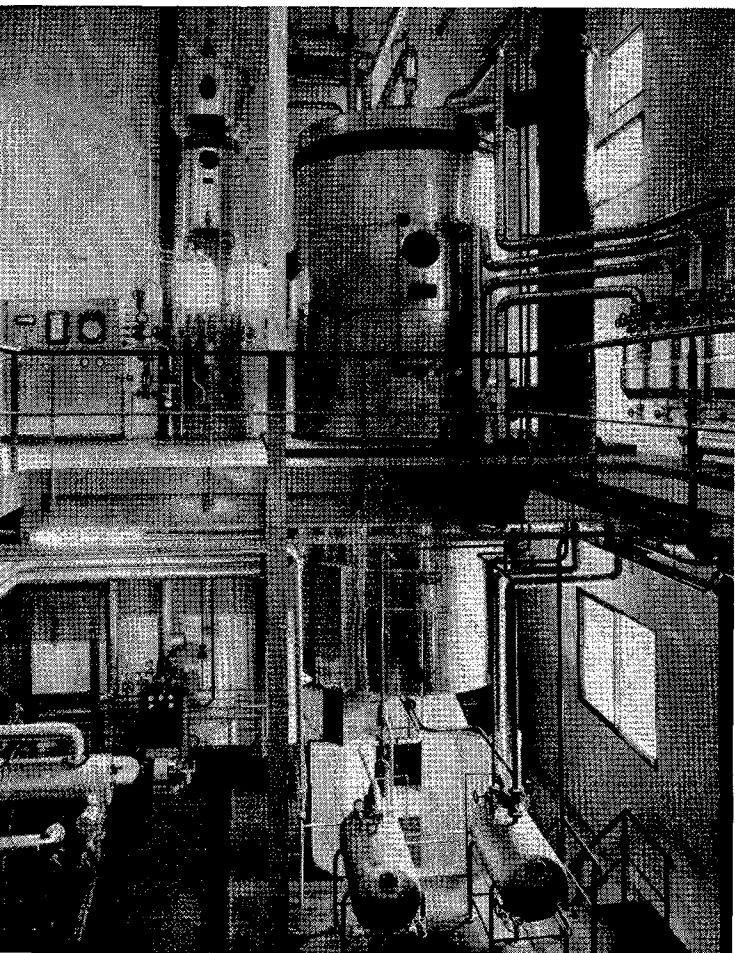
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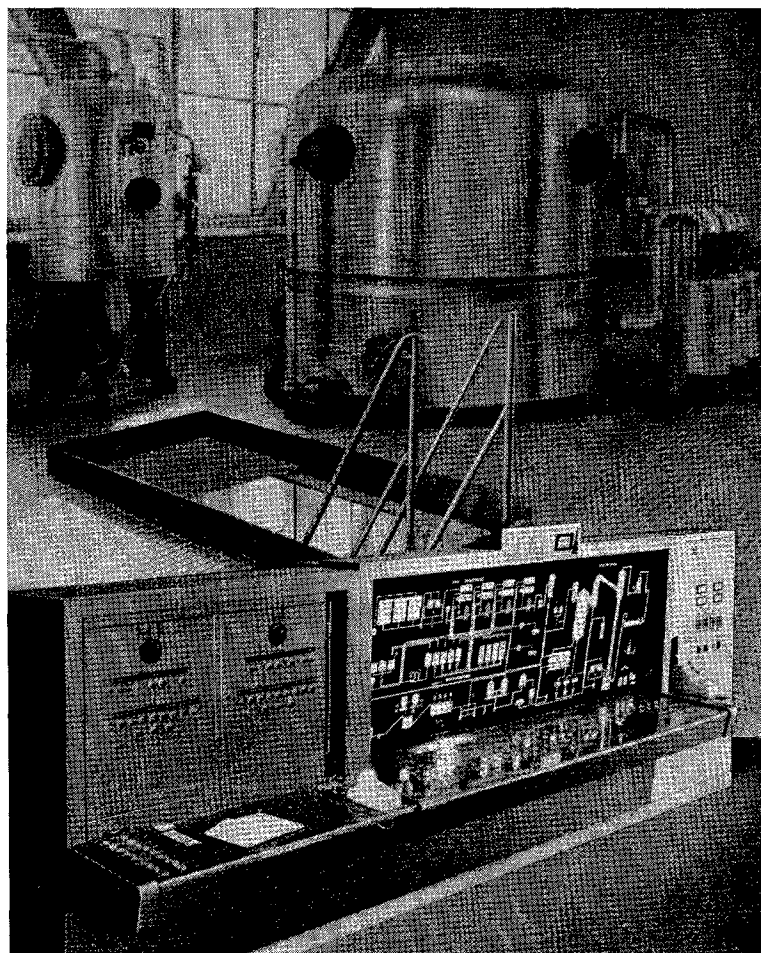
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Chevreur Medal Awarded to AOCS Member for Eighth Time

Since 1963, the Association Francaise des Techniciens des Corps Gras has awarded the Chevreur Medal to outstanding recipients in order to honor foreign or French leaders in the field of lipid research. Eugène Chevreur was a nineteenth century French chemist noted for his work on fats and soaps and the medal has been established in his memory.



W. O. Lundberg

This year the medal has been awarded to W. O. Lundberg ('44) of the United States and to Roger Francois of France. This is the eighth time that an AOCS member has been awarded the coveted medal. Dr. Edgar Piret, Scientific Attache, American Embassy in Paris, represented Dr. Lundberg at the presentation.

Dr. Lundberg, besides being Editor of the AOCS's LIPIDS journal, is Executive Director and Professor of Biochemistry at The Hormel Institute, University of Minnesota. Mr. Francois is Honorary Director of the Institute des Corps Gras.

Previous winners who have been AOCS members are: Giovanni Jacini ('51) of Italy, Marcel Loncin ('54) of Belgium, A. R. Baldwin ('44) of the United States, Henryk Niewiadowski ('68) of Poland, Charles Paquot ('52) of France, Jan Boldingh ('68) of the Netherlands and A. C. Frazer ('64) of Great Britain. Other winners have been G. Champetier of France, T. P. Hilditch of Great Britain, J. Martinez Moreno of Spain, Miss Marie Therèse François and Pierre Desnuell of France, and C. Trottmann of France.

New Research Station Opened by Harrisons & Crosfield

A new Research and Development Laboratory was opened on July 10, 1970, at Camberley in Surrey, England, by J. F. E. Gilchrist, Chairman of Harrisons & Crosfield. The ceremony was attended by more than seventy distinguished guests from the United Kingdom and overseas including the High Commissioner of Malaysia.

The Laboratory is believed to be the only one outside the producing countries owned by a commercial organization specifically built and equipped to carry out a comprehensive program of palm oil and natural rubber research. Its main objective will be to improve the quality of the plantation products offered by Harrisons & Crosfield to world markets and to extend their use into new applications. Considerable emphasis will be given in its work to palm oil, of which the Group handles more than ten per cent of world production, and where for some years they have been making intensive efforts to meet buyers' quality requirements.

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Meetings

AOCS National Meetings

- Sept. 27-Oct. 1, 1970—Chicago, Conrad Hilton Hotel.
- May 2-6, 1971—Houston, Shamrock Hotel.
- Oct. 2-6, 1971—Atlantic City, Chalfonte-Haddon Hall Hotel.
- April 23-26, 1972—Los Angeles, Calif., Statler Hilton Hotel.
- Sept. 24-28, 1972—Ottawa, Canada, Chateau Laurier Skyline Hotel.

Other Organizations

- Oct. 11-14, 1970—Ninth Annual Meeting, ASTM Committee E-19 on Chromatography, Brown Palace Hotel, Denver, Colo.
- * Oct. 14-16, 1970—Second Technical Conference on Photopolymers, Nevele Country Club, Ellenville, N.Y.
- Oct. 14-17, 1970—International Symposium on Computer Applications in Engineering Sciences, Istanbul Technical University, Istanbul, Turkey.
- Oct. 12-15, 1970—84th Annual Meeting of the Association of Official Analytical Chemists, Marriott Motor Hotel, Twin Bridges, Washington, D.C.
- * Oct. 18-21, 1970—20th Canadian Chemical Engineering Conference, Sarnia, Ontario, Canada.
- Oct. 26-29, 1970—ISA 25th Annual Conference and Exhibit on Instrumentation, Systems and Automatic Control, Civic Center, Philadelphia, Pa.
- Oct. 26-28, 1970—17th Spectroscopy Symposium and Exhibition of Instrumentation, Skyline Hotel, Ottawa, Ontario, Canada.
- Oct. 26-30, 1970—Fourth Materials Research Symposium, National Bureau of Standards, U.S. Department of Commerce, Gaithersburg, Md.
- Oct. 28-31, 1970—48th Annual Meeting of the Federation of Societies for Paint Technology, Statler-Hilton and Sheraton-Boston, Boston, Mass.
- Oct. 29-30, 1970—Annual Meeting of the Texas Seedmen's Association, Fairmont Hotel, Dallas, Tex.
- Nov. 1-5, 1970—Dairy & Food Industries Exposition, Astrohall, Houston, Tex.
- Nov. 2-4, 1970—Technicon International Congress on Automated Analysis, New York Hilton Hotel, New York, N.Y.
- Nov. 8-13, 1970—Second Annual Educational Conference of the College of Pharmaceutical Sciences, Columbia University and the Society of Cosmetic Chemists, Dellwood Conference Center, New York, N.Y.
- * Nov. 9-13, 1970—U.S. Flow Automation Equipment Exhibition, U.S. Department of Commerce, U.S. Trade Center, London, England.
- * Nov. 9-13, 1970—U.S. Biochemical Test, Control Equipment Exhibition, U.S. Department of Commerce, U.S. Trade Center, Sydney, Australia.
- Nov. 16-21, 1970—Industrial and Scientific Temperature, Measurement and Control Equipment Exhibition, U.S. Trade Center for Scandinavia, Stockholm, Sweden.

*Additions to previous calendar.