2020 AOCS Annual Meeting & Expo Phospholipid Abstracts

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Presentations dated Friday, January 1, 2021, were provided on-demand.

Phospholipid

Wednesday, July 1, 2020
Session Time: 8:25 AM - 9:45 AM
Presentation Time: 8:25 AM - 8:30 AM
Track: Phospholipid

Introduction: Sustainable Processing and Fractionation for Novel Phospholipids

Co-Chair: Ozan N. Ciftci - University of Nebraska-Lincoln
Co-Chair: Zachary Cooper, MS - Utah State University

Wednesday, July 1, 2020
Session Time: 8:25 AM - 9:45 AM
Presentation Time: 8:30 AM - 8:55 AM
Track: Phospholipid

(3914) Emulsifying Properties of Sunflower Phosphatidylcholine Enriched Fractions in Oil-in-water Emulsions

Presenting Author: Mabel C. Tomas, PhD - CIDCA-UNLP

Lecithin modification under industrial conditions with adequate techniques of analysis may be useful for evaluating the potential applications of these sunflower by-products to the production of new emulsifiers. The aim of this research was to study the effect of the use of different absolute-ethanol:water mixtures and pH levels on the differential extraction of phospholipids from sunflower lecithin and to evaluate the emulsifying properties in O/W emulsions of the different PC-enriched fractions thus obtained. Phospholipid composition of the enriched fractions was determined by 31PNMR. The highest PC enriched fraction yields were obtained during the fractionation with ethanol: water mixtures 96:4. However, the different conditions of pH assayed did not markedly modify the yield of the enriched fractions with different solvent extraction. The emulsifying properties of the PC enriched fractions obtained were evaluated in oil in water O/W (30:70 wt/wt) emulsions, which were optically characterized using a vertical

scan analyzer (QuickScan) to determine the corresponding destabilization kinetics involved. Emulsions formulated with PC enriched fractions obtained with ethanol:water mixtures 96:4 exhibited greater stability, mainly at pH 7.5, in comparison with those corresponding to PC enriched fractions from ethanol:water mixtures 90:10 for the different pH levels assayed.

Wednesday, July 1, 2020
Session Time: 8:25 AM - 9:45 AM

Presentation Time: 8:55 AM - 9:20 AM

Track: Phospholipid

(4181) Extraction of Dairy Phospholipids using Switchable Solvents

Presenting Author: Sergio I. Martínez-Monteagudo - South Dakota State University

Dairy foods and their byproducts represent a natural source of phospholipids (PLs) with great potential for isolation and further commercialization. The current extraction of dairy PLs involves various steps (concentration, solvent separation, lipid recovery and fractionation) within the entire process, which results in low overall efficiency and economically unviable. This work summarizes our research efforts at evaluating a primary amine (N,N-dimethylcyclohexylamine) as a switchable hydrophilicity solvent (SHS) for extracting dairy PLs. A tertiary anime (N,N-dimethylcyclohexylamine, CyNMe2) was used as switchable solvent, and the extraction was evaluated over a wide range of conditions. After extraction, the solvent was removed from the extract by bubbling CO2 at atmospheric pressure. The recovered PLs were quantified by thin-layer chromatography and HPLC. The extraction efficiency of CyNMe2 ranged from 0.33-99%, depending on the type of byproduct. Remarkably, the CyNMe2 extracted up to 99% of the PLs directly from buttermilk, while only about 11 and 3% of the PLs were extracted with FE and ME, respectively. For CyNMe2, scanning electron images, particle size, and gel electrophoresis revealed great disruption of the protein matrix, releasing the PLs into the aqueous medium. These results demonstrated the feasibility of using SHS such as N,N-dimethylcyclohexylamine for the extraction of dairy PLs.

Thursday, July 2, 2020
Session Time: 8:25 AM - 12:10 PM

Presentation Time: 10:30 AM - 10:55 AM

Track: Phospholipid

(3951) Development and characterization of multilayer microcapsules with chia and sunflower by-products

Presenting Author: Claudia N. Copado, PhD in the area of chemistry - CIDCA-CONICET UNLP

Modified sunflower lecithin by hydrolysis (lysolecithin) presents interesting properties as emulsifying agent. Also, the use of biopolymer combinations to improve their individual characteristics associated with the preservation of bioactive lipids like omega-3 by the

microencapsulation process represents a relevant challenge for the food technology. In this sense, tri-layer chia oil (~64%ALA) emulsions 5% wt/wt were obtained through the application of the layer- by- layer technique by the electrostatic deposition of chitosan (Ch) (cationic character) onto hydrolyzed sunflower lecithin (anionic character) coated droplets (pH 5), high pressure homogenization at 1000 bar and the addition of maltodextrin (Mx) and chia mucilage (CM) as wall materials. Furthermore, the tri-layer chia oil microcapsules were obtained by spray-drying of these emulsions with an efficiency of ~ 98%, aw and moisture levels of ~0.22 and ~1.3%, respectively. The electrostatic deposition of chia mucilage was evidenced by the ζ-potential change of +43 to -15.8 mV. The combination of these wall materials recorded PV values ~1.1 meq/kg oil, D3,2 ~6.1 µm and color parameters L* (94.72), a* (0.025) and b* (5.49). These results suggest that hydrolyzed sunflower lecithins were a good emulsifying agent and the wall materials Mx-Ch-CM efficient barriers against the lipid oxidation of chia oil. Thus, this formulation could be used in the development of chia oil tri-layer microcapsules for their application in powder foods.

Thursday, July 2, 2020
Session Time: 8:25 AM - 12:10 PM

Presentation Time: 10:55 AM - 11:20 AM

Track: Phospholipid

(4101) Use of Modified Lecithin for Stabilization of Emulsions in Beverages

Presenting Author: Ernesto M. Hernandez, MS, PhD - Advanced Lipid Consultants

Lecithin-derived phospholipids are widely utilized as natural emulsifiers in food and beverages because of their tendency to form structures such as bilayers, micelles, and liposomes. Applications of lecithin and some modified phospholipids have extended into more specialized areas such as efficient delivery of nutrients and also for stabilization of beverages themselves to prevent instability effects of creaming, coalescing and phase separation. This presentation will include the use of modified blends of soybean, canola sand sunflower phospholipids in the preparation and stabilization of emulsions for beverages. These oil-in-water emulsions were manufactured using modified lecithin blends, hydrocolloids, natural weighting agents, and modified sugars. The main objectives of these new emulsions was to stabilize the suspended emulsion particles by preventing creaming, coalescing and precipitation of suspended lipid globules. The methods of emulsion preparation included high shear mixing and high pressure homogenization. The resulting emulsions were analyzed for emulsion stability, suspended particles size distribution, organoleptic quality and shelf life. Results showed that these new lecithin blends are able to prevent creaming, coalescing and oil phase precipitation in the emulsion by facilitating micelle formation and balancing the specific gravity of the oil phase versus the water phase. It was demonstrated that the modified lecithins are able to replace other emulsion weighting used in beverages such as Ester gum and Sucrose ester isobutyrate. The particle size distribution of the suspended lipid globules ranged 1-5 micros and the shelf life of model beverages prepared with emulsions was comparable to commercial products

Thursday, July 2, 2020
Session Time: 12:10 PM - 1:00 PM

Presentation Time: 12:35 PM - 1:00 PM

Track: Phospholipid

(3932) Reshaping Lipid Biochemistry by Combining Technology Advancements Permitting Fast High-Defined Snapshots of Lipidomes with Standardization

Presenting Author: Kim Ekroos, PhD - Lipidomics Consulting Ltd.

Objective: Lipid metabolism is tightly regulated to maintain homeostasis. Loss of control can result in unwanted cascades of biological events triggering deleterious pathophysiological conditions. Evidently, this is impacted by the nutrition. However, the details and dynamics on the affected underlying lipid networks still remain poorly defined. The evolution of lipidomics technologies is set to tackle this problem, driven by high expectations in its ability to afford new opportunities for studying lipids in health and disease. Methods: The initial groundwork has been made through advanced mass spectrometry and high-throughput technologies for the precise assessment of lipidomes and biomarker discovery, enabled by automation and software tools. We are now introducing the ion-mobility based Structures for Lossless Ion Manipulations (SLIM) technology to further unlock new dimensions of the lipidome in unprecedented timeframes. Results: SLIM favors diagnostic use by its ultimate simplicity, unparalleled resolution, speed, and scalability, permitting wider lipidome coverage without compromising time and robustness through its LC free strategy. We show the power of the technology by quantitative in-depth profiling of such as molecular gangliosides. In conjunction with parallel developments such as dynamic FLUX determinations, accurate quantification and standardization, this collectively reshapes lipid biochemistry. The whole field is further advanced by the introduction of the International Lipidomics Society (ILS) flagship, fostering international community-wide coordination and communication for the creation of lipidomics specific guidelines for good scientific practice. Conclusions: A new era in lipidomics is underway, paving the way to new clinical and industrial applications.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Phospholipid

(4115) Selective extraction of phospholipids and minor lipid components from Camelina sativa seed using ethanol-modified supercritical carbon dioxide

Presenting Author: Ozan N. Ciftci - University of Nebraska-Lincoln

Camelina sativa seed is an underutilized oilseed that attracted interest for biofuel production. In recent years, there is a growing interest to camelina seed as an edible oil source due to its high omega-3 fatty acids and minor lipid components such as tocopherols, phytosterols, and phospholipids. Its fatty acid composition was reported before but there is little information on its

phospholipid and minor lipid composition. On the other hand, its high omega-3 content and growing demand for clean food processing technologies make conventional oil extraction less attractive. Therefore, there is a need for alternative clean and sustainable methods to extract camelina seed lipids, including phospholipids. In this study, effect of extraction methods on the bioactive minor lipids and phospholipid composition of the camelina seed oil was investigated. Camelina seed oils were extracted with ethanol-modified supercritical carbon dioxide (SC-CO2) as a green extraction method, and compared with cold press and hexane extractions. Ethanol-modified SC-CO2 extractions were carried out at varying temperatures (50 and 70 °C), pressures (35 and 45 MPa), and ethanol concentrations (0–10%, w/w). The highest total lipid yield (37.6%) was at 45 MPa/70 °C with SC-CO2 modified with 10% (w/w) ethanol. Phospholipids and phenolic content increased significantly with ethanol-modified SC-CO2 ($p<0.05$). SC-CO2 with 10% (w/w) ethanol concentration selectively increased phosphatidylcholine content. Ethanol-modified SC-CO2 extraction allowed modification of the lipid composition that was not possible with the conventional extraction methods. This is a promising green method for selective extraction and fractionation of camelina seed phospholipids.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Phospholipid

(4180) Recovery of Phospholipids from Sweet Whey by Electrodialysis with Bipolar Membrane

Presenting Author: Laurent Bazinet, Ph.D - Laval University

Defatted whey is mostly valorized in human nutrition as a dairy food ingredient due to its interesting composition. However, the presence of residual lipids, mainly phospholipids, limits whey applications due to turbidity issues and organoleptic defects. Nevertheless, phospholipids present bioactivities that have positive effects on human health and therefore have a great potential as nutraceuticals. These residual lipids can be isolated using electrodialysis with bipolar membrane (EDBM) which simultaneously lowers ionic strength and pH, leading to lipoprotein complexes that can be removed by centrifugation. This technology was tested on defatted cheddar cheese whey and whey protein concentrates (WPCs) at different protein concentrations. Also, it was compared to a process integrating a demineralization step before electroacidification as well as a dilution step after electroacidification. EDBM process increased lipids precipitation rates, from a cheddar cheese whey, by almost 50% in comparison with a centrifugation step alone whereas a demineralization step prior to electroacidification has a limited effect on the precipitation rate. Precipitates obtained were mainly composed of lipids (phospholipids) but also contained proteins [1]. The EDBM process without dilution of a WPC 55% resulted in the precipitation of 39% of the initial lipid content (vs 18% for the control) and confirmed previous results obtained on cheese whey [2]. The combination of the bipolar membrane acidification process with the dilution of the WPC allowed a 73% decrease in its lipid content: A dilution step is necessary to increase the lipid precipitation rate. Whatever the protein concentration of the

WPCs, the samples diluted before centrifugation presented a higher defatting rate than the samples only centrifuged (73% vs 12% for WPC 37%). Furthermore, when diluted, the WPCs with a higher protein concentration (58-62%) had a higher defatting rate than the WPC with a lower one (37%) (78% vs 73%). This new process would have two advantages, the production of a phospholipids-enriched fraction which could be used in cosmeceutics and a purified (demineralized and delipided) and more valuable protein fraction after concentration of the whey. References [1] Lin Teng Shee et al. Journal of Agricultural and Food Chemistry, 53 (2005) 5635-5639. [2] Lin Teng Shee et al. Journal of Agricultural and Food Chemistry, 55 (2007) 3985-3989.

Friday, January 1, 2021
Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Phospholipid

(4182) Composition and Emulsifying Properties of Water and Enzyme Degummed Camelina Sativa Lecithin

Presenting Author: Henok D. Belayneh - Terviva Bioenergy, Inc.

Camelina seed is a promising source of omega-3 oil. In addition to its omega-3 oil content, it is a new source for lecithin. However, there is little information on the chemical composition of camelina seed lecithin; therefore, the objective of this study was to investigate the chemical composition and emulsifying properties of lecithin separated from camelina seed oil by water and enzymatic degumming. Both water and enzyme degumming yielded phosphatidylinositol (PI)-rich lecithins, and contents were 37.8 and 25.2 % (w/w), respectively. Lecithin obtained by enzymatic degumming yielded more lysophospholipids compared to water degumming. Enzyme-degummed camelina lecithin contained more saturated fatty acids compared to water-degummed one. Emulsions prepared with enzyme degummed camelina lecithin formed highest stability emulsions when deionized water was used as the aqueous phase (original pH); however, emulsions were less stable compared to the emulsion stabilized with soy lecithin at pH=7.5. Results showed that camelina seed lecithin is an alternative PI-rich emulsifier for various food applications.

Friday, January 1, 2021
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Presentation Time: 1:00 AM - 2:00 AM

Track: Phospholipid

(4183) Opportunities and Challenges for Recovering Phospholipids from Oilseeds

Presenting Author: Nurhan T. Dunford - Oklahoma State University

The term 'lecithin' refers to a mixture of phospholipids (PL) usually mixed with vegetable oil. Although various health benefits of PL naturally present in seed oils have been widely reported in scientific literature, these compounds are separated from crude vegetable oils during a refining process referred to as degumming. They end up in the processing byproduct streams. Commercial products containing lecithin or pure PL are usually isolated from the byproducts. The conventional lecithin production techniques utilize large amounts of organic solvents such as acetone and water. This presentation will focus on sustainable processing techniques for separation of PL from crude seed oils, de-oiling crude lecithin produced during conventional degumming processes and enrichment of desirable PL, i.e. phosphatidyl choline (PC) in the final product. Applications of enzyme aided processing and supercritical fluid technology in PL recovery from commodity oils, i.e. canola, and specialty oils such as wheat germ oil will be highlighted. Opportunities and challenges involved in sustainable PL production will be discussed.

Friday, January 1, 2021

Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Phospholipid@@@Edible Applications Technology

(4206) Phospholipids and Premenstrual Syndrome (PMS/PMDD)

Presenting Author: David Rutenberg - Lipogen Products (9000) Ltd.

Many women experience emotional and physical symptoms around the time of ovulation and more so before menstruation which interfere with their daily normal life (PMS - Premenstrual Syndrome and PMDD - Premenstrual Dysphoric Disorder). Recent observational data suggest that supplementation with Lipogen's PAS complex (PS- phosphatidylserine and PA-phosphatidic acid, V:V 1:1) alleviates naturally and effectively the symptoms of this syndrome. Lipogen reports clinical study results which aimed to confirm these observations and the positive effects of PAS on PMS/PMDD symptom severity within a controlled clinical trial setting. Methods: Forty women aged 18-45 years with a diagnosis of PMS/PMDD were assigned to either Lipogen-PAS (400mg PS & 400mg PA per day) or a placebo (maize starch). The study comprised 5 on-site visits of 1 baseline menstrual cycle followed by 3 treatment cycles. Treatment intake was controlled for by electronic device (MEMS - Medication Event Monitoring System). The primary outcome of the study was the PMS symptoms severity as assessed by using the Daily Record of Severity of Problems (DRSP). Further, SIPS/ PSST questionnaire

(Premenstrual Symptoms Screening Tool), salivary hormone levels (cortisol awakening response (CAR) and evening cortisol levels) as well as serum levels (cortisol, estradiol, progesterone and corticosteroid binding globulin (CBG)) were assessed. Results: PMS symptoms as assessed by the DRSP Total Score as compared to the placebo group showed a significantly improvement (p ¼ 0.001) over a 3 cycles of PAS intake as compared to placebo. In ddition, PAS treated women reported a greater improvement in physical (p ¼ 0.002) and depressive symptoms (p ¼ 0.068), a lower reduction of productivity (p ¼ 0.052) and a stronger decrease in interference of relationships with others (p ¼ 0.099). No other DRSP scale or item showed significant results. In regards to the biomarkers, the salivary cortisol percentage increase of the CAR was significantly less pronounced in the follicular phase of cycle 4 than in the follicular phase of cycle 1 for subjects taking PAS when compared to subjects taking placebo (p ¼ 0.018). Furthermore, the change of serum cortisol levels between visit 1 and visit 5 differed significantly between groups (p ¼ 0.043). While serum cortisol levels of PAS treated females slightly decreased between visit 1 and visit 5, cortisol levels of females treated with placebo increased. For all other biomarkers, no treatment effects were observed over the 4 cycles study period. Conclusions: The current study clearly substantiates the effective and safe treatment of PMS with a complex of phosphatidylserine and phosphatidic acid. The PAS complex alleviated the PMS symptoms, providing a safe alternative to standard pharmacological treatment. In view of the recent inclusion of PMDD in the DSM-5, the positive results of this clinical study merits consideration of developing the PAS complex as a botanical drug for treatment of PMDD.

Wednesday, July 1, 2020

Session Time: 8:25 AM - 9:45 AM

Presentation Time: 9:20 AM - 9:45 AM

Track: Phospholipid@@@Health and Nutrition

(4073) Feasibility of the preparation of solvent-free vs solvent liposomes with trans-fatty acids for animal studies

Presenting Author: Farzad mohammadi - Endocrinology and Nephrology Unit, CHU de Québec-Laval University Research Center, Québec (QC), Canada

Objective/Hypothesis: Naturally trans fatty acids (FA) may provide health benefits. However, the low water solubility of FA complexifies studies in animals. Previously, nanovesicles of lecithin were developed using a chloroform-based method. Yet, the solvent used in nanoencapsulation may be toxic to animals. The objective is to examine the feasibility of preparing nanovesicles without solvent. The hypothesis is that 1- the yield will be the equivalent in the solvent and solvent-free preparations and 2- no residual solvent in solvent-free method will be detected. Methods: Nanovesicles containing either lecithin alone or in combination with trans FA were prepared with two methods. In the lipid-film method, solutions in chloroform were evaporated to form a thin film which was then hydrated. In the solvent-free method, dry powders of lipids were hydrated in ultrapure water at 60°C for six hours. Both hydrated lipid suspensions were extruded on polycarbonate membranes to obtain vesicles with diameters ca. 100 nm. The yield obtained was quantified in the concentrations of phospholipids before and after extrusion.

The residual solvent in formulations was measured by gas chromatography. Results: The yields of the solvent and solvent-free preparations were comparable. The regular lipid-film followed by extrusion method resulted in formulations with residual solvent above acceptable levels (ICH Q3C). In opposition, no solvent was detected in the formulations prepared with the solvent-free method. Conclusion: Preliminary results suggest the solvent-free preparation method appears a promising way to fabricate vesicles encapsulating FA. Further chemical analysis will be performed to monitor oxidation and lipid content. (Funding: NSERC)

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Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Phospholipid@@@Health and Nutrition

(4167) Lessons from Agpat4/Lpaat-delta knockout mice on brain phospholipids and anxiety in aging

Presenting Author: Robin E. Duncan - University of Waterloo

Abstract Title: Lessons from Lpaat-delta/Agpat4 knockout mice on brain phospholipids and anxiety in aging Introduction: Lysophosphatidic acid acyltransferase delta (LPAATδ)/acylglycerophosphate acyltransferase 4 (AGPAT4) synthesizes phosphatidic acid (PA) from lysophosphatidic acid (LPA) and fatty acyl-CoAs. We have studied 11-17 week old male mice deficient in Lpaatδ/Agpat4, and found they have an induction of other Lpaat/Agpat homologues that restores total PA levels. However, this does not functionally compensate for deficient Lpaatδ/Agpat4, since brain phosphatidylcholine, phosphatidylethanolamine, and phosphatidylinositol are significantly reduced, and mice have deficits in memory and learning caused by a significant reduction in NMDA-receptor subunits 1, 2A and 2B. We also observed an increase in rearing activity at this age, which is indicative of increased anxiety. However, it did not reach significance. Objective: We have investigated whether behavioral and activity changes occur with aging in Lpaatδ/Agpat4 mice. Methods: We have used the comprehensive laboratory monitoring system (CLAMS) to assess movement and metabolic parameters, and the elevated-plus maze (EPM) and open-field (OF) testing to assess probably anxiety in 14 and 20 month old male mice. Results: At 14 months of age, Lpaatδ/Agpat4 mice spent 45% less time in the open arms of the EPM and 25% less time in the centre of the OF, and this worsened to 75% less time in the open arms of the EPM, and 40% less time in the centre of the OF by 21 months. Mice also showed increased rearing activity. Conclusions: Our results show an interaction between Lpaatδ/Agpat4 deficiency and progressive anxiety with aging. These findings will be discussed in the context of human polymorphisms in this gene.

Friday, January 1, 2021

Session Time: 1:00 AM - 2:00 AM

Presentation Time: 1:00 AM - 2:00 AM

Track: Phospholipid@@@Lipid Oxidation and Quality

(3690) Optimization of lecithin modification with phospholipase-D for high phosphatidylethanolamine content to increase tocopherol's antioxidant efficacy

Presenting Author: Mitchell D. Culler - University of Massachusetts Amherst

Current clean label trends have caused consumers to eschew synthetic antioxidants which creates a problem for food manufacturers hoping to incorporate unsaturated fatty acids in food products without them being susceptible to lipid oxidation (LO). The present research aims to solve this problem by modifying lecithin to have a high phosphatidylethanolamine (PE) content which will work synergistically with tocopherol in emulsion systems to delay LO. While the phosphatidylcholine (PC) found in many commercially available lecithins has been shown to have a prooxidant effect, PE is able to recharge tocopherol-quinone back to its active, antioxidant form. This extends the period of time that tocopherol is able to act as an antioxidant and thus increase the lag phase for formation of lipid oxidation products. Phospholipase D (PL-D) was used from commercially available sources as well as extracted from natural sources such as cabbage, soy, and poppyseed and used to modify lecithin to have a high PE content. The rate of conversion from PC to PE for enzymes of different sources at different temperatures and pH levels was measured using HPLC- ELSD analysis. Results are presented in a series of surface-response plots showing the efficiency of each enzyme under varying sets of conditions as well as the evaluation of products formed. These results have tremendous commercial relevance for understanding and optimizing the conversion of lecithin from having high PC to high PE fractions using natural sources of PL-D.

Thursday, July 2, 2020

Session Time: 8:25 AM - 12:10 PM

Presentation Time: 11:20 AM - 11:45 AM

Track: Phospholipid@@@Surfactants and Detergents

(4179) Disruption of Model Membranes by Surfactants used in Gene Delivery

Presenting Author: Shawn Wettig, PhD, CChem - School of Pharmacy, University of Waterloo

Purpose: Gene delivery relies on the delivery of a specific gene of interest to target cells. One of the major barriers to successful gene therapy is the transport of the DNA across cellular membranes. Synthetic gene therapy vectors rely on the use of various cationic agents (polymer, lipid, or surfactant) to condense and package DNA, and to facilitate its transport across cellular membranes. The purpose of this study was to examine the effect that surfactants used for gene delivery have on the structure of a simplistic model of an endosomal membrane. **Method:** Model membranes were prepared from DPPC/Cholesterol or POPC/Cholesterol mixtures that were dissolved in Chloroform and deposited onto the surface of water contained in a Langmuir trough.

Monolayers were treated with nanoparticles containing DNA, the neutral lipid DOPE, and gemini surfactant. Surface pressure was monitored using the Wilhelmy plate method while monolayers were compressed at a rate of 10 mm/min, providing the surface pressure vs. molecular area isotherm. Images of the monolayer at various surface pressures were obtained using a Brewster's Angle Microscope. **Results:** DOPE did not appear to participate significantly in the interaction between the surfactants and DNA. Both gemini surfactants were able to increase the fluidity of the model membranes. **Conclusions:** The effect of gemini surfactants with respect to facilitating DNA delivery may involve not only condensing and packaging DNA, but also by playing an important role in the disruption of cellular membranes; specifically the disruption of endosomal membranes resulting in release of DNA into the cytosol.