



International Liposome Society

ILS Newsletter

Volume 2, Number 1
Summer 2005

From the President's Desk
Gregory Gregoriadis
ILS President



My last ILS Newsletter address (Volume 1, Number 3) referred, briefly, to the future of liposomology. The essence of what I said was that we have been resting on our laurels for too long, and that the time has come "to break through the glass ceiling" hanging over our (ageing) success. The field of drug delivery has exploded, indeed it is a force already determining the direction of the pharmaceutical industry worldwide. A number of other delivery systems are flexing their muscles, so to speak, positioning themselves for a share of the treasures, both scientific and commercial, awaiting to be discovered. It is now time for liposomology to attain a higher level of sophistication to meet the challenges of the new generation of drugs and vaccines that need to be delivered.

The first official ILS Annual Meeting 'Liposome Advances: Progress in Drug and Vaccine Delivery' in London, on December 12-16, 2005, will provide an excellent opportunity to hear of recent progresses, experimental and clinical, hopefully of developments that exploit the full potential of our multifaceted delivery system. Liposomologists from both sides of the Atlantic and beyond, from academia and industry, will share a variety of events for five days, mix with the thirty-odd veterans in the field (flanked by younger successors), listen to their wisdom of decades on the job, learn from their latest successes and (occasional!) failures. It will enable us liposomologists to renew and expand our friendships and collaborations, and in the process strengthen the

bonds of our international community. See you all in December!



International Liposome Society News

ILS Annual Meeting

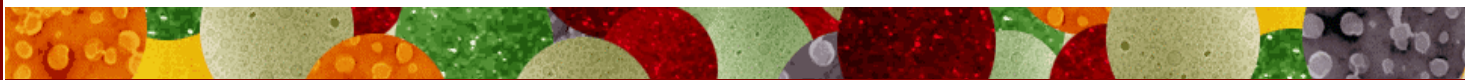
In an effort to build one, strong, consolidated meeting for all those involved in the field of liposome research, ILS is pleased to announce that it will be hosting its first official Annual Meeting.

The ILS 2005 Annual Meeting 'Liposome Advances: Progress in Drug and Vaccine Delivery' will be held from December 12-16, 2005 at the School of Pharmacy, London University, London, UK.

This international conference on the use of liposomes in drug and vaccine delivery will discuss advances attained so far or expected to occur within this decade and beyond. Since 1970, when liposomes were first used in drug delivery there has been, as you know, great progress in the technology of the system and its application in therapeutics and vaccines. Such progress has been consolidated by the success of a number of biotechnology companies, the ever-increasing involvement of established larger industries, and the significant number of liposome-based products already marketed.

The conference will deal critically with major aspects of liposomology including technical advances, control of liposomal behaviour in vivo, and application of liposomes in antimicrobial and cancer treatment, gene therapy, conventional and genetic vaccines as well as topical therapy. Over 40 lecturers from both the academic world and industry will discuss recent progress and future plans.

Watch the ILS website, www.liposome.org, for further details.



ILS Newsflash

June 6, 2005 marked the official launch of the ILS Newsflash. The Newsflash is an electronic update from the ILS for all stakeholders in the field of liposome research. Delivered via email on an ad hoc basis, the Newsflash contains ILS society news, industry news, meetings and events, as well as any other information relevant to liposome researchers. You are invited to submit content to ils@liposome.org.

ILS Membership Recruitment

ILS is engaging in an official individual and corporate membership recruitment drive. The Society currently has 62 individual members, with plans to double that number this year.

As a reminder, ILS benefits include the following:

- a subscription to the Journal of Liposome Research with print and online access;
- website with timely information, resources, online membership and registration forms;
- quarterly digital newsletter (the ILS Newsletter) on items and stories of interest to the field and ILS activities;
- ad hoc electronic newsflash (the ILS Newsflash)
- membership directory;
- annual awards; and
- participation on committees and working groups

ILS wishes to acknowledge the generous support of its inaugural Corporate Members:

- Avanti Polar Lipids
- INEX
- NOF Corporation
- Northern Lipids

We also welcome two new Corporate Members to the Society:

- Lipoid
- Encapsula NanoSciences

Information about Corporate Membership is available on the ILS website, www.liposome.org.

A strong, involved, and supportive membership base is key to the success of the Society. Encourage your colleagues, sign up your organization, and sponsor your students to join. We look forward to working with you each of you to build a vibrant ILS, and to supporting your needs. Please contact the ILS Head

Office with your feedback, comments, and suggestions at ils@liposome.org.



Literature Report

The Literature Report column attempts to provide ILS members with timely updates, highlighting liposome and vesicle advances and progress reported from as wide a spectrum of scientific fields as possible. The papers that attracted our attention during the last few months include:

Review of the Quarter

Polymer genomics: shifting the gene and drug delivery paradigms

Kabanov AV, Batrakova EV, Sriadibhatla S, Yang Z, Kelly DL, Alakov VY.
Journal of Controlled Release
101(1-3):259-71 JAN 3 2005

Vesicle Therapeutics & Diagnostics

Novel mechanism of hybrid liposomes-induced apoptosis in human tumor cells

Matsumoto Y, Iwamoto Y, Matsushita T, Ueoka R
International Journal of Cancer
115 (3): 377-382 JUN 20 2005

Lipid mixing between lipoplexes and plasma lipoproteins is a major barrier for intravenous transfection mediated by cationic lipids

Tandia BM, Loney C, Vandenbranden M, Ruyschaert JM, Elouahabi A
Journal of Biological Chemistry
280 (13): 12255-12261 APR 1 2005

Haloperidol-associated stealth liposomes - A potent carrier for delivering genes to human breast cancer cells

Mukherjee A, Prasad TK, Rao NM, Banerjee R
Journal of Biological Chemistry
280 (16): 15619-15627 APR 22 2005

Distribution in brain of liposomes after convection enhanced delivery; modulation by particle charge,

particle diameter, and presence of steric coating

MacKay JA, Deen DF, Szoka FC
Brain Research
1035 (2): 139-153 FEB 28 2005

Vesicle Colloids

Proteocubosomes: Nanoporous vehicles with tertiary organized fluid interfaces

Angelova A, Angelov B, Papahadjopoulos-Sternberg B, Ollivon M, Bourgaux C
Langmuir
21 (9): 4138-4143 APR 26 2005

Effect of chain lengths of PEO-PPO-PEO on small unilamellar liposome morphology and stability: an AFM investigation

Liang XM, Mao GZ, Ng KYS
Journal of Colloid and Interface Science
285 (1): 360-372 MAY 1 2005

Vesicle Biophysics

Fusogenic tilted peptides induce nanoscale holes in supported phosphatidylcholine bilayers

El Kirat K, Lins L, Bresseur R, Dufrene YF
Langmuir
21 (7): 3116-3121 MAR 29 2005

Vesicles in Novel Applications

Polymersome Encapsulated Hemoglobin: A Novel Type of Oxygen Carrier

Dian R. Arifin and Andre F. Palmer
Biomacromolecules; **2005**;
ASAP Web Release Date: JUN 4, 2005; **(Article)**
DOI: [10.1021/bm0501454](https://doi.org/10.1021/bm0501454)

Utilization of cell-sized lipid containers for nanostructure and macromolecule handling in microfabricated devices

Tresset G, Takeuchi S
Analytical Chemistry
77 (9): 2795-2801 MAY 1 2005



Industry News

The following is an excerpt from an interview conducted by Kostas Kostarelos, ILS Newsletter Editor, with Zahra MirAfzali, CEO of Encapsula NanoSciences, LLC.



The Liposomologists

KK "On behalf of the International Liposome Society, I would like to take this opportunity to thank Encapsula NanoSciences for joining the Society as a Corporate Member. We hope that ILS Corporate Membership will be beneficial to Encapsula NanoSciences as a vehicle for corporate profile, education and marketing. Let me start off by asking for a general overview of the focus of your company."

ENS: Thank you very much for this interview. It is a great honor for Encapsula NanoSciences to be a Corporate Member of the International Liposome Society.

Encapsula NanoSciences is a producer and supplier of various types of liposomal systems in small and large quantities (from few milliliters to hundreds of liters) to research laboratories in universities and research institutes, and also biotechnology and pharmaceutical companies.

Encapsula is also a contract research company that specializes in the development of liposome based pharmaceutical formulations.

We make various types of liposomal systems such as plain liposomes, fluorescence liposomes, spin labeled liposomes, drug encapsulated liposomes, immunoliposomes, proteoliposomes, liposomes for gene delivery and many other types of custom-made liposomes. For more information about our company visit our website at www.encapsula.com.

KK "Please tell us about yourself and your colleagues who make up the Encapsula NanoSciences team."

ENS: I, Zahra MirAfzali, am the founder and CEO of Encapsula NanoSciences. I have a dual Ph.D. in Chemistry and Biochemistry, and Molecular Biology from Michigan State University. I also have a Master of Business Administration with concentrations in entrepreneurship, marketing and finance from Vanderbilt University. Encapsula also has a very excellent synthetic organic chemist with more than 30 years of experience in synthesizing complicated molecules. A very experienced electron microscopist will join our company shortly. We also have several part time research staff.

Currently we are trying to expand our company and hire more scientists.

KK "How do you see the liposome industry maturing over the next three years and what role does Encapsula NanoSciences expect to play in those changes?"

ENS: I am sure that many exciting discoveries and innovations will happen in liposome sciences and more companies will do liposome research over the next few years, and hopefully more liposome-based drugs will be approved by the FDA.

Encapsula, as a custom-made liposome company, will be involved in producing any formulations of liposomes for research labs in academia and industry. In addition, Encapsula will actively perform R&D for developing better drug delivery systems. Encapsula is especially interested in developing better and more effective magnetic liposomes.

KK "What would Encapsula NanoSciences like to see happening in the liposome research front that academic institutions undertake and how would a company like Encapsula NanoSciences prefer to collaborate with academic labs?"

ENS: I really want to see more academic research labs doing liposome research. Many top universities in the US do not have liposome research laboratories. In other words, if you want to do your PhD dissertation on liposomal systems or do your post doctoral

research work in this field, then you really have very limited options.

To answer the second part of your question, I would say that based on our own experience at Encapsula, there are usually two types of academic research labs:

- 1) Research labs that use liposomal systems for their research, but do not specialize in hard core liposome research. There are many research labs that use drug encapsulated liposomes in order to repeat a scientific experiment, use liposomes as artificial cell models, or use proteoliposomes for various experiments; however, these labs don't develop liposomal systems. They just use liposomes for specific experiments.
- 2) Research labs that are real experts in developing liposomal systems and train their graduate students and postdocs as liposome experts.

Most of Encapsula's clients are the first type of research labs. These labs prefer to outsource their liposome needs instead of investing the time, money and equipment required to make the liposomal systems on their own.

Encapsula is also looking to collaborate with the second type of research labs to commercialize the products of their research. As we all know, there is a huge gap between academia and industry and it usually takes many years for a product that has been developed in academia to become commercialized. We hope that Encapsula facilitates this process of commercialization.

KK "As a Corporate Member of ILS, what is Encapsula NanoSciences hoping that ILS will bring to the field of liposome research?"

ENS: I hope that ILS becomes more visible. There are many top universities that do not have subscriptions to the Journal of Liposome Research. I remember that I used to order this journal through inter-library loans from other universities because the library in the universities that I attended didn't have subscription to the Journal of Liposome Research -- and the universities that I attended were all top universities in United States.

I hope that ILS organizes more conferences in United States so more graduate students and junior scientists can be exposed to the latest developments in this field.

KK "Thank you, for taking the time to participate in this interview. Also, thank you for supporting ILS through your Corporate Membership and welcome to the Society. We look forward to having you on board during this important time in the growth and development of ILS.

ENS: Thank you for all your efforts at ILS. I am sure that more scientists will become connected through this Society.



**Journal of Liposome Research
News**

Andrew Janoff

Editor, Journal of Liposome Research



New Editorial System

ILS 2005 members should be receiving Volume 15, Issue 1&2 of the Journal of Liposome Research in the mail shortly. The next issue, Volume 15, Issue 3&4, is hoped to be our final combined issue as we have recently implemented a new editorial system that is designed to improve the timeliness of the peer review process.

The Journal is pleased to welcome several new members to the Editorial team. Dr. Sadao Hirota, Dr. Ijeoma Uchegbu, and Dr. Volkmar Weissig have joined the Journal as Associate Editors. We also have a new Editorial Coordinator, Ashka Wirk.

With the revamped editorial system, authors will be asked to submit manuscripts by mail, in paper, and on disk as follows:

- Authors based in **Asia** will submit to Dr. Sadao Hirota, Material Sciences Department, Tokyo Denki University, 6-6-18 Higashi-Kaigan-Minami, Chigasaki, Kanagawa 253-0054 Japan
- Authors based in **Europe** will submit to Dr. Ijeoma Uchegbu, Department of Pharmaceutical Sciences, University of Strathclyde, 27 Taylor St., Glasgow G4 0NR UK

- Authors based in **North America** will submit to Dr. Volkmar Weissig, Department of Pharmaceutical Sciences, Northeastern University, 360 Huntington Ave., 211 Mugar Building, Boston, MA 02115 USA
- **All other authors** will submit to the nearest Associate Editor, or to the Editorial Coordinator, Ashka Wirk, International Liposome Society, 570 West 7th Avenue, Suite 402, Vancouver, BC V5Z 1B3 Canada

Online Access

In addition to a hard copy version of the Journal, ILS members are entitled to online access. Taylor and Francis, our publishers, have fully implemented the online version of the Journal. The steps for accessing the Journal online are as follows. These instructions are also available on the ILS website at www.liposome.org.

1. Visit <http://taylorandfrancis.metapress.com>.
2. Register for an online account. If you have an individual ILS membership, register for an individual account. If you have a corporate membership with ILS, register for an institutional account. You will receive an 8-digit Metapress ID.
3. Once you have registered, contact Paul Nash, Online Coordinator with the Journal of Liposome Research (Paul.Nash@tandf.co.uk), and state that you belong to ILS, your Metapress ID number, and your ILS membership number.
4. Once your access has been enabled, you will receive an email notification from Taylor and Francis.
5. Visit <http://www.journalonline.tandf.co.uk> and log on with your Metapress username and password. Use the alphabetical listing tool on the left hand side of the main page to trace the Journal of Liposome Research. Once you have found and clicked on the link, you will have full text access to current and back issue material for the Journal.

Contact Ashka Wirk (ashka@liposome.org) should you encounter any difficulties with this process.

As always, the continued success of the Journal is based on your submissions, timely reviews, participation, and support.



Conference Review

11th Mejbaum-Katzenellenbogen's Molecular Biology Seminar

Amphiphiles and their Supramolecular Aggregates in Basic and Applied Science

Arkadiusz Kozubek

*Laboratory of Lipids and Liposomes,
Institute of Biochemistry and Molecular Biology
University of Wrocław
Wrocław, Poland*



This 11th international conference was held on May 15-19, 2005 near the University of Wrocław at the beautifully restored medieval castle, Kliczków, about 12km from Bolesławiec, the Southwest part of Poland.

This was the fourth time that this meeting was held in this area and, like the previous three, it was organized by our group with the support of several institutions, such as the University of Wrocław, Pharmaceutical Research Institute, Ministry of Science and Sport, Committee of Biochemistry and Biophysics and the Polish Network for Cell Biology UNESCO/PAN. Nearly 100 participants, representing 25 countries, from academia, research institutes and industry attended the conference. Phospholipid GmbH, a supplier of phospholipids for industrial applications, and Malvern Poland, a supplier of equipment for the characterization of supramolecular aggregates contributed to the conference with exhibits and financial sponsorships. Almost all aspects of basic and applied use of amphiphiles, not only phospholipids, were covered through comprehensive lectures and

posters, enhanced by the excellent atmosphere of the medieval castle at which the conference was held.

The lectures and posters together dealt with the basic research that is fundamental to the various uses of amphiphilic supramolecular structures (e.g. micelles, nanoemulsions, vesicular carriers, lipoplexes etc.) showing that the area of supramolecular aggregates is growing and has a real value and benefit for human health.

The conference began with lectures presenting important aspects of supramolecular aggregates such as carriers for bioactive compounds (Kaplun), pharmacokinetic and pharmacodynamic aspects of such carriers that have to be recognized (Allen), and submicron as well nanoemulsion forms as drug carriers (Sznitowska). The next session dealt with the interaction of vesicular carriers with target cells. The lectures concerned both prokaryotic cells (Omri) and eukaryotic cells (Scherphof, Kamps, Atrouse). Studies on the interaction of drugs with model biological membranes, including cyclic lipodepsipeptides (Grof), were also presented. The role of cholesterol-rich membrane domains in the interaction of liposomal carriers with cells was presented by Sentjurs. Fluctuating membrane pores as the possible mechanism of the action of the antibiotic polypeptide KLA1 were discussed by Kloesgen.

Another group of lectures and presentations was concerned with the production of liposomes on an industrial scale (Wagner), as well as the application of supercritical carbon dioxide for the extraction of lipids, and their enzymatic modification and production of supramolecular drug carriers in an environmentally friendly medium (Szwajcer-Dey).

Several lectures presented achievements in the field on non-liposomal carriers, e.g. PEG-stabilized bilayer disks (Edwards), biodegradable polymeric micelles (van Nostrum), targeted micelles made of amphiphilic polymers (Torchilin), and polylactide-co-glycolide microspheres (Buono da Costa) that may be used in vaccinology. A very interesting approach for cancer therapy using radioactive iodine was presented by Ickenstein. The application of targeted multimodal liposomes for imaging and radioisotopic therapy was presented by Koning.

Another group of lectures and presentations dealt with the delivery of nucleic acids to target cells, with consideration being given to both the mechanism and practical applications. The role of non-bilayer phases in the mechanism of lipoplex-mediated gene delivery was broadly discussed by Hoekstra. The role of metal cations in modulation of DNA-liposome aggregates was discussed by Uhríkova. Rejman discussed the role of clathrin and caveolae-mediated endocytosis in gene transfer mediated by lipo- and polyplexes, whereas Uchegbu presented approaches for self-assembling polymers as carriers for gene and drug delivery. A very interesting lecture concerning the use of fluorescence correlation spectroscopy for the study of DNA was presented by Hof. The role of surface charge density in the formation of interdigitated layers in cationic amphiphiles-PC mixtures was discussed by Uhríkova. Other aspects were discussed by Ryhaenen. Gawrisch presented results obtained by NMR studies on reconstitution of GPCR into lipid bilayers supported in cylindrical aluminum oxide nanopores.

A few presentations were related to basic biomembrane science, such as transmembrane domains of proteins (Ruysschaert), modeling of biomineralization (Saeily), and the effect of biosurfactants from *Bacillus subtilis* (lipopeptides) upon biomembrane models (Deleu). Also, numerous presentations (lectures, oral presentations and posters) were devoted to the application of molecular modelling and new experimental techniques for studying events underlying the behaviour of lipid bilayer and/or biological membranes upon incorporation of particular lipid/drug components. These contributions were presented by Pasenkiewicz-Gierula, Marrink, Loison, Rog. Mozafari, in his lecture, discussed the relationship between vesicular structures and the origin of life.

In general, over 50% of conference attendees were young scientists who found this meeting fruitful for furthering their contacts and encouraging collaboration. Terry Allen suggested joining the ILS as the best way for grouping those of us that are interested in the application of vesicular (there was a controversy between liposomal and vesicular) carriers in practice (e.g. medical, veterinarian and other applications). Most of participants agreed that the organization of such meetings on similar topics (e.g. liposomes, supramolecular structures) should be more

collaboratively controlled as not all of us can afford to attend three meetings a year.

As the Chair of the Organizing Committee, I am very satisfied that this conference attracted scientists representing the classical liposome group as well as quite a large group of newcomers. In conclusion, the supramolecular aggregate's carriers group is strong and the future seems to be promising.



Upcoming Meetings

'Lipids, Liposomes and Biomembranes 2005: New Technologies'

July 26-30

Vancouver, Canada

www.liposomesandmembranes.com

This conference is being organized by some of the most exciting leaders in the field: Pieter Cullis (Vancouver), Ben de Kruijff (Utrecht), Terry Allen (Edmonton), Hagan Bayley (Oxford) and Frank Szoka (San Francisco) with partial support by the International Liposome Society and a number of industry sponsors. The event promises to be an exciting conference at the leading edge of liposome and biomembrane research.

Topics to be covered include:

- Physical properties and functional roles of lipids in membranes
- Liposomes for cancer chemotherapy
- Lipid and lipid-protein domains
- Liposomes for gene therapy
- Membrane channels
- Targeted liposomes

The use of liposomes as therapeutics evolved began over 20 years ago, utilizing liposomes that were developed as models of biological membranes. Since then the liposome and the biomembrane research communities have diverged. However, the basic principles underlying the design of liposomes for drug delivery have deep roots in an understanding of the properties of biomembranes. This conference is aimed at bringing the

liposome and biomembrane groups back together with the objective of stimulating cross-disciplinary interactions and new research directions in both fields. Particular emphasis will be given to the design of increasingly sophisticated liposomal systems for therapeutic applications as well as the new technologies that are being developed to study membrane components and processes.

American Academy of Nanomedicine

First Annual Scientific Meeting

August 15-16, 2005

Johns Hopkins University-Medical Campus,
Baltimore, MD, USA.

<http://www.nanomedacademy.org/meeting/>

The 19th European Colloid and Interface Society Conference

September 18 - 23, 2005

[Park Inn Highland, Geilo](#), Norway

<http://www.kjemi.uio.no/ecis//>

13th Annual Congress of the European Society of Gene Therapy (ESGT)

October 29 - November 1

Prague, Czech Republic

<http://www.esgt.org/esgt2005/index.html>

Biophysical Society 50th Annual Meeting

February 18-22, 2006

Salt Lake City, Utah

<http://www.biophysics.org/meetings/2006.htm>



From the Editor's Desk

Kostas Kostarellos

ILS Newsletter Editor



This is the second year following the ILS rejuvenation. This year, ILS is looking at establishing its membership base and expanding to more diverse disciplines in which liposomes and other vesicle systems are used.

One of the most important challenges for our field is consolidation. We all know that liposomes and vesicles have found a myriad of different applications other than their core drug delivery system utilization. Our task is to start bringing these diverse liposomologists together. This can only succeed if our base membership is healthy and actively involved with the various activities organized by the ILS. We would like to see more of us subscribe and contribute to the Journal of Liposome Research; actively participate during the proceedings of the upcoming 'ILS 2005 Annual Meeting: Liposome Advances' at the School of Pharmacy, University of London; disseminate the ILS Newsletter and Newsflashes to more people you think may find the information useful and interesting. A healthy and engaged ILS membership base will offer our field the consolidation needed. We look forward to receiving your contributions!

A related topic that all of us at ILS feel is extremely important to the growth of our field is the consolidation of scientific meetings with a central theme around liposomes and vesicles. It is common knowledge to all of us in the liposome field that neither the time nor the financial resources are available to most of us to attend three or four meetings on a similar topic. We propose consolidation of scientific meetings under the umbrella of a single ILS Annual Meeting to be held at different liposome and vesicle research hotbeds around the world. These meetings will be the continuation of the successful 'Liposome Advances' and 'Liposome Research Days'. A single ILS meeting per year will give all of us enough motivation to invest the time and effort to interact with the rest of the world's liposome and vesicle scientists. The inaugural ILS Annual Meeting will be bringing everybody in this field together this year in a familiar location in London, UK. Hope to see you all there!

Specific developments for the ILS Newsletter and website this year include:

ILS Newsletter

- A new column will be introduced in the next issue called: '**Liposome Research - National Updates**', showcasing the current status of liposome research at the national level.
- The *ILS Newsflash* will be circulated electronically to all ILS members in between the ILS Newsletter with any breaking news from academia and industry that could be of interest to our members.



ILS Website

- We are putting out a call for submissions of website addresses and short descriptions of laboratories active in liposome and vesicle research for the Liposome Laboratories section of the ILS website

I look forward to receiving your contributions, comments and ideas about ILS activities.



ILS wishes to acknowledge the support of its 2005 Corporate Members.

Visit the ILS website, www.liposome.org, or contact Ashka Wirk at the ILS Head Office at ashka@liposome.org to enroll your company in the ILS Corporate Membership program!

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Basic Corporate Members:



The Liposomologists



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www.liposome.org

Join ILS today!

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