

## New Trends in Lyotropic Liquid Crystals

Figueiredo Neto, Antonio M.\*

Universidade de São Paulo, Instituto de Física, Brasil

The liquid crystalline state of matter has been investigated for more than 100 years by many researchers from different branches of science, technology, and even the arts. This state may be encountered in mixtures of amphiphilic molecules and solvents, or shape-anisotropic colloids in solvents, which constitute the family of lyotropic liquid crystals [1]. Their phase diagrams are very rich, showing structures not present in thermotropics. Their closeness with biological systems (e.g., the cell membrane structure), allows to learn some properties and behaviors of living systems (e.g., the human Low-Density Lipoproteins – LDL). The kosmotropic and chaotropic (bonding/order inducing and disrupting) characteristic of the chemical groups present in some molecules forming lyotropics give interesting information about the water arrangement (solvation water) at the solute/solvent interface. Since the seminal works of Lawson and Flautt and Saupe the uniaxial and biaxial nematic lyotropic mesophases were identified and extensively investigated. One of the structures present in lyotropics is the lamellar, where the amphiphilic molecules organize in bilayers separated by water. Usually, the non-polar parts of the molecules in the bilayer are in a liquid state or, in some cases, parallel to the layer normal. However, there are some examples in literature of lyotropic structures similar to the thermotropic SmC phase. Another family of lyotropics (the chromonics) are formed by linear stacks of disc-shaped molecules in water. The liquid crystalline state is governed by weak, non-covalent forces. Flexible and polydisperse aggregates of molecules are formed. Recently, new mixtures have been proposed, enlarging the possibility of new structures and exciting new properties. It is expected that in the near future, research in lyotropics will increasingly impact biology and medicine – in particular in the field of drug delivery with low toxicity, membrane permeation, and elasticity. In this tutorial, these aspects will be presented and discussed [2].

**Acknowledgements:** This work was funded by Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) (465259/ 2014-6); Fundação de Amparo à Pesquisa do Estado de São Paulo (2008/ 57685-7, 2011/13616-4); Coordenação de Aperfeiçoamento de Pessoal de Nível Superior; Instituto Nacional de Ciência e Tecnologia de Fluidos Complexos (INCT-FCx); Núcleo de Apoio à Pesquisa de Fluidos Complexos (NAP-FCx) (2011.1.9358.1.6).

### References (selected):

- [1] A.M.F. Neto, S.R.A. Salinas The Physics of Lyotropic Liquid Crystals: Phase Transitions and Structural Properties, first edition (Oxford University Press, New York, 2005).
- [2] New Trends in Lyotropic Liquid Crystals, *Crystals*, [https://www.mdpi.com/journal/crystals/special\\_issues/Lyotropic\\_Liquid-Crystals](https://www.mdpi.com/journal/crystals/special_issues/Lyotropic_Liquid-Crystals).

\* Author for Correspondence: [afigueiredo@if.usp.br](mailto:afigueiredo@if.usp.br)