

Biological Organic Chemistry

4th Degree

Optative

Credits: 6 (3 Theory, 3 Practice)

Teachers:

**Ángela Sastre Santos, Full Professor Organic Chemistry
(Responsible of the Course). asastre@umh.es**

Luis Martín Gomis, Assistant Professor.



MODULUS I ORGANIC CHEMISTRY OF BIOLOGICAL STRUCTURES

- *ADVANCED structural study of the functional groups and molecular building blocks of the main biological structures*
- *Understanding the basic molecular components and functional groups of major biological structures and their reactivity.*

MODULUS II. CHEMISTRY OF NATURAL PRODUCTS

- *Know the main metabolic pathways and chemical properties of the final obtained compounds.*

MODULUS III. BIOORGANIC CHEMISTRY

- *Understanding the mechanisms of action at the molecular level of the enzymes and receptors and increase their knowledge of supramolecular chemistry*

Report of a scientific publication and its oral presentation

MODULUS IV. SEMINARS

^1H -NMR, ^{13}C -NMR, MS, UV-VIS, FLUORESCENCE

MODULUS I ORGANIC CHEMISTRY OF BIOLOGICAL STRUCTURES

- *ADVANCED structural study of the functional groups and molecular building blocks of the main biological structures*
- *Understanding the basic molecular components and functional groups of major biological structures and their reactivity.*

0. Functional Groups and Heterocycles

1. Asymmetry of biological structures. Preferences of Nature.
2. Carbohydrates and polysaccharides. Structure (conformational study glycosidic bond). Properties. Chemical reactivity. Synthesis of sugars. Structural determination. cyclodextrins
3. Lípids. Acoblament molecular de molècules anfifílicas. Micel·les, membranes i vesícules.
4. Amino acids. Natural amino acids. Acidity and basicity. Proteinogenic amino acids and unnatural. α - and β -amino acids. Polihidroxi aminoácidos. Amino acids α , β -disubstituted.
5. Peptides and Proteins. Peptide bond. Hydrogen bonds. Conformational study of peptides. Primary structure of the quaternary structure. Protein sequencing. Protecting groups. Structural determination. Protein biosynthesis. Particular study of some proteins. Hemoglobin. HIV-protease.
6. Nucleosides and nucleotides. Purines and pyrimidines. Phosphates: hydrolysis mechanisms. Ribonuclease.
7. Nucleic Acids DNA, RNA. Structural aspects. Sequencing. Nucleic acid biosynthesis.

MODULUS II. CHEMISTRY OF NATURAL PRODUCTS

•*Know the main metabolic pathways and chemical properties of the final obtained compounds.*

8. Principal Reactions in Bioorganic Chemistry

9 Metabolites derived from acetate Fatty acids, prostaglandins, polyphenols, quinones.

10 Metabolites derived from mevalonate. Terpenes. Biogenesis.

11 Carotenoids. Vitamin A. Chemistry of vision.

12. Steroids Classification and nomenclature. Examples. Bile acids and steroid hormones.

13 Shikimate derived metabolites. Benzoic and cinnamic acids. Coumarins. Flavonoids.

14 Secondary metabolism of amino acids. Biogenesis of alkaloids. Classification and examples of alkaloids.

15 Alkaloids. Ephedrine, papaverine. Polycyclic systems. Morphine, berberine.

MODULUS III. SEMINARS. BIOORGANIC CHEMISTRY

- Understanding the mechanisms of action at the molecular level of the enzymes and receptors and increase their knowledge of supramolecular chemistry.

Enzymatic catalysis. Enzymatic action (selectivity). Mechanisms of action

Abiotic Receptors. Podands, coronands and cryptands. Synthetic Methods. More complex systems.

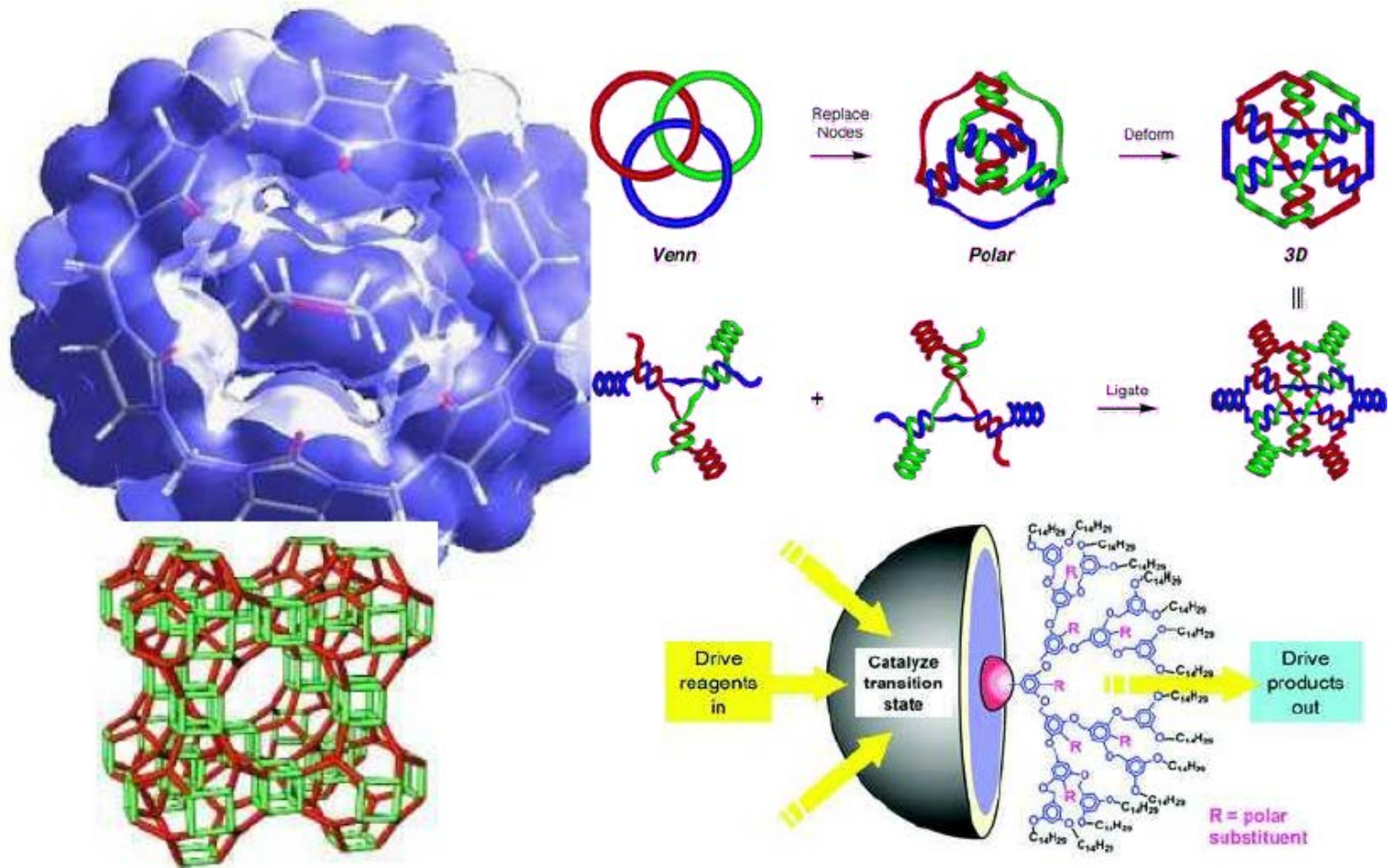
Molecular Recognition. Complementarity receptor pre-organization. Circular and spherical Recognition: complexation of cations.

Complexation recognition chiral anion. Macrocyclic polyamides. Cascade effect.

Enzymatic Models. General principles for design. Multiple recognition. Regulation and allostery. Micelles: stereochemical reconomiento. Polymers.

Transport processes. Ion transport. Ionophores and channels. Membrane models. Transport mechanisms. Stereoselective transport. Isomerizable photo-receptors.

Química Supramolecular



Química Supramolecular

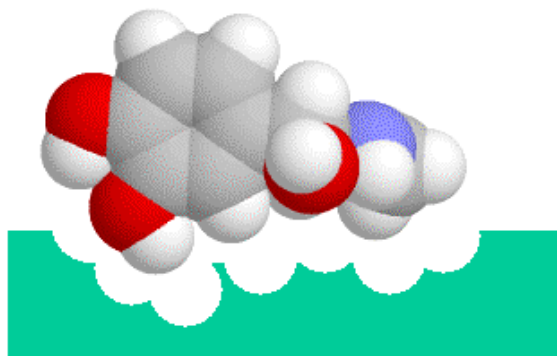
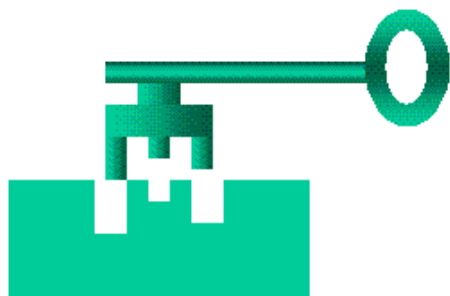
Jean-Marie Lehn (Nobel, 1987): “(L)a *Química Supramolecular es la Química de los enlaces intermoleculares, y estudia la estructura y funciones de las entidades formadas por dos o más especies químicas.*”

Del artículo “Metallosupramolecular Chemistry”, Chemistry & Industry (1994) por Edwin Constable

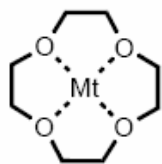
Subdisciplinas: Ingeniería de cristales, dispositivos supramoleculares, sistemas con autoensamblaje y autoreparación, materiales inteligentes, nanotecnología, etc.

Host-guest chemistry

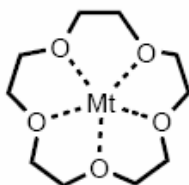
- In host-guest chemistry the host is a bigger molecule that binds the smaller molecule with lock and key principle
- The host is like a lock in which the key fits perfectly
- In biology, enzymes are host that bind the substrates (guests).



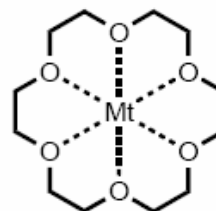
Preorganization & Complementarity of Host and Guest



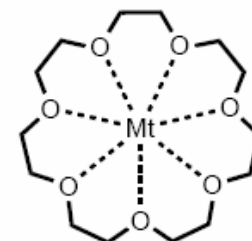
12-crown[4]



15-crown[5]



18-crown[6]



21-crown[7]

cavity	1.20-1.50	1.70-2.20	2.60-3.30	3.40-3.30
selectivity	Li ⁺	Na ⁺	K ⁺	Cs ⁺
diameter	1.36	1.90	2.60-3.30	3.38

MODULUS III SEMINARS

It will be developed in them by students with a supervised work based on literature searches on topics of interest within the area of bioorganic as indicated below. Such work must be exposed after completion of oral form to the rest of the class.

The first seminar will be devoted by the teacher training in literature search.

A list of publications will be provided to the student to present their seminars.

Issues (for example): Heteroaromatic metabolites. Porphyrin biosynthesis. Porphyrins of biological interest. Catalytic antibodies. Artificial Enzymes. Artificial Receptors. Molecular hosts. Polyvalent Interactions. Crown-ethers as enzyme models. Metalloproteins as enzyme models. System coenzymes NAD (P) + / NAD (P) H. Pyridoxal phosphate system. Cyclodextrins as enzyme models. Dendrimers as enzyme models. Calixarenes as enzyme models. Helicates bio-organometallic chemistry: Cobalt and Vitamin B12. Phthalocyanines of biological interest. Perylenediimides of biological interest. BODYPYs of biological interest.

Any issue of interest proposed by the students.

DENDRITIC CELL LECTIN-TARGETING SENTINEL-LIKE UNIMOLECULAR GLYCOCONJUGATES TO RELEASE AN ANTI-HIV DRUG

Qiang Zhang,[†] Lu Su,[‡] Jennifer Collins,[†] Guosong Chen,[‡] Russell Wallis,[§] Daniel A. Mitchell,^{||}
David M. Haddleton,^{*,†} and C. Remzi Becer^{*,†,⊥}



José David Celdrán López

BIOLOGICAL ORGANIC CHEMISTRY

Journal of Biomedical Optics

SPIEDigitalLibrary.org/jbo

Lipidots: competitive organic alternative to quantum dots for *in vivo* fluorescence imaging

Julien Gravier
Fabrice P. Navarro
Thomas Delmas
Frédérique Mittler
Anne-Claude Couffin
Françoise Vinet
Isabelle Texier

Adrián Guerrero Moreno

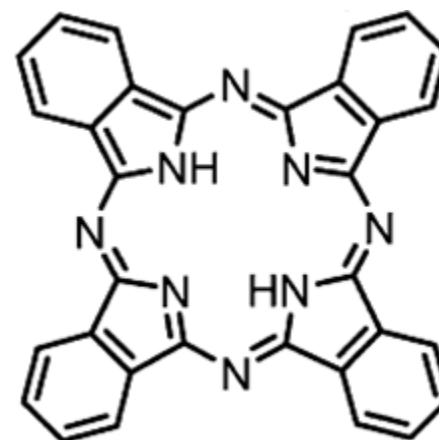
4th Biotechnology

Synthesis and Properties of Cell-Targeted Zn(II)-Phthalocyanine-Peptide Conjugates

Martha Sibrian-Vazquez, Javier Ortiz, Irina V. Nesterova, Fernando Fernandez-Lazaro, Angela Sastre-Santos, Steven A. Soper, and M. Gracüa H. Vicente

Department of Chemistry, Louisiana State University, Baton Rouge, Louisiana 70803, and División de Química Orgánica, Instituto de Bioingeniería, Universidad Miguel Hernández, 03202 Elche, Spain.
Received September 22, 2006; Revised Manuscript Received November 29, 2006

Eduardo Puerta Baile
Biological Organic Chemistry
4th Biotechnology



CRD

CANNABIDIOL, CLINICAL STUDIES AND CHEMICAL SYNTHESIS

José David Fernández Palacios

Laboratory Practices

May 23-27; 15:30-20:00h

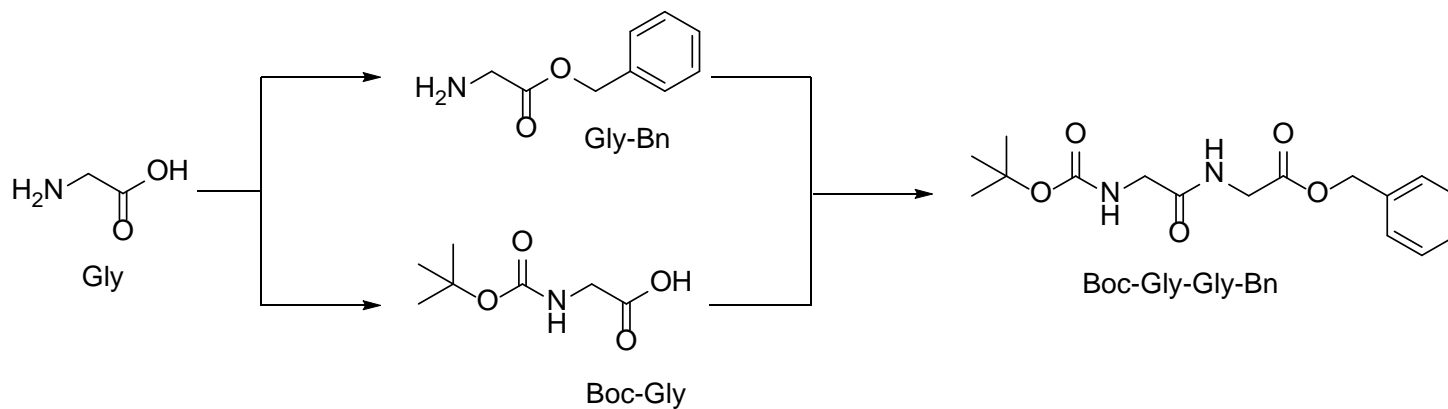
ARENALES BUILDING

QUIMICA ORGANICA LABORATORY

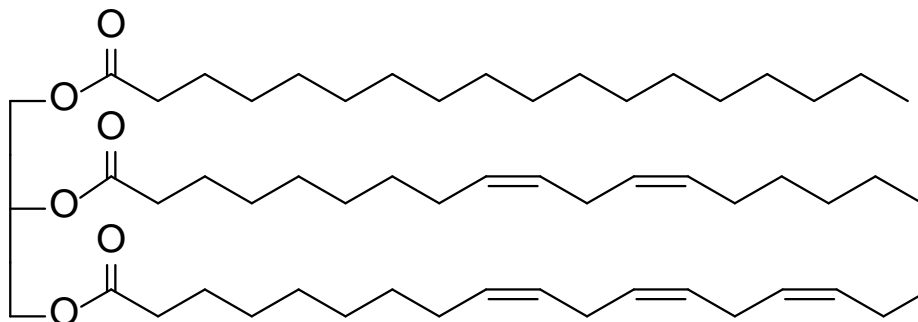


Luis Martín Gomis, Assistant Professor

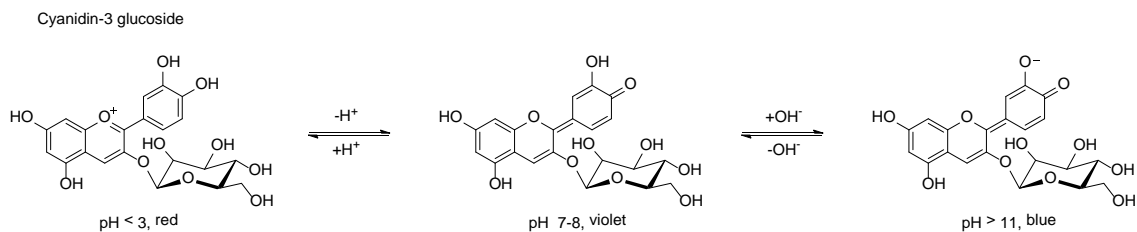
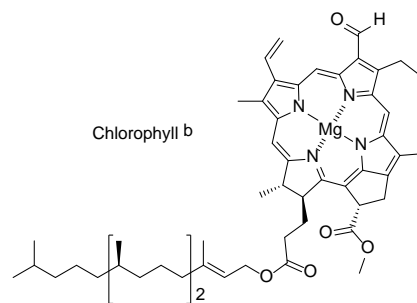
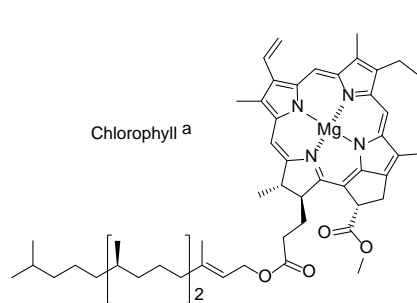
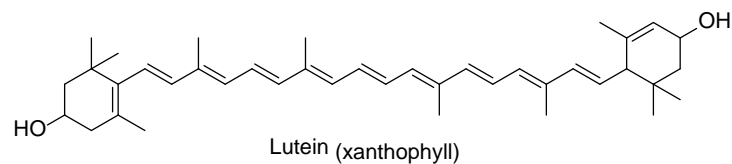
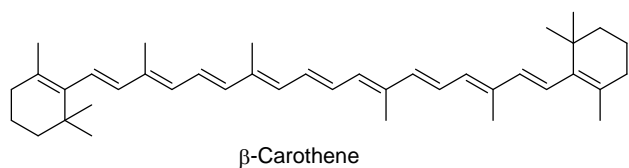
PRACTICAL SECTION 1. Total Synthesis and $^1\text{H-NMR}$ characterization of a Glycine Dipeptide



PRACTICAL SECTION 2. Extraction and ^1H NMR Analysis of Fats from Convenience Foods



PRACTICAL SECTION 3. Column Chromatography of Leaf Pigments:



EVALUATION SYSTEM

The evaluation of the course will consist of 3 sections added 10 points: theory, laboratory and production and exhibition of work. The course can be overcome reaching 5 points.

Evaluation of the theory. Test that will be graded from 0 to 5 points will be made. 2.5 points must be obtained in this section to pass the course.

Evaluation of laboratory practices. Practices are compulsory. The evaluation of each of the five practices is 2.5 grade points for the course and in which assessed: (1) timeliness and follow basic safety rules in the laboratory and (2) Delivery of a report results / conclusions. Students suspended or not retained for subsequent calls presented the cumulative score in the labs except wishing voluntarily give it up.

Evaluation of the report of a scientific publication and its oral presentation. This section will be valued at 2.5 points. Job performance will score up to 1 point and 1.5 points the oral presentation. Students suspended or not retained for subsequent calls presented the cumulative score in this paragraph except wishing to voluntarily give it up.