



## Teaching Guide

| Teaching Guide      |                                                                                                                                                                                                                                                   |        |                       |           |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------|-----------|
| Identifying Data    |                                                                                                                                                                                                                                                   |        |                       | 2018/19   |
| Subject (*)         | Medicinal Chemistry                                                                                                                                                                                                                               |        | Code                  | 610G01040 |
| Study programme     | Grao en Química                                                                                                                                                                                                                                   |        |                       |           |
| Descriptors         |                                                                                                                                                                                                                                                   |        |                       |           |
| Cycle               | Period                                                                                                                                                                                                                                            | Year   | Type                  | Credits   |
| Graduate            | 2nd four-month period                                                                                                                                                                                                                             | Fourth | Optional              | 4.5       |
| Language            | Spanish                                                                                                                                                                                                                                           |        |                       |           |
| Teaching method     | Face-to-face                                                                                                                                                                                                                                      |        |                       |           |
| Prerequisites       |                                                                                                                                                                                                                                                   |        |                       |           |
| Department          | Química                                                                                                                                                                                                                                           |        |                       |           |
| Coordinador         | García Romero, Marcos Daniel                                                                                                                                                                                                                      | E-mail | marcos.garcia1@udc.es |           |
| Lecturers           | García Romero, Marcos Daniel                                                                                                                                                                                                                      | E-mail | marcos.garcia1@udc.es |           |
| Web                 |                                                                                                                                                                                                                                                   |        |                       |           |
| General description | An introductory course in Medicinal Chemistry is offered. Basic concepts related to the structure and activity of drugs, mechanisms of action and metabolism are covered. Main strategies in the design and synthesis of drugs are also analyzed. |        |                       |           |

## Study programme competences

| Code | Study programme competences                                                                                                                                                                                            |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A1   | Ability to use chemistry terminology, nomenclature, conventions and units                                                                                                                                              |
| A9   | Knowledge of structural characteristics of chemical and stereochemical compounds, and basic methods of structural analysis and research                                                                                |
| A10  | Knowledge of chemical kinetics, catalysis and reaction mechanisms                                                                                                                                                      |
| A13  | Understanding of chemistry of main biological processes                                                                                                                                                                |
| A14  | Ability to demonstrate knowledge and understanding of concepts, principles and theories in chemistry                                                                                                                   |
| A15  | Ability to recognise and analyse new problems and develop solution strategies                                                                                                                                          |
| A16  | Ability to source, assess and apply technical bibliographical information and data relating to chemistry                                                                                                               |
| A17  | Ability to work safely in a chemistry laboratory (handling of materials, disposal of waste)                                                                                                                            |
| A18  | Risk management in relation to use of chemical substances and laboratory procedures                                                                                                                                    |
| A19  | Ability to follow standard procedures and handle scientific equipment                                                                                                                                                  |
| A20  | Ability to interpret data resulting from laboratory observation and measurement                                                                                                                                        |
| A21  | Understanding of qualitative and quantitative aspects of chemical problems                                                                                                                                             |
| A22  | Ability to plan, design and develop projects and experiments                                                                                                                                                           |
| A23  | Critical standards of excellence in experimental technique and analysis                                                                                                                                                |
| A24  | Ability to explain chemical processes and phenomena clearly and simply                                                                                                                                                 |
| A25  | Ability to recognise and analyse link between chemistry and other disciplines, and presence of chemical processes in everyday life                                                                                     |
| A26  | Ability to follow standard laboratory procedures in relation to analysis and synthesis of organic and inorganic systems                                                                                                |
| B1   | Learning to learn                                                                                                                                                                                                      |
| B2   | Effective problem solving                                                                                                                                                                                              |
| B3   | Application of logical, critical, creative thinking                                                                                                                                                                    |
| B4   | Working independently on own initiative                                                                                                                                                                                |
| B6   | Ethical, responsible, civic-minded professionalism                                                                                                                                                                     |
| B7   | Effective workplace communication                                                                                                                                                                                      |
| C1   | Ability to express oneself accurately in the official languages of Galicia (oral and in written)                                                                                                                       |
| C2   | Oral and written proficiency in a foreign language                                                                                                                                                                     |
| C3   | Ability to use basic information and communications technology (ICT) tools for professional purposes and learning throughout life                                                                                      |
| C4   | Self-development as an open, educated, critical, engaged, democratic, socially responsible citizen, equipped to analyse reality, diagnose problems, and formulate and implement informed solutions for the common good |
| C6   | Ability to assess critically the knowledge, technology and information available for problem solving                                                                                                                   |
| C7   | Acceptance as a professional and as a citizen of importance of lifelong learning                                                                                                                                       |

|    |                                                                                                      |
|----|------------------------------------------------------------------------------------------------------|
| C8 | Understanding role of research, innovation and technology in socio-economic and cultural development |
|----|------------------------------------------------------------------------------------------------------|

| Learning outcomes                                                                                                                                                                                                                                                                                                                  |                             |    |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----|----|
| Learning outcomes                                                                                                                                                                                                                                                                                                                  | Study programme competences |    |    |
| Know the structure and mode of action of drugs and the relationship with biological activity                                                                                                                                                                                                                                       | A1                          | B1 | C1 |
|                                                                                                                                                                                                                                                                                                                                    | A9                          | B2 | C2 |
|                                                                                                                                                                                                                                                                                                                                    | A10                         | B3 | C3 |
|                                                                                                                                                                                                                                                                                                                                    | A13                         | B4 | C4 |
|                                                                                                                                                                                                                                                                                                                                    | A14                         | B6 | C6 |
|                                                                                                                                                                                                                                                                                                                                    | A15                         | B7 | C7 |
|                                                                                                                                                                                                                                                                                                                                    | A16                         |    | C8 |
|                                                                                                                                                                                                                                                                                                                                    | A21                         |    |    |
|                                                                                                                                                                                                                                                                                                                                    | A24                         |    |    |
|                                                                                                                                                                                                                                                                                                                                    | A25                         |    |    |
| Know basic principles and strategies used to design and synthesized drugs.                                                                                                                                                                                                                                                         | A1                          | B1 | C1 |
|                                                                                                                                                                                                                                                                                                                                    | A9                          | B2 | C2 |
|                                                                                                                                                                                                                                                                                                                                    | A10                         | B3 | C3 |
|                                                                                                                                                                                                                                                                                                                                    | A13                         | B4 | C4 |
|                                                                                                                                                                                                                                                                                                                                    | A14                         | B6 | C6 |
|                                                                                                                                                                                                                                                                                                                                    | A15                         | B7 | C7 |
|                                                                                                                                                                                                                                                                                                                                    | A16                         |    | C8 |
|                                                                                                                                                                                                                                                                                                                                    | A17                         |    |    |
|                                                                                                                                                                                                                                                                                                                                    | A18                         |    |    |
|                                                                                                                                                                                                                                                                                                                                    | A19                         |    |    |
|                                                                                                                                                                                                                                                                                                                                    | A20                         |    |    |
|                                                                                                                                                                                                                                                                                                                                    | A21                         |    |    |
|                                                                                                                                                                                                                                                                                                                                    | A22                         |    |    |
|                                                                                                                                                                                                                                                                                                                                    | A23                         |    |    |
|                                                                                                                                                                                                                                                                                                                                    | A24                         |    |    |
|                                                                                                                                                                                                                                                                                                                                    | A25                         |    |    |
|                                                                                                                                                                                                                                                                                                                                    | A26                         |    |    |
| Know the impact of drugs and the pharmaceutical companies in the society.                                                                                                                                                                                                                                                          | A13                         | B1 | C1 |
|                                                                                                                                                                                                                                                                                                                                    | A14                         | B3 | C3 |
|                                                                                                                                                                                                                                                                                                                                    | A16                         | B4 | C6 |
|                                                                                                                                                                                                                                                                                                                                    | A24                         | B6 | C7 |
|                                                                                                                                                                                                                                                                                                                                    | A25                         | B7 | C8 |
| The students should be able to identify appropriate information on the scientific literature, assess their responsibility in the management of information and knowledge in the field of Industrial Chemistry and the Chemical Research, use scientific terminology and appreciate the value of quality and continuous improvement | A14                         | B1 | C1 |
|                                                                                                                                                                                                                                                                                                                                    | A15                         | B2 | C2 |
|                                                                                                                                                                                                                                                                                                                                    | A16                         | B3 | C3 |
|                                                                                                                                                                                                                                                                                                                                    | A22                         | B4 | C4 |
|                                                                                                                                                                                                                                                                                                                                    | A24                         | B6 | C6 |
|                                                                                                                                                                                                                                                                                                                                    | A25                         |    | C7 |
|                                                                                                                                                                                                                                                                                                                                    |                             |    | C8 |

| Contents |           |
|----------|-----------|
| Topic    | Sub-topic |



|                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chapter 1. Basic principles in Medicinal Chemistry                       | 1.1 Medicinal Chemistry : definition and basic concepts<br>1.2 Historical Perspective .<br>1.3 Pharmacokinetics and Pharmacodynamics<br>Drug Discovery 1.4<br>1.5 Drugs: nomenclature and classification                                                                                                                                                                                                                                                                                                                                                                                       |
| Chapter 2. Molecular basis on pharmacological activity: Pharmacodynamics | 2.1 Drug-receptor interactions . Molecular topology and biological activity<br>2.2 Proteins: structure and function. Protein Interactions<br>2.3 Enzymes: enzymatic catalysis. Michaelis - Menten equation . Enzyme inhibition : Types<br>2.5 Cell receptors: structure and classification .<br>2.6 Nucleic Acids . Structure and functions. Drug interactions with nucleic acids<br>2.7 Interactions with lipid and carbohydrate                                                                                                                                                              |
| Chapter 3. Phramacokinetics                                              | 3.1 ADME processes.<br>3.2 Absorption of drugs. Modes of administration . Physicochemical properties of drugs : Lipinsky rules . Bioavailability .<br>3.3 Distribution of drugs. Blood : composition and properties. Removal rate . Mid life. Volume of distribution<br>3.4 Drug metabolism : metabolism in phase I and phase II<br>3.5 Elimination of drugs.                                                                                                                                                                                                                                  |
| Chapter 5. Drug discovery                                                | 4.1 Steps in drug discovery. Biological target vs Phenotypic approach. Structural diversity. Chemical space. Drug binding energy. High Throughput Screening ( HTS ). Chemical libraries: combinatorial chemistry , parallel synthesis , solid phase synthesis<br>4.2 Strategies in drug discovery (lead discovery) . Screening modes . Drug screening methods . Drug Design<br>4.3 Optimization of drugs (lead optimization) . Structure- actividadIdentificación pharmacophore . Pharmacomodulation : modification of functional groups. Optimization receptor binding and pharmacokinetics . |
| Chapter 7. Drug synthesis                                                | Main synthetis methods for the synthesis of drugs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| Planning                        |                                                                                                       |                      |                               |             |
|---------------------------------|-------------------------------------------------------------------------------------------------------|----------------------|-------------------------------|-------------|
| Methodologies / tests           | Competencies                                                                                          | Ordinary class hours | Student?s personal work hours | Total hours |
| Guest lecture / keynote speech  | A1 A9 A10 A13 A14<br>A15 A16 A21 A24<br>A25 B1 B2 B3 B4 B6<br>B7 C1 C3 C4 C6 C7<br>C8                 | 16                   | 16                            | 32          |
| Seminar                         | A1 A9 A10 A13 A14<br>A15 A16 A21 A24<br>A25 B1 B2 B3 B4 B6<br>B7 C1 C3 C4 C6 C7<br>C8                 | 7                    | 28                            | 35          |
| Laboratory practice             | A9 A13 A14 A15 A16<br>A17 A18 A19 A20<br>A22 A23 A25 A26 B1<br>B2 B3 B4 B6 B7 C1<br>C2 C3 C4 C6 C7 C8 | 10                   | 10.5                          | 20.5        |
| Mixed objective/subjective test | A1 A9 A13 A14 A15<br>B2 B3 B6 C6 C1                                                                   | 4                    | 20                            | 24          |
| Personalized attention          |                                                                                                       | 1                    | 0                             | 1           |



(\*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

| Methodologies                   |                                                                                                                                                                                                                                                                         |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Methodologies                   | Description                                                                                                                                                                                                                                                             |
| Guest lecture / keynote speech  | The contents will be presented. During the presentations the teacher can provide supplementary material to the literature with the aim that the explanations can be tracked effectively. The ability to create notes and search for information will also be developed. |
| Seminar                         | The contents of each chapter will be discussed in seminars by solving exercises and analysis of practical cases. Students will have early enough problem sets through the Moodle platform. We may request delivery of solved exercises.                                 |
| Laboratory practice             | Practices involving the use of software and web resources for the rational design of drugs and / or experiments related for the synthesis of drugs is proposed.                                                                                                         |
| Mixed objective/subjective test | A test with questions related to the contents of the subject will be asked.                                                                                                                                                                                             |

| Personalized attention         |                                                                                                                                    |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Methodologies                  | Description                                                                                                                        |
| Guest lecture / keynote speech | This activity will be headed to the individual assistance for explanations, doubts, as well as to the resolution of the exercises. |
| Laboratory practice            | Part-time students and those with special academic leave permission could ask for presential or email tutorials when necessary.    |
| Seminar                        |                                                                                                                                    |

| Assessment                      |                                                                                                       |                                                                                                                          |               |
|---------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|---------------|
| Methodologies                   | Competencies                                                                                          | Description                                                                                                              | Qualification |
| Mixed objective/subjective test | A1 A9 A13 A14 A15<br>B2 B3 B6 C6 C1                                                                   | The responses in the written exam will be evaluated.                                                                     | 60            |
| Guest lecture / keynote speech  | A1 A9 A10 A13 A14<br>A15 A16 A21 A24<br>A25 B1 B2 B3 B4 B6<br>B7 C1 C3 C4 C6 C7<br>C8                 | Attendance and participation in class will be assessed                                                                   | 5             |
| Laboratory practice             | A9 A13 A14 A15 A16<br>A17 A18 A19 A20<br>A22 A23 A25 A26 B1<br>B2 B3 B4 B6 B7 C1<br>C2 C3 C4 C6 C7 C8 | Attendance and the final report will be assessed.                                                                        | 15            |
| Seminar                         | A1 A9 A10 A13 A14<br>A15 A16 A21 A24<br>A25 B1 B2 B3 B4 B6<br>B7 C1 C3 C4 C6 C7<br>C8                 | The active participation of students in solving the problems of the bulletins and assignment submitted will be assessed. | 20            |

Assessment comments

The assistance to the lectures, seminars and practicals is mandatory. A student can obtain the qualification of "Not presented" if do not realise activities with an upper computation to 50% in the evaluation or not to present to the mixed test. The students will have two opportunities, and those that do not surpass the subject in the first opportunity will conserve the qualification obtained in the seminars and laboratory practicals, and will realise a second mixed test in the determinate dates by the calendar fixed by the Board of Faculty. The students that are evaluated in the second opportunity only will be able to opt to the "matrícula de honor" (highest qualification) if these have not been covered at the first opportunity.

Part-time students or students with special academic permission (according to the rules of the UDC):

The

same evaluation criteria listed above would be applied, but being not mandatory to attend classroom lectures and seminars.

Nevertheless, It is compulsory to attend practical sessions, but it will be tried to fit the dates to the student's availability. When not possible otherwise, these students should exchange the practical activities by tasks related that not require attendance.

The

final grade will be the sum of 15% of the mark obtained in the lab practice and 85% of the mark obtained in the mixed test. The same criteria will be applied to both opportunities.

Students who has not attended the final exam will be assessed as "non attendance".

For all the students, the education-learning process, included the evaluation, refers to an academic course and starts every new academic course, including all the activities and procedures of evaluation programmed.

#### Sources of information

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Basic</b>         | <ul style="list-style-type: none"> <li>- Delgado, A.; Minguillón, C.; Joglar, J. (2002). Introducción a la síntesis de fármacos. Madrid: Síntesis</li> <li>- Avendaño, C (2001). Introducción a la Química Farmacéutica. Madrid: McGraw-Hill</li> <li>- Delgado, A.; Minguillón, C.; Joglar, J. (2003). Introducción a la Química Terapéutica. Madrid: Díaz de Santos</li> <li>- Patrick, G. L (2013). An Introduction to Medicinal Chemistry. 5th ed.. New York: Oxford University Press</li> <li>- Thomas, Gareth (2007). Medicinal Chemistry: An introduction. Wiley</li> <li>- Stevens, E. (2014). Medicinal Chemistry, an Introduction.. Pearson Education. New York.</li> </ul> |
| <b>Complementary</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

#### Recommendations

##### Subjects that it is recommended to have taken before

Organic Chemistry 1/610G01026  
 Organic Chemistry 2/610G01027  
 Intermediate Organic Chemistry/610G01028  
 Advanced Organic Chemistry/610G01030

##### Subjects that are recommended to be taken simultaneously

Final Dissertation/610G01043

##### Subjects that continue the syllabus

##### Other comments

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.