# General skills:

1. To know and understand the biological processes from a molecular, cellular, and physiological point of view.
2. To know and understand the basic facts, concepts, principles, and theories of organisms and their influence on human activities.
3. To use accurately the terminology and classification systems in each course.
4. To understand the scientific method. To know, understand, and apply tools, techniques, and protocols of experimentation in the laboratory and acquire skills of observation and interpreting of the results obtained.
5. To acquire the suitable skills provided in the courses through the description, quantifying, analysis, and critical assessment of the results obtained from experiments.
6. To work appropriately in a biological, chemical, or biochemical laboratory, knowing and applying the standards and techniques related to safety and hygiene, laboratory animal manipulation, and waste management.
7. To culture and manipulate animal and plant cells and microorganisms.
8. To acquire, develop, and apply the main techniques of preparation, staining, and observation of biological specimens.
9. To develop methods of acquisition, interpreting, and analysis of biological information, and be able to understand the appropriate contexts for their use through manuals, monographs, essays, original articles, etc.
10. To use avant-garde scientific and technical literature, acquiring the ability to notice the current progress and the possible future developments.
11. To know the appropriate methods and technologies to explain and communicate the different aspects that affect biotechnology (information analysis, biostatistics, etc.)
12. To be aware of how important is to work in teams and encourage the debate of the common objectives.
13. To be able to get involved in the current biotechnological development and its applications, and also in philosophical and ethical aspects.
14. To be able to communicate with specialists and non-experts in the field and also to make judgements that include a reflection on relevant issues of a social, scientific, or ethical nature.
15. To be able to raise awareness about the importance of the contribution of biotechnology to debates, and how this knowledge improve the opinion on resources quality and sustainability.
16. To be able to organize a research in a way that optimizes resources.
17. To assimilate multidisciplinary knowledge and make judgments based on this knowledge.
18. To demonstrate initiative at work.
19. To develop study habits and reflection skills to seek professional excellence.
20. To be aware of the environmental, economic, and legal consequences of biotechnological processes and products.
21. To develop necessary learning skills to continue studying with a high level of autonomy.
22. To analyze, sythetize, and use the critical thinking in science.
23. To understand the basic mechanisms of analysis and design of top-down and bottom-up methods for problems and complex processes solution.
24. To develop the creativity that encourages dynamism, entrepreneurial and innovative capacity, and the identification of analogies between situations that allows the application of solutions to new problems.
25. To understand that the knowledge acquired is applicable to the professional task of a biotechnologist from a broad and beneficial point of view to society.

26. To know the R&D&I process and be able to connect the knowledge fields of biotechnology, from the biological and physic-chemical principles to the new scientific ones for the development of specific applications and the introduction of new biotechnological products of interest to the market.

## Specific skills:

1. To know the atomic-molecular origin of the properties of matter, pure substances, mixtures, and solutions.
2. To know the laws of thermodynamics and their application to the thermochemical and thermodynamic study of a reaction. To know the concepts of chemical equilibrium and equilibrium constant and identify the factors on which they depend.
3. To know the characteristics of physic-chemical transport processes: diffusion, osmosis, and electrophoresis, etc.
4. To know the concepts of reaction rate and rate constant, and identify the factors on which they depend. To know how to describe the proton and electron transfer reactions, and apply the thermodynamics concepts to their conduct.
5. To know the main principles of surface chemistry and adsorption, and apply the concepts of thermodynamics and kinetics to their description.
6. To know the main functional groups and the main reactions of organic synthesis.
7. To know the main types of isomers in organic compounds and the main separation techniques.
8. To know what a polymer is, its types, and the main polymerization reactions.
9. To know the basis of synthesis of peptides, oligonucleotides, and other biopolymers.
10. To know the basis of spectroscopic methods for the quantitative analysis and structural elucidation of organic compounds.
11. To know the basis of combinatorial chemistry.
12. To understand the cell theory, identify the different cell components, and describe the molecular mechanisms of the main cell processes.
13. To understand the cell-division cycle and the factors that regulate it. To identify and describe the different animal and plant tissues in histological preparations, and differentiate the structures and functions of tissues and organs of animals and plants.
14. To know and understand the animal physiological mechanisms and understand the physiological differences between the different groups of animals.
15. To understand the physiology regulation principles and mechanisms of animals and the relation between structure and function.
16. To master the basic principles of how vascular plants function.
17. To know the basic techniques used in a laboratory of plant physiology.
18. To know the basic techniques of microbiology, such as culture and microscopy, and their applications in microbial growth control and quantification, and in microorganism isolation and identification.
19. To know the microorganism structure diversity, the relations between the microbial structures and its functions, its role, and its applications in biotechnology.
20. To know the basic tools of bacterial genetics and their uses in basic research and biotechnological applications.
21. To know the diversity of animal, bacterial, and plant viruses, and their interaction with hosts.
22. To know the replication cycle of diverse types of viruses depending on the type of genome and the different steps of their interaction with the host cell to replicate and to colonize new hosts.
23. To understand the virus and cell interaction, steps, and types of virus infection, and cellular alterations provoked due to a virus infection.
24. To understand appropriately the concept of measure in science, including the correct use of the system of measurement and the meaning and management of measurement error.

25. To use and know how to inconvert the different types of mathematical notations, and negative exponents, decimals, and logarithms.
26. To master numerical and error analysis.
27. To formulate and solve algebraic equations and systems of linear equations.
28. To understand the basis of computing.
29. To learn the statistical concepts and methods applied to biotechnology.
30. To learn the different sampling and field research techniques.
31. To know how to apply analytical methods and their guidelines for validation.
32. To know the main analysis and quantification methods of biomolecules and biopolymers.
33. To know the basis of the programming language in Perl and script languages in Linux and all the possibilities of script languages.
34. To know the main groups of techniques used in genomics, functional genomics, transcriptomics, proteomics, enzymomics, interactomics, localisome, and metabolomics, and differentiate them.
35. To solve problems related to kinetic constant of an enzyme and the effect of activators and inhibitors on enzyme kinetics.
36. To know the basic elements of physiological activities (transport, chemotaxis).
37. To know the different types of extremophiles, its adaptations, and its application in biotechnology.
38. To know the basis of the methods used in plant breeding.
39. To know the applications of cell culture of plants and genetically modified plants in biotechnology.
40. To know the main functions and products of microorganisms and their interest in biotechnology.
41. To know examples of microorganisms applications in food biotechnology, environmental biotechnology, biocatalysis, agrobiotechnology, and biomedicine.
42. To understand the importance of the biotechnological systems based on cell culture.
43. To keep tidy the cell storage systems and the place of work.
44. To know the scales and development of biotechnological processes according to economic parameters.
45. To know the current legislation of biotechnology at the European and Spanish level: diversity of laws; to distinguish the preferential approach of application.
46. To know the Spanish public administrations related to biotechnology: of the state and of the autonomous communities. To know the special position of the Spanish food safety organism (Agencia Española de Seguridad Alimentaria).
47. To know how the Spanish legal system addresses the genetically modified organisms (GMOs), in the framework of law, human health, and sustainable environment: administrative authorization procedures.
48. To know the main problems of bioethics in public health, the production, and management of food and medicines, transplant, genetics, assisted reproductive technology, euthanasia, drugs, etc.
49. To know the methodology of projects design, management, and assessment.
50. To solve problems in genetics, being able to assess, interpret, and apply the result obtained to give an answer or a conclusion.
51. To know how to design and carry out an experimental methodology of laboratory to solve problems in genetics using model organisms, methods, and typical equipment of a basic experimental level.
52. To know how to explain physiology concepts, in particular, the interactions between systems and mechanisms of feedback.
53. To be able to use the basic techniques of microbiology, culture cell, and microscopy methods, and apply this knowledge in microbial growth control and quantification.
54. To know how to use basic tools of bacterial genetics and how to apply them to basic research and biotechnology.
55. To know the different types of immune response and the functions of the involved cell types. To know the different factors that triggered the types of immune response and its importance for the development of vaccines.

56. To know and identify the physical processes involved in biotechnology, their basis, especially in applications related to engineering and analytical techniques.
57. To calculate appropriately the relevant parameters of a process or experiment through manual representation of experimental information on millimeter graph paper, and logarithmic graph papers.
58. To solve limits, derivatives, and integrals problems in experiments.
59. To master and solve problems related to differential equations and numerical methods in experiments.
60. To know how to use some computing tools to solve mathematical and statistical problems (Excel, SPSS), and to use appropriately the scientific calculator.
61. To use the most usual operating systems to solve basic calculations.
62. To design medium-complexity algorithms to solve computing problems.
63. To design and encrypt simple computer programs in a programming language.
64. To identify the appropriate technique for each analytical problem and assess their advantages and disadvantages comparing alternative techniques.
65. To access to molecular databases to get information from them.
66. To analyse groups of molecular sequences through making multiple sequence alignments and consulting databases of domains and motifs.
67. To predict and visualize protein structures.
68. To process information from omics experiments.
69. To create small computer programs with Perl and scripts in Linux.
70. To deduce possible functions of genes, proteins, and metabolites depending on expression, interaction, location, or phenotypes of loss of functionality.
71. To differentiate the types of macromolecules based on their function, structure, and know the purification procedures.
72. To explain, in a scientific language, the basis of thermodynamics of bioenergetics and membrane transport.
73. To describe, integrate, and solve problems on the different metabolic pathways and their control mechanisms.
74. To be able to measure different metabolic activities, understand and interpret the results of activities related to metabolic pathways, organisms, and defined conditions of growth, in nature or in experiments, and connect them to biotechnological applications such as biodegradation of polluting or production of interest metabolites.
75. To be able to understand and interpret experiment results to clarify microbial metabolism regulation, and predict the results of the modification of metabolic pathways and their regulation in relation to biotechnological processes.
76. To be able to understand and interpret experiment results to clarify the functioning of different microbial physiological processes, and suggest biotechnological applications of some of these processes.
77. To design genetic strategies to solve a biological problem.
78. To deduce metabolic pathways from mutant phenotypes and expression changes.
79. To design and carry out appropriate strategies to obtain recombinant DNA with different objectives and to modify DNA in vitro.
80. To design and carry out appropriate strategies to obtain genetically modified organisms.
81. To design and carry out the different steps of protein purification protocol.
82. To design and carry out the different steps of a protein purification protocol of DNA and RNA of a biological specimen, and determine its sequencing.
83. To distinguish processes susceptible of animal breeding based on scientific arguments and natural selection assisted by genetic markers.
84. To design strategies of animal genotype and chose genes through biomic technology.
85. To design strategies to generate genetically modified animals or animal cells.
86. To apply the basis of the techniques and methods used in plant breeding.
87. To master tools to manipulate microorganisms and design manipulation strategies to improve biotechnological processes.

88. To calculate, interpret, and rationalize the relevant parameters in transport phenomena and mass and energy balances in bio-industrial processes.
89. To create, maintain, and manipulate different types of cell cultures through different methods.
90. To integrate well the basis of life and engineering science in the development of products and applications.
91. To design and carry out appropriately a complete protocol of obtaining and purification of a biotechnological product.
92. To design industrial separation processes.
93. To develop and control bioprocesses.
94. To design and handle bioreactors at laboratory-scale.
95. To establish the models to explain and predict the cell and enzymatic variables. (Cell growth and cell and enzyme activity).To deduce basic kinetic and stoichiometric equations.
96. To use appropriately the equipment of biotechnological production at pilot-scale or superior, and know and apply the action and security protocol in an industrial plant.
97. To apply the scales and development of biotechnological processes according to economic parameters.
98. To propose a design problem, identify and delimit it. To suggest resolution alternatives and chose the most adequate for the problem. To solve the problem, and explain the solution in a scientific way.
99. To get into ethical principles in business field and analyze practical cases where ethic issues are involved.
100. To write projects on biotechnological processes, and use appropriately the computing tools of project management.
101. To understand the reality of the biotechnology business and its competitive environment. To be able to analyze the most important decisions related to the different business subsystems and the application of different methods and techniques that support those decisions.