



| Teaching Guide | | | | |
|--------------------------|---|--------|--|---------|
| Identifying Data | | | | 2021/22 |
| Subject (*) | Stem Cells and Cell Therapy | Code | 610441010s | |
| Study programme | Máster Universitario en Bioloxía Molecular, Celular e Xenética (semipresencial) | | | |
| Descriptors | | | | |
| Cycle | Period | Year | Type | Credits |
| Official Master's Degree | 2nd four-month period | First | Optional | 3 |
| Language | SpanishGalicianEnglish | | | |
| Teaching method | Hybrid | | | |
| Prerequisites | | | | |
| Department | BioloxíaCiencias Biomédicas, Medicina e FisioterapiaDepartamento profesorado másterFisioterapia, Medicina e Ciencias Biomédicas | | | |
| Coordinador | Arufe Gonda, María del Carmen | E-mail | maria.arufe@udc.es | |
| Lecturers | Arufe Gonda, María del Carmen Blanco García, Francisco Javier Doménech García, María Nieves Fafián Labora, Juan Antonio Rendal Vazquez, Maria Esther Silva Magalhães, Joana Cristina | E-mail | maria.arufe@udc.es fblagar@sergas.es nieves.domenech@col.udc.es juan.labora@udc.es esther.rendal.vazquez1@udc.es joana.magalhaes@udc.es | |
| Web | | | | |
| General description | Subject's coordinator :María del Carmen Arufe Gonda maria.arufe@udc.es Teachers from INIBIC: Dr. Fco. Javier Blanco García (fblagar@sergas.es) Dra. Nieves Domenech García (nieves.domenech.garcia@sergas.es) Dra. Mª Esther Rendal Vázquez | | | |
| Contingency plan | 1. Modifications to the contents : NO 2. Methodologies *Teaching methodologies that are maintained *Teaching methodologies that are modified NONE 3. Mechanisms for personalized attention to students: ON LINE 4. Modifications in the evaluation: TEAMS *Evaluation observations: 5. Modifications to the bibliography or webgraphy NO | | | |

| Study programme competences | |
|-----------------------------|---|
| Code | Study programme competences |
| A6 | Skills of understanding the functioning of cells through the structural organization, biochemistry, gene expression and genetic variability. |
| A7 | Skills of knowing and analyzing specific cellular systems as stem cells, nerve cells, cells of the immune system, or other cells related to several pathologies. |
| A8 | Skills of having an integrated view of the previously acquired knowledge about Molecular and Cellular Biology and Genetics, with an interdisciplinary approach and experimental work. |



| | |
|----|---|
| B1 | Analysis skills to understand biological problems in connection with the Molecular and Cellular Biology and Genetics. |
| B3 | Skills of management of the information: that are able to gather and to understand relevant information and results, obtaining conclusions and to prepare reasoned reports on scientific and biotechnological questions |
| B4 | Organization and work planning skills: that are able to manage the use of the time as well as available resources and to organize the work in the laboratory. |
| B8 | Critical reasoning skills and ethical commitment with the society: sensitivity in front of bioethical problems and to the ones related to the natural resource conservation |
| C1 | Ability to express oneself correctly, both orally and in writing, in the official languages of the autonomous community |
| C6 | Acquiring skills for healthy lifestyles, and healthy habits and routines. |
| C8 | Valuing the importance of research, innovation and technological development for the socioeconomic and cultural progress of society. |

| Learning outcomes | | | | |
|----------------------------------|--|-----------------------------|-----|-----|
| Learning outcomes | | Study programme competences | | |
| The study of cellular techniques | | AR6 | BR1 | CC1 |
| | | AR7 | BR3 | CC6 |
| | | AR8 | BR4 | CC8 |
| | | | BR8 | |

| Contents | |
|--------------------------------------|--|
| Topic | Sub-topic |
| Introduction | Culture area for cell therapy. Stem cells and therapy basic cell. Embryonic stem cells and therapeutic cloning. |
| Search cell sources for cell therapy | Obtaining mesenchymal stem cells from umbilical strome. Cell therapy in cartilage recovery. Cell therapy in myocardial recovery. Culture of ocular limbal cells to repair |
| Tissue Engineering | Transplantation of tissue-engineered skin produced. Scaffolds and Biopolymers in tissue engineering. |

| Planning | | | | |
|--------------------------------|----------------|----------------------|-------------------------------|-------------|
| Methodologies / tests | Competencies | Ordinary class hours | Student?s personal work hours | Total hours |
| Guest lecture / keynote speech | A6 A7 A8 B1 B3 | 12 | 30 | 42 |
| Laboratory practice | B4 B8 C1 | 7 | 0 | 7 |
| Seminar | C6 | 1 | 7 | 8 |
| Objective test | C8 | 1 | 17 | 18 |
| Personalized attention | | 0 | 0 | 0 |

(*)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 | Lecture participatory, encouraging the exchange of views, debate and answer questions from students. |
| Laboratory practice | They unfold techniques currently used in biomedical research, complementing the knowledge imparted in the keynote session. |
| Seminar | Invitation some scientist to show us her most recent research. |
| Objective test | Multiple choice exam in which each question consists of 4 claims of which only one is correct. |

| Personalized attention |
|------------------------|
|------------------------|



| Methodologies | Description |
|-----------------------------------|---|
| Guest lecture / keynote speech | Being a small group of students, it is possible to resolve doubts and individualized monitoring during the learning process itself. |
| Laboratory practice | In particular, the master class is participatory, encouraging the exchange of opinions, debate and answer questions. The students in labs are supervised at all times by teachers and, if necessary, by the research group in which the student integrates. Students with part-time dedication or waiver of presence should contact the teachers of the subject in the early going to establish a schedule of activities to acquire and evaluate in a complementary way the competences. |

| Assessment | | | |
|-----------------------------------|----------------|---|---------------|
| Methodologies | Competencies | Description | Qualification |
| Guest lecture / keynote speech | A6 A7 A8 B1 B3 | Attendance and participation | 15 |
| Objective test | C8 | Questions about the theory and methodology used in the class. | 40 |
| Seminar | C6 | Reading and discussion commented. This activity will be assessed the acquisition of skills A18, B1, B3, B4, B8. | 15 |
| Laboratory practice | B4 B8 C1 | Attendance and participation. This activity will be assessed the acquisition of skills A3, A4, A6, A9, A10 | 30 |

| Assessment comments |
|--|
| Students with part-time dedication or waiver attendance may choose to be evaluated in a final exam if they do not qualify for continuous evaluation. |

| Sources of information |
|------------------------|
| Basic |



Complementary

1 Lawrence, R. C. et al. Estimates of the prevalence of arthritis and other rheumatic conditions in the United States. Part II. *Arthritis Rheum* 58, 26-35, doi:10.1002/art.23176 (2008). 2 Arufe, M. C., De la Fuente, A., Fuentes-Boquete, I., De Toro, F. J. & Blanco, F. J. Differentiation of synovial CD-105(+) human mesenchymal stem cells into chondrocyte-like cells through spheroid formation. *J Cell Biochem* 108, 145-155, doi:10.1002/jcb.22238 (2009). 3 Csaki, C., Matis, U., Mobasher, A., Ye, H. & Shakibaei, M. Chondrogenesis, osteogenesis and adipogenesis of canine mesenchymal stem cells: a biochemical, morphological and ultrastructural study. *Histochem Cell Biol* 128, 507-520, doi:10.1007/s00418-007-0337-z (2007). 4 Carlson, C. S., Loeser, R. F., Purser, C. B., Gardin, J. F. & Jerome, C. P. Osteoarthritis in cynomolgus macaques. III: Effects of age, gender, and subchondral bone thickness on the severity of disease. *J Bone Miner Res* 11, 1209-1217 (1996). 5 Olson, E. J., Lindgren, B. R. & Carlson, C. S. Effects of long-term estrogen replacement therapy on the prevalence and area of periarticular tibial osteophytes in surgically postmenopausal cynomolgus monkeys. *Bone* 41, 282-289, doi:S8756-3282(07)00355-9 [pii] 10.1016/j.bone.2007.04.175 (2007). 6 Ham, K. D., Loeser, R. F., Lindgren, B. R. & Carlson, C. S. Effects of long-term estrogen replacement therapy on osteoarthritis severity in cynomolgus monkeys. *Arthritis Rheum* 46, 1956-1964, doi:10.1002/art.10406 (2002). 7 Tang, C. H. et al. Bone-derived SDF-1 stimulates IL-6 release via CXCR4, ERK and NF-kappaB pathways and promotes osteoclastogenesis in human oral cancer cells. *Carcinogenesis* 29, 1483-1492, doi:bgn045 [pii] 10.1093/carcin/bgn045 (2008). 8 Mateos, J. et al. Lamin A deregulation in human mesenchymal stem cells promotes an impairment in their chondrogenic potential and imbalance in their response to oxidative stress. *Stem Cell Res* 11, 1137-1148, doi:10.1016/j.scr.2013.07.004 (2013). 9 Ramallal, M. et al. Xenotransplantation of pig chondrocytes into rabbit to treat localized articular cartilage defects: an animal model. *Wound Repair Regen* 12, 337-345, doi:10.1111/j.1067-1927.2004.012309.x WRR12309 [pii] (2004). 10 Liechty, K. W. et al. Human mesenchymal stem cells engraft and demonstrate site-specific differentiation after in utero transplantation in sheep. *Nat Med* 6, 1282-1286, doi:10.1038/81395 (2000). 11 MacDonald, D. J. et al. Persistence of marrow stromal cells implanted into acutely infarcted myocardium: observations in a xenotransplant model. *J Thorac Cardiovasc Surg* 130, 1114-1121, doi:S0022-5223(05)00975-X [pii] 10.1016/j.jtcvs.2005.04.033 (2005). 12 Grinnemo, K. H. et al. Xenoreactivity and engraftment of human mesenchymal stem cells transplanted into infarcted rat myocardium. *J Thorac Cardiovasc Surg* 127, 1293-1300, doi:10.1016/j.jtcvs.2003.07.037 S0022522303015137 [pii] (2004). 13 Chen, F. H. & Tuan, R. S. Mesenchymal stem cells in arthritic diseases. *Arthritis Res Ther* 10, 223, doi:ar2514 [pii] 10.1186/ar2514 (2008). 14 Hunziker, E. B. Articular cartilage repair: basic science and clinical progress. A review of the current status and prospects. *Osteoarthritis Cartilage* 10, 432-463, doi:10.1053/joca.2002.0801 S1063458402908010 [pii] (2002). 15 Koch, T. G. & Betts, D. H. Stem cell therapy for joint problems using the horse as a clinically relevant animal model. *Expert Opin Biol Ther* 7, 1621-1626, doi:10.1517/14712598.7.11.1621 (2007). 16 Arufe, M. C., De la Fuente, A., Fuentes-Boquete, I., De Toro, F. J. & Blanco, F. J. Differentiation of synovial CD-105(+) human mesenchymal stem cells into chondrocyte-like cells through spheroid formation. *J Cell Biochem*, doi:10.1002/jcb.22238 (2009). 17 Karlsson, C., Thornemo, M., Henriksson, H. B. & Lindahl, A. Identification of a stem cell niche in the zone of Ranvier within the knee joint. *J Anat*, doi:JOA1115 [pii] 10.1111/j.1469-7580.2009.01115.x (2009). 18 Grogan, S. P., Miyaki, S., Asahara, H., D'Lima, D. D. & Lotz, M. K. Mesenchymal progenitor cell markers in human articular cartilage: normal distribution and changes in osteoarthritis. *Arthritis Res Ther* 11, R85, doi:ar2719 [pii] 10.1186/ar2719 (2009). 19 Isakova, I. A., Baker, K., Dufour, J., Gaupp, D. & Phinney, D. G. Preclinical evaluation of adult stem cell engraftment and toxicity in the CNS of rhesus macaques. *Mol Ther* 13, 1173-1184, doi:S1525-0016(06)00012-8 [pii] 10.1016/j.ymthe.2005.12.014 (2006). 20 Mundy, G. R. Metastasis to bone: causes, consequences and therapeutic opportunities. *Nat Rev Cancer* 2, 584-593, doi:10.1038/nrc867 nrc867 [pii] (2002). 21 Taichman, R. S. et al. Use of the stromal cell-derived factor-1/CXCR4 pathway in prostate cancer metastasis to bone. *Cancer Res* 62, 1832-1837 (2002). 22 Heng, B. C. et al. Trans-Catheter Injection Induced Changes in Human Bone Marrow-Derived Mesenchymal Stem Cells. *Cell Transplant*, doi:ct2093heng [pii] 10.3727/096368909X12483162197006 (2009). 1 Lawrence, R. C. et al. Estimates of the prevalence of arthritis and other rheumatic conditions in the United States. Part II. *Arthritis Rheum* 58, 26-35, doi:10.1002/art.23176 (2008). 2 Arufe, M. C., De la Fuente, A., Fuentes-Boquete, I., De Toro, F. J. & Blanco, F. J. Differentiation of synovial CD-105(+) human mesenchymal stem cells into chondrocyte-like cells through spheroid formation. *J Cell Biochem* 108, 145-155, doi:10.1002/jcb.22238 (2009). 3 Csaki, C., Matis, U., Mobasher, A., Ye, H. & Shakibaei, M. Chondrogenesis, osteogenesis and adipogenesis of canine mesenchymal stem cells: a biochemical, morphological



and ultrastructural study. *Histochem Cell Biol* 128, 507-520, doi:10.1007/s00418-007-0337-z (2007). 4 Carlson, C. S., Loeser, R. F., Purser, C. B., Gardin, J. F. & Jerome, C. P. Osteoarthritis in cynomolgus macaques. III: Effects of age, gender, and subchondral bone thickness on the severity of disease. *J Bone Miner Res* 11, 1209-1217 (1996). 5 Olson, E. J., Lindgren, B. R. & Carlson, C. S. Effects of long-term estrogen replacement therapy on the prevalence and area of periarticular tibial osteophytes in surgically postmenopausal cynomolgus monkeys. *Bone* 41, 282-289, doi:S8756-3282(07)00355-9 [pii] 10.1016/j.bone.2007.04.175 (2007). 6 Ham, K. D., Loeser, R. F., Lindgren, B. R. & Carlson, C. S. Effects of long-term estrogen replacement therapy on osteoarthritis severity in cynomolgus monkeys. *Arthritis Rheum* 46, 1956-1964, doi:10.1002/art.10406 (2002). 7 Tang, C. H. et al. Bone-derived SDF-1 stimulates IL-6 release via CXCR4, ERK and NF-kappaB pathways and promotes osteoclastogenesis in human oral cancer cells. *Carcinogenesis* 29, 1483-1492, doi:bgn045 [pii] 10.1093/carcin/bgn045 (2008). 8 Mateos, J. et al. Lamin A deregulation in human mesenchymal stem cells promotes an impairment in their chondrogenic potential and imbalance in their response to oxidative stress. *Stem Cell Res* 11, 1137-1148, doi:10.1016/j.scr.2013.07.004 (2013). 9 Ramallal, M. et al. Xenotransplantation of pig chondrocytes into rabbit to treat localized articular cartilage defects: an animal model. *Wound Repair Regen* 12, 337-345, doi:10.1111/j.1067-1927.2004.012309.x WRR12309 [pii] (2004). 10 Liechty, K. W. et al. Human mesenchymal stem cells engraft and demonstrate site-specific differentiation after in utero transplantation in sheep. *Nat Med* 6, 1282-1286, doi:10.1038/81395 (2000). 11 MacDonald, D. J. et al. Persistence of marrow stromal cells implanted into acutely infarcted myocardium: observations in a xenotransplant model. *J Thorac Cardiovasc Surg* 130, 1114-1121, doi:S0022-5223(05)00975-X [pii] 10.1016/j.jtcvs.2005.04.033 (2005). 12 Grinnemo, K. H. et al. Xenoreactivity and engraftment of human mesenchymal stem cells transplanted into infarcted rat myocardium. *J Thorac Cardiovasc Surg* 127, 1293-1300, doi:10.1016/j.jtcvs.2003.07.037 S0022522303015137 [pii] (2004). 13 Chen, F. H. & Tuan, R. S. Mesenchymal stem cells in arthritic diseases. *Arthritis Res Ther* 10, 223, doi:ar2514 [pii] 10.1186/ar2514 (2008). 14 Hunziker, E. B. Articular cartilage repair: basic science and clinical progress. A review of the current status and prospects. *Osteoarthritis Cartilage* 10, 432-463, doi:10.1053/joca.2002.0801 S1063458402908010 [pii] (2002). 15 Koch, T. G. & Betts, D. H. Stem cell therapy for joint problems using the horse as a clinically relevant animal model. *Expert Opin Biol Ther* 7, 1621-1626, doi:10.1517/14712598.7.11.1621 (2007). 16 Arufe, M. C., De la Fuente, A., Fuentes-Boquete, I., De Toro, F. J. & Blanco, F. J. Differentiation of synovial CD-105(+) human mesenchymal stem cells into chondrocyte-like cells through spheroid formation. *J Cell Biochem*, doi:10.1002/jcb.22238 (2009). 17 Karlsson, C., Thornemo, M., Henriksson, H. B. & Lindahl, A. Identification of a stem cell niche in the zone of Ranvier within the knee joint. *J Anat*, doi:JOA1115 [pii] 10.1111/j.1469-7580.2009.01115.x (2009). 18 Grogan, S. P., Miyaki, S., Asahara, H., D'Lima, D. D. & Lotz, M. K. Mesenchymal progenitor cell markers in human articular cartilage: normal distribution and changes in osteoarthritis. *Arthritis Res Ther* 11, R85, doi:ar2719 [pii] 10.1186/ar2719 (2009). 19 Isakova, I. A., Baker, K., Dufour, J., Gaupp, D. & Phinney, D. G. Preclinical evaluation of adult stem cell engraftment and toxicity in the CNS of rhesus macaques. *Mol Ther* 13, 1173-1184, doi:S1525-0016(06)00012-8 [pii] 10.1016/j.ymthe.2005.12.014 (2006). 20 Mundy, G. R. Metastasis to bone: causes, consequences and therapeutic opportunities. *Nat Rev Cancer* 2, 584-593, doi:10.1038/nrc867 nrc867 [pii] (2002). 21 Taichman, R. S. et al. Use of the stromal cell-derived factor-1/CXCR4 pathway in prostate cancer metastasis to bone. *Cancer Res* 62, 1832-1837 (2002). 22 Heng, B. C. et al. Trans-Catheter Injection Induced Changes in Human Bone Marrow-Derived Mesenchymal Stem Cells. *Cell Transplant*, doi:ct2093heng [pii] 10.3727/096368909X12483162197006 (2009).



Recommendations

Subjects that it is recommended to have taken before

Cellular Techniques/610441001

Subjects that are recommended to be taken simultaneously

Molecular Techniques/610441002

Subjects that continue the syllabus

Advanced Cellular Biology/610441003

Other comments

<p>Para axudar a conseguir una contorna inmediata sustentable e cumprir o obxectivo estratéxico 9 do I Plan de Sustentabilidade Medio-ambiental Green Campus FCS, todos os traballos documentais que se realicen nesta materia serán entregados a través de Moodle, en formato dixital, sen necesidade de imprimilos. De realizarse en papel: - Non se empregarán plásticos. - Realizaranse impresións a dobre cara. - Empregarase papel reciclado. - Evitarase imprimir borradores. </p>

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