The objective is that the student acquires knowledge of the applications of biomaterials in medicine and, therefore, be able to relate properties and biological response of biomaterials and apply selection criteria to determine the more suitable for application. In addition, the different techniques of biological characterization in vitro and in vivo of biomaterials are described, as well as the interpretation of the results obtained through the different techniques. The
specific objectives are:
- Review the different types of biomaterials, their characteristics and biocompatibility.
- Knowledge of the basic principles of biological characterization in vitro and in vivo to evaluate biocompatibility of biomaterials.
- Description of the main applications of biomaterials in medicine

<table>
<thead>
<tr>
<th>Study load</th>
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</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong> 150h</td>
<td></td>
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<tr>
<td>Hours large group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>Hours medium group:</td>
<td>28h</td>
<td>18.67%</td>
</tr>
<tr>
<td>Hours small group:</td>
<td>14h</td>
<td>9.33%</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>6h</td>
<td>4.00%</td>
</tr>
<tr>
<td>Self study:</td>
<td>102h</td>
<td>68.00%</td>
</tr>
</tbody>
</table>
## Content

### Evaluation of the cell / biomaterial interaction

**Learning time:** 35h  
- Practical classes: 6h  
- Laboratory classes: 3h  
- Guided activities: 2h  
- Self study: 24h

**Description:**
- Cell / biomaterial interaction, biocompatibility  
- Type of cell cultures: primary crop, secondary crop, cultivation  
- Basic cellular responses: adhesion, proliferation, differentiation and apoptosis  
- Evaluation of the cytotoxicity of a biomaterial: measurements of metabolic activity (LDH, MTT) and trials based on the principle of cell exclusion (immunofluorescence, ELISA)  
- Evaluation of the bacterial / biomaterial interaction  
- Evaluation of blood / biomaterial interaction

### Biomedical materials for cardiovascular applications

**Learning time:** 29h  
- Practical classes: 5h  
- Laboratory classes: 4h  
- Guided activities: 1h  
- Self study: 19h

**Description:**
- Cardiovascular diseases; Endothelialization and thrombogenicity  
- Cardiovascular stents  
- Heart valves  
- Cardiovascular grafts

### Biomedical materials for dental and orthopedic applications

**Learning time:** 34h  
- Practical classes: 6h  
- Laboratory classes: 3h  
- Guided activities: 1h  
- Self study: 24h

**Description:**
- Biomaterials for bone replacement: inert metals and ceramics  
- Dental implants. Prosthesis of hip and knee. Osteoisynthesis materials: plates and screws. Intervertebral disc  
- Biomaterials for bone regeneration: bioceramics and bioavailable  
- Biomaterials for condral repair and regeneration. Tissue engineering applied to orthopedic and maxillofacial surgery

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- Biomaterials for bone replacement: inert metals and ceramics  
- Dental implants. Prosthesis of hip and knee. Osteoisynthesis materials: plates and screws. Intervertebral disc  
- Biomaterials for bone regeneration: bioceramics and bioavailable  
- Biomaterials for condral repair and regeneration. Tissue engineering applied to orthopedic and maxillofacial surgery
### Biomedical materials for ophthalmic applications, skin, adhesives and sutures

<table>
<thead>
<tr>
<th>Learning time: 27h</th>
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</thead>
<tbody>
<tr>
<td>Practical classes: 6h</td>
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<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td>Guided activities: 1h</td>
</tr>
<tr>
<td>Self study: 18h</td>
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</table>

**Description:**
- Biomaterials for ophthalmic applications: Anatomy of the eye; soft and hard contact lenses; intraocular lenses; corneal implants
- Biomaterials for applications for skin replacement: Structure of the dermis; permanent and reabsorbable implants; tissue engineering applied to skin regeneration
- Adhesives, sealants and sutures: adhesion mechanisms; composition and characteristics of adhesive materials; stickers for soft tissue; adhesives for hard tissues; natural and synthetic sutures

### Materiales biomédicos para la liberación controlada de fármacos

<table>
<thead>
<tr>
<th>Learning time: 25h</th>
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<tbody>
<tr>
<td>Practical classes: 5h</td>
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</tr>
<tr>
<td>Guided activities: 1h</td>
</tr>
<tr>
<td>Self study: 17h</td>
</tr>
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</table>

**Description:**
- Control of the release of a drug, between effectiveness and toxicity
- Control of release for dissemination
- Liberation control systems by penetration of water to the device
- Chemically controlled devices

### Qualification system

\[ N_{final} = 0.40 \times N_{ex \ final} + 0.40 \times N_{ex \ midterm} + 0.10 \times N_{Laboratory} + 0.10 \times N_{Work} \]

In case of reassessment, \[ N_{final} = 0.80 \times N_{ex \ reassessment} + 0.10 \times N_{Laboratory} + 0.10 \times N_{Work} \]
Bibliography

Basic:


Complementary:


Others resources:

Audiovisual material
Presentacions en PPT
Presentations in PPT