Fracture healing and plate fixation  
**Mechanics of interfragmentary tissues**

### Tasks

1a. Slowly pull granulation model horizontally from one side

1b. Note degree of cell deformation as a function of initial gap width

2. Use foam model to demonstrate how deforming forces produce different strain levels between gaps in various fracture configurations.

### Learning objectives

- Define absolute and relative stability
- Define the importance of initial gap width onto cell deformation under the condition of relative stability
- Explain the effect of deforming forces on tissue strain

### Take-home message

Under relative stability the cells in a small fracture gap can be destroyed because of too high strain (Perren’s strain theory)

### Model

Granulation tissue with cells between two bone fragments

### Cell deformation under traction

- Numbers indicate cell diameter units
- In each step, the gap is increased by 1 unit
- Relative deformation of the cells is shown

### Cell deformation under bending

Compression or distraction of cells in the gap under bending

- Cell destruction when elongation exceeds one cell unit
Fracture healing and plate fixation

**Stiffness of composite beam systems under load**

**Tasks**
- Compare stiffness of beam models

**Learning objectives**
- Describe the bending stiffness of isolated beams with respect to composite beams
- Recognize plate fixation of fractures as a composite beam system
- Describe importance of plate position on overall stiffness of internal fixation using plates

**Take-home message**
- Plate alone is relatively weak
- Stiffness of plate depends on bending direction
- Important increase of bending stiffness when bone and plate are tightly connected
- Composite system with plate on tension side is the most rigid construct under the condition that the fracture can be axially loaded

**In plate osteosynthesis stiffness¹ and strength² depend on these elements**

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<th>Factors</th>
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<td>Plate</td>
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¹ stiffness = the ability of a material to withstand deformation
² strength = the ability of a material to withstand destruction