AO TRAUMA

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

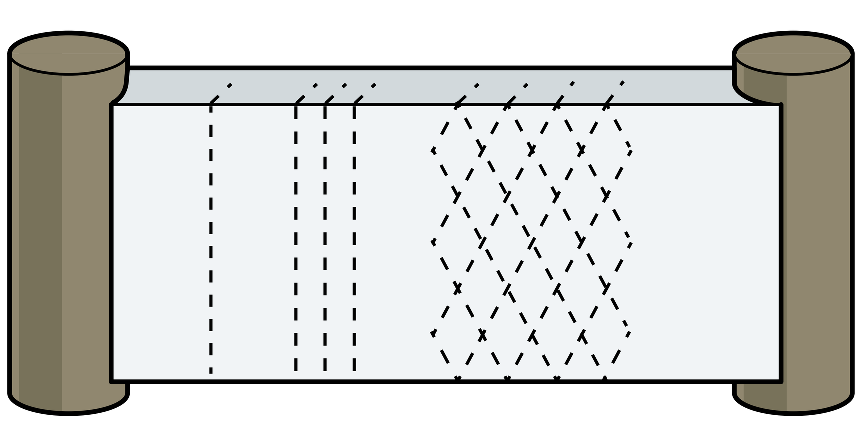
2 Use foam model to demonstrate how deforming forces produce different strain levels between gaps in various fracture configurations.

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

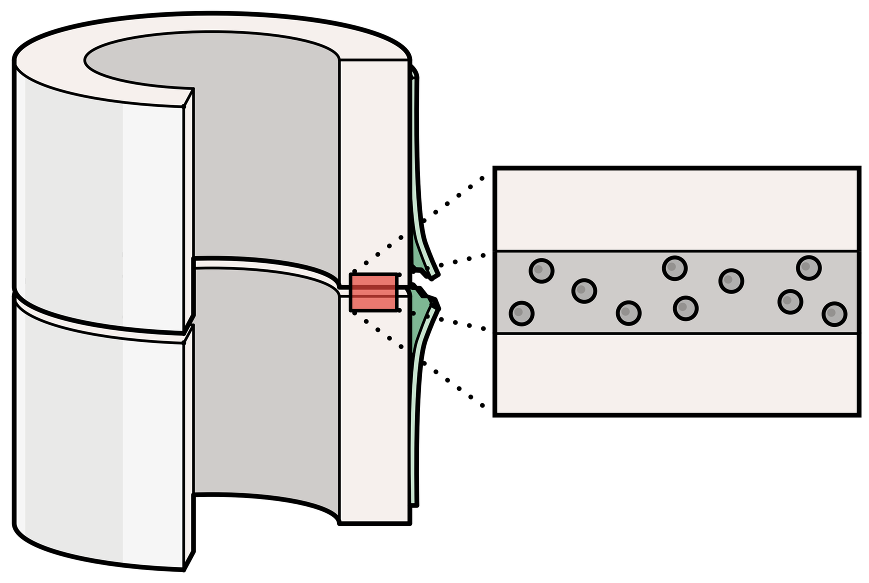
Take-home message

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



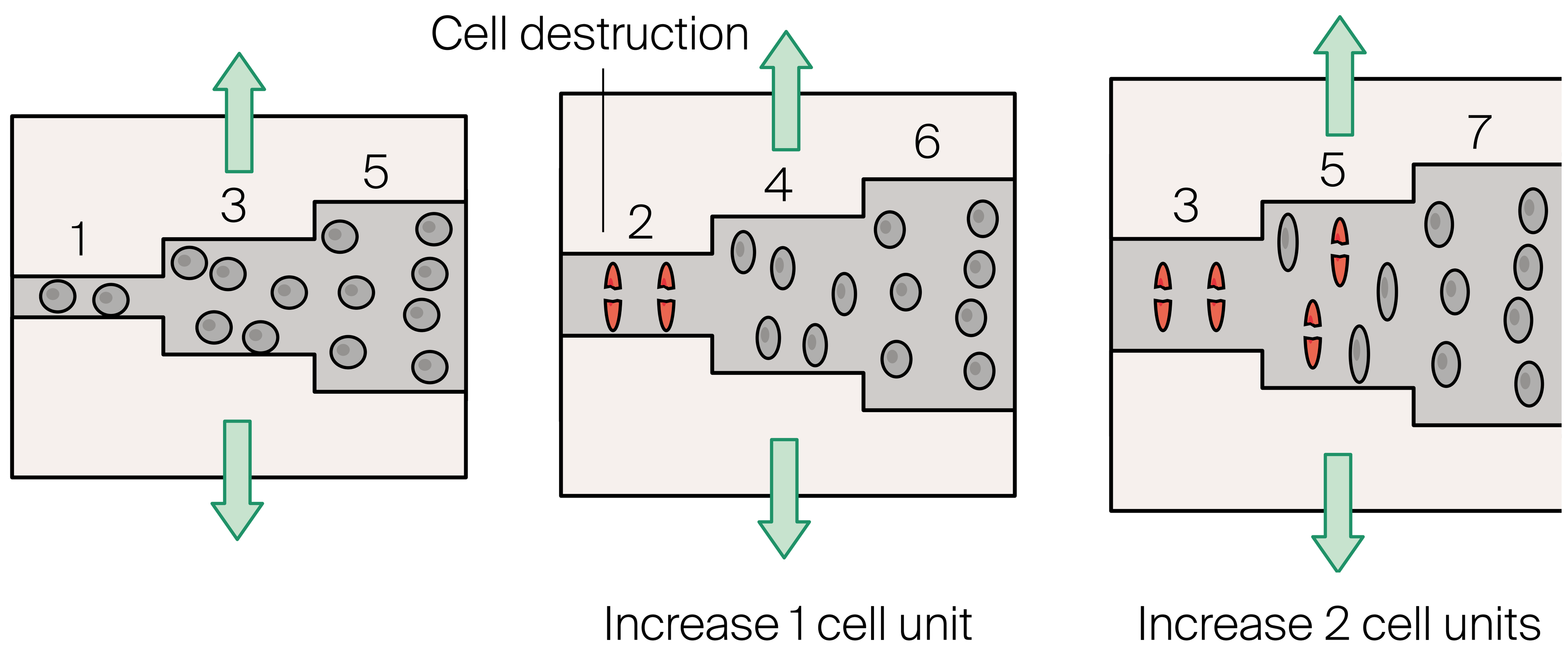
Model

Granulation tissue with cells between two bone fragments



Cell deformation under traction

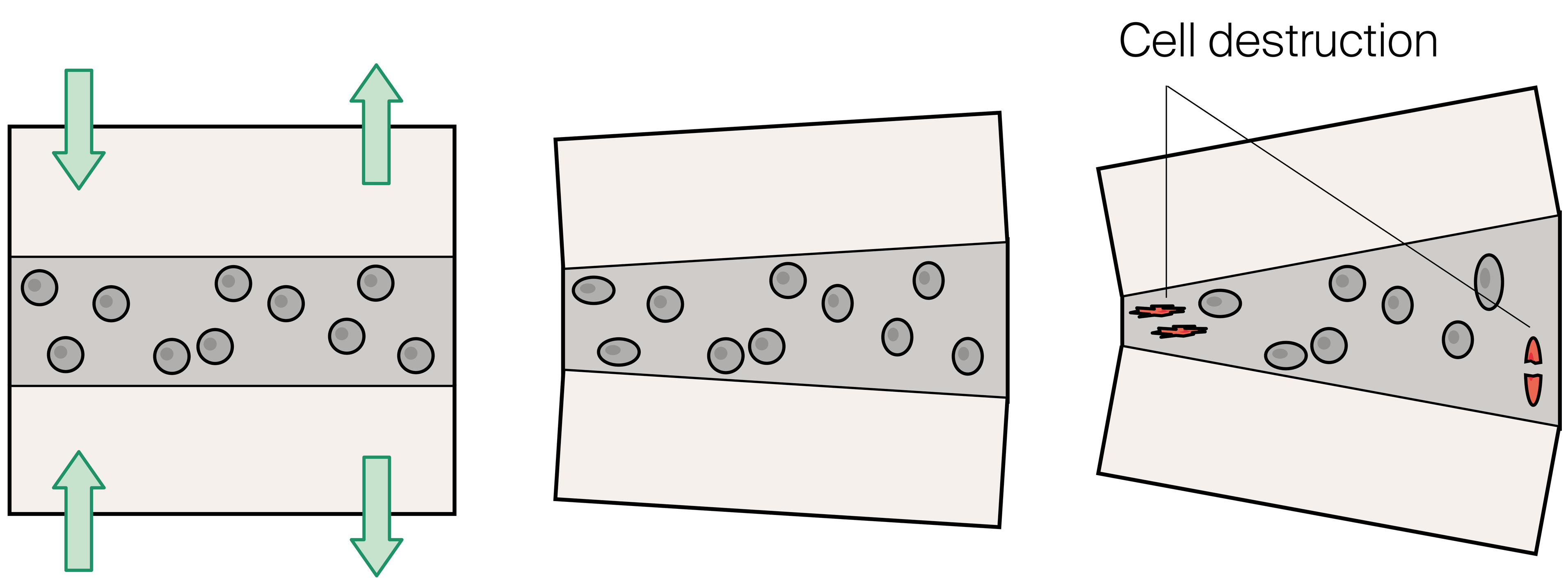
- Numbers indicate cell diameter units
- In each step, the gap is increased by 1 unit
- Relative deformation of the cells is shown



Cell deformation under bending

Compression or distraction of cells in the gap under bending

- Cell destruction when elongation exceeds one cell unit



AO TRAUMA

Fracture healing and plate fixation

Stiffness of composite beam systems under load

Tasks

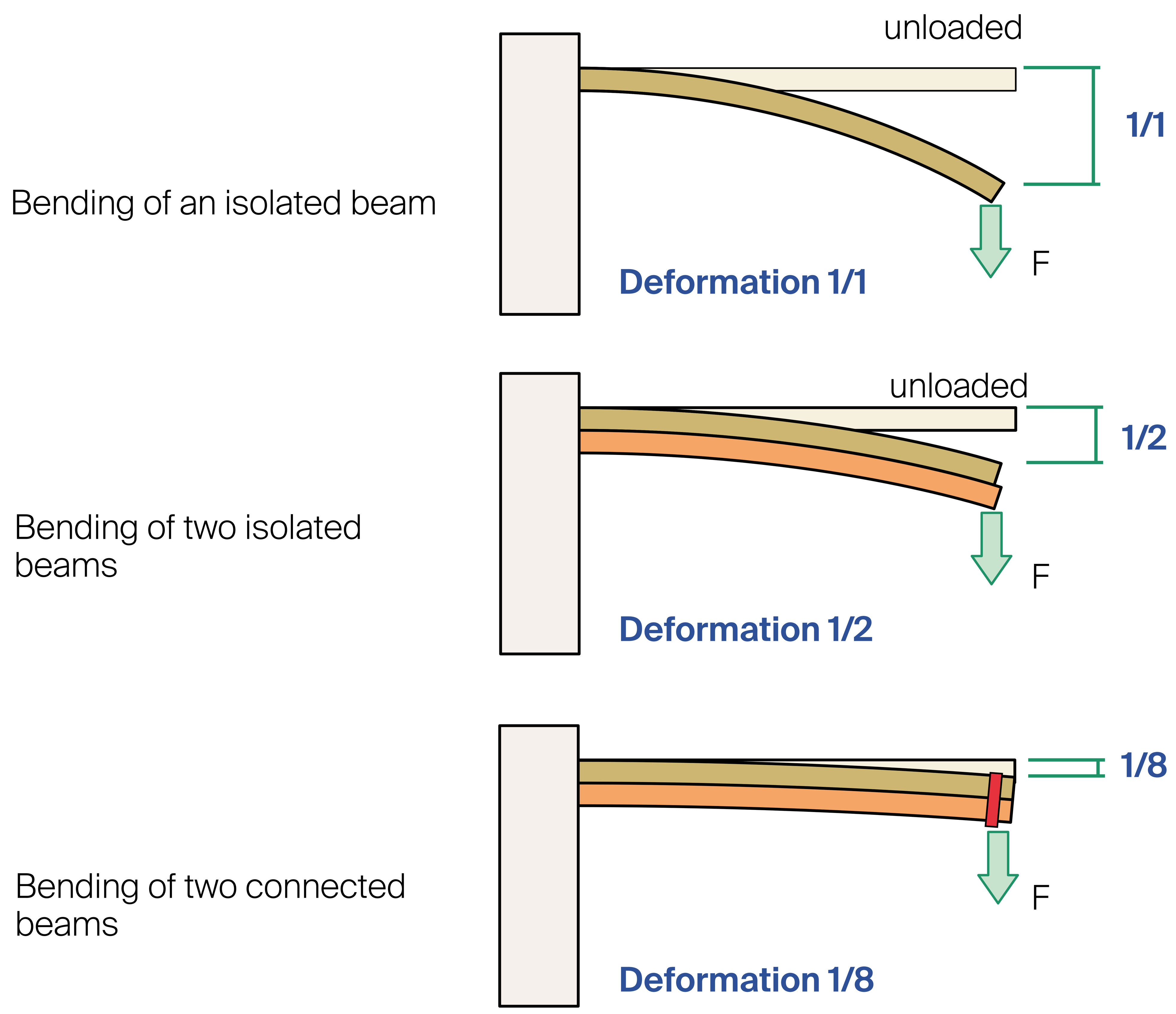
Compare stiffness of beam models

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 stiffness[1] and strength[2] depend on these elements

Bone	- Cross-section
	- Quality of bone
Fracture	- Simple versus comminuted fracture
	- Contact versus noncontact situation
Plate	- Cross-section
	- Material
	- Bending direction
Screws	- Anchorage
	- Number and position
	- Length of the plate
Fixation	- Splinting
	- Compression

[1] stiffness = the ability of a material to withstand deformation
[2] strength = the ability of a material to withstand destruction