Key role of hospital in biomedical research innovation

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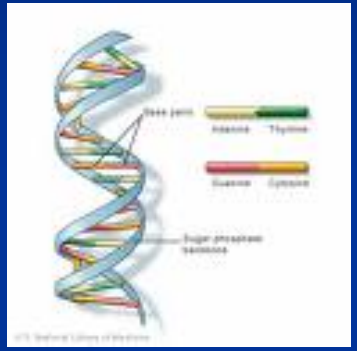
The purpose of biomedical research innovation :

- to discover the secret of life
- to promote human healthy



That will be meaningful only when the biomedical innovation serve preventing diseases, maintaining healthy

Hospital

- Diseases diagnosis, treatment, preventing
- Health management and promotion
- Most active and focus on Clinical practice, Medical education, Medical research

Hospital and Innovation

- Clinical problems and patient's needs
- Hard and soft wares for medical innovation
- Lots of clinical resources(data, cases, images, etc)
- Base of clinical trails and commercial exploitation

Clinical problems and patient's needs


- Severe tissue damage and absence

  ---- Tissue engineering

- Shock and multiple organ dysfunction syndrome (MODS)

  ---- Portal blood analyzer

- Acute myocardial infarction(AMI)

  ---- Electrocardiogram

- Cerebral hemorrhage or thrombosis

  ---- MRI, CT


Hard and soft wares for research innovation

- Humane resource: doctor, nurse, technologist, researcher, manager

- Professional experts: senior doctor, professor

- **Hardware:**

  Medical machines:

  Biochemistry autoanalyzer, Olympus 5421

  Blood autoanalyzer, Sysmex 2700, 800i

  PET, MRI, CT, Ultrsonic B, X-ray machine

  Information systems: HIS, LIS, PACS

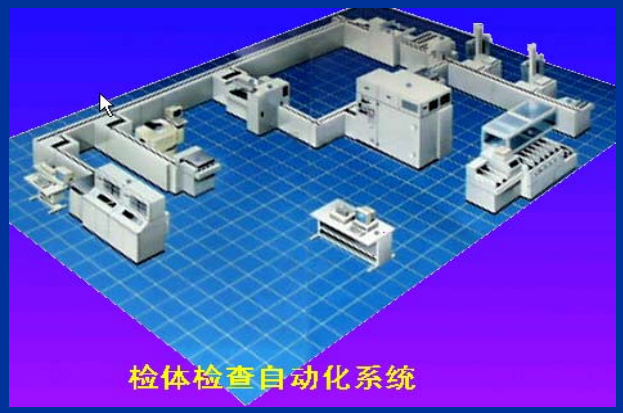


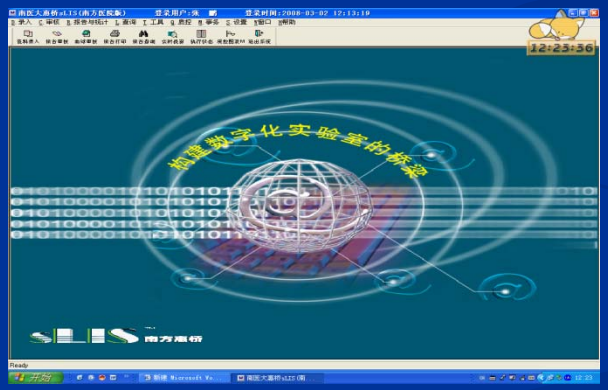


Clinical resources (Nanfang hospital)

- Out-patients: 4000-5000 / day
- In-patients: 1800-2000 beds
- Comprehension hospital with different kinds of diseases

- Clinical laboratory: lab tests data for 10 years stored in the LIS
- Medical imaging department: tens and thousands of images stored in PASC
- Medical records: All the patients stored in HIS





Base of clinical trails and commercial exploitation

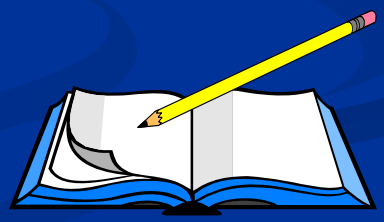
- Myocardial markers analyzer
- Diagnosis kits
- Bone matrix materials
- Medical imaging analysis softwares
- New drugs
- Medical equipments
- New therapy methods

Research innovation in Nanfang Hospital, SMU

Bone tissue engineering clinical application

Bone tissue engineering

- Isolation and culture of osteoblasts
- Extracellular Matrix Material
- Construction and clinical application of tissue-engineered bone



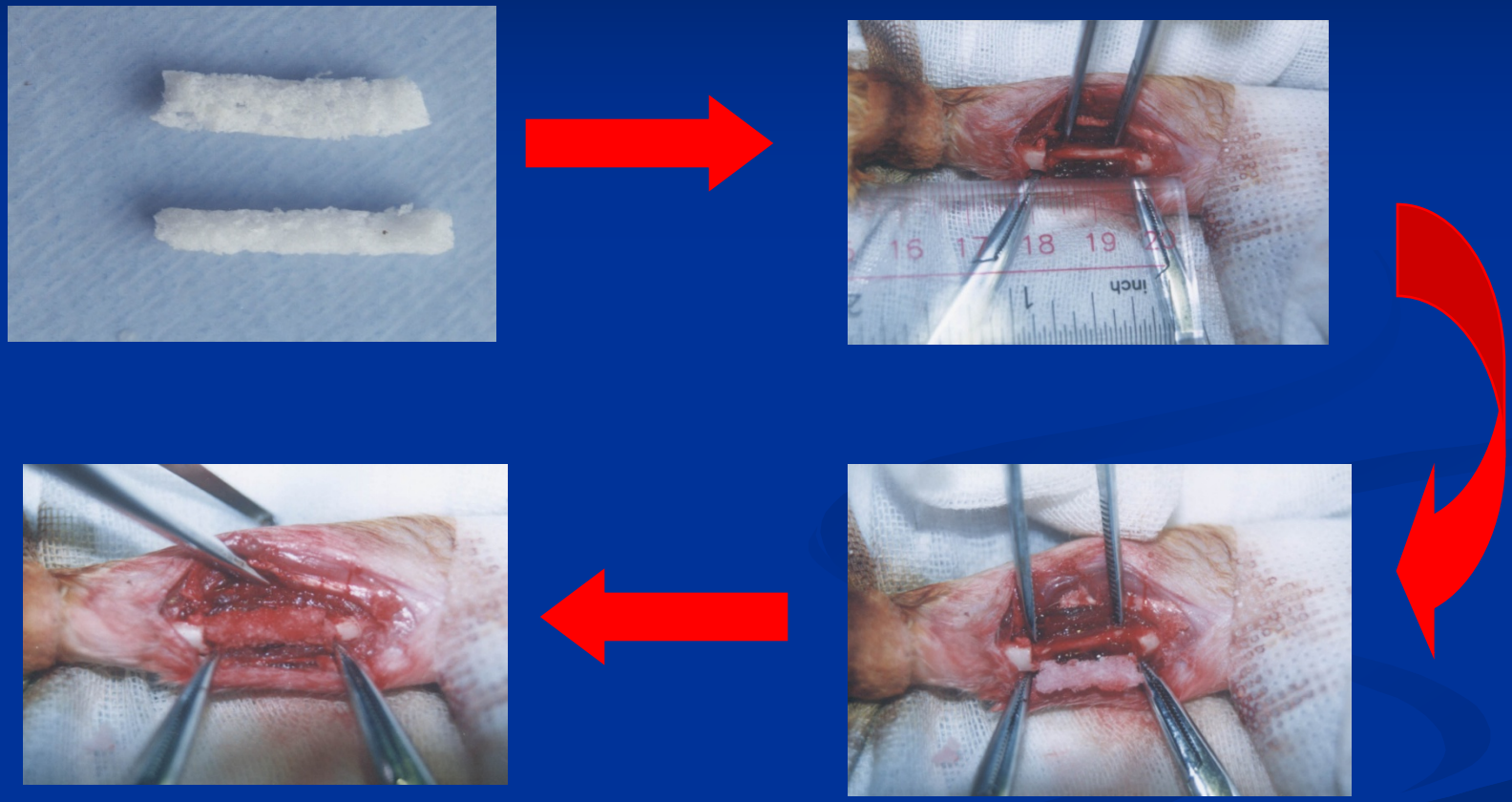
Bone tissue engineering (tissue construction)

Osteogenesis in muscle or under skin → **Bone defection repair**

Bone tissue construction → Compound tissue construction

Bone defection repair in small animal → **Bone defection repair in large animal**

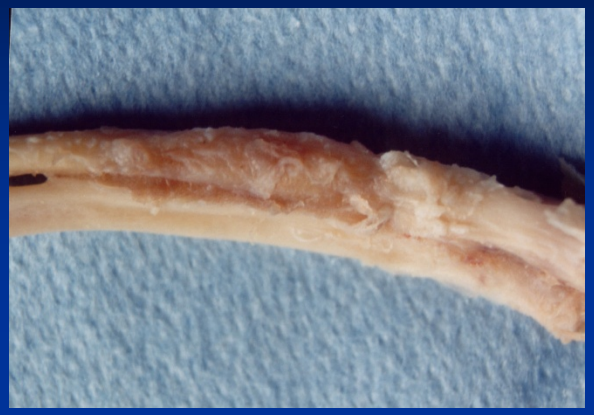
Tissue-engineered bone construction using bone marrow stromal cells tranfected by BMP-7 gene



Bone defect repairing in Rabbit radial with tissue-engineered bone

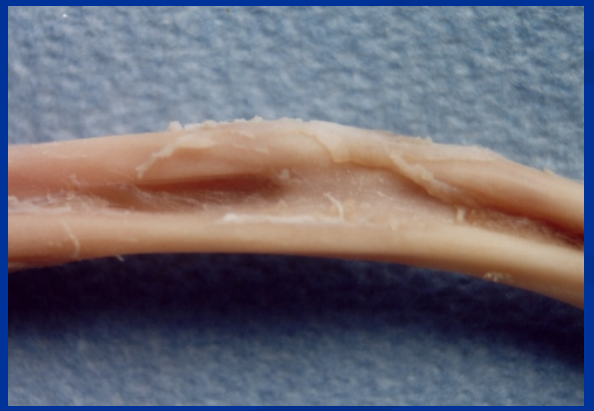
Tissue-engineered bone construction using bone marrow stromal cells tranfected by BMP-7 gene

Contral group



HA group

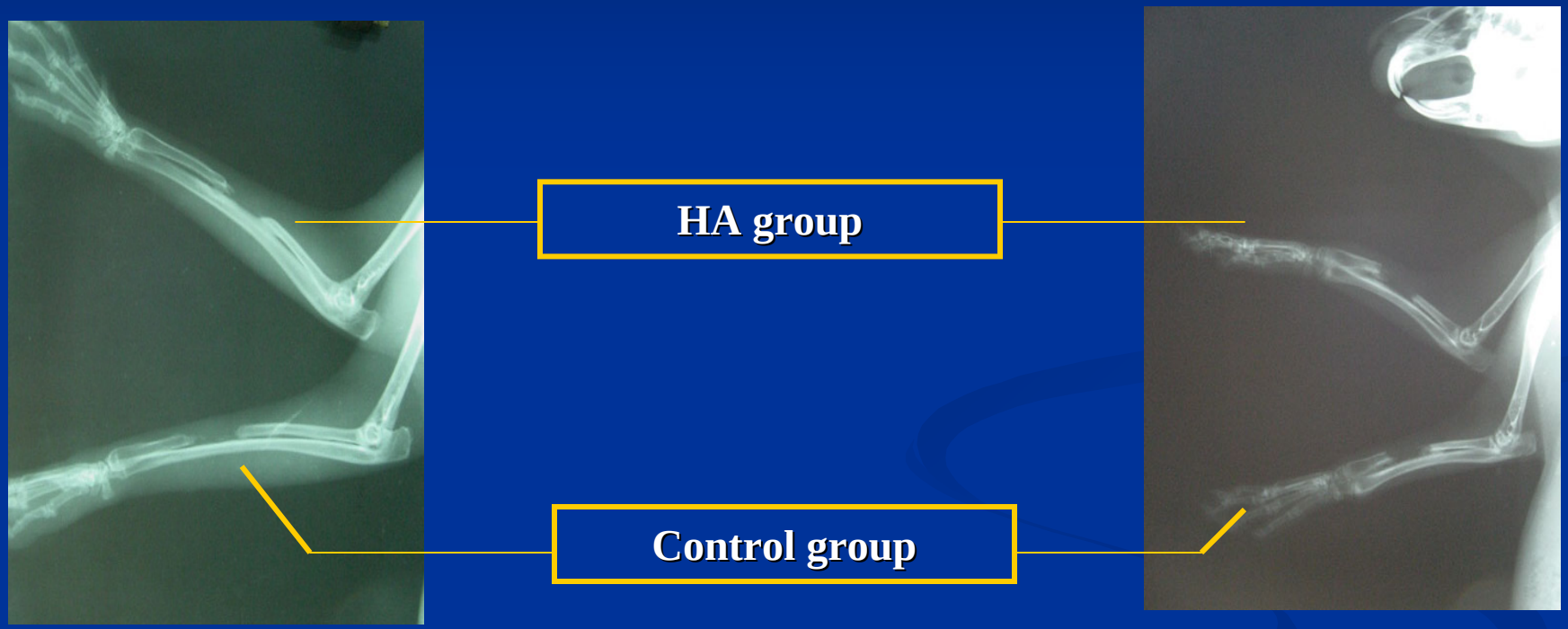
BMSCs group



BMP-7 tranfected BMSCs group

bone defect repairing（6 Weeks later）

Tissue-engineered bone construction using bone marrow stromal cells transfected by BMP-7 gene



PLNCX2-BMP7 transfected BMSc repairing bone defect in rabbit radia（X-ray）

Tissue-engineered bone construction using bone marrow stromal cells tranfected by BMP-7 gene

BMP7 transfected BMSc group

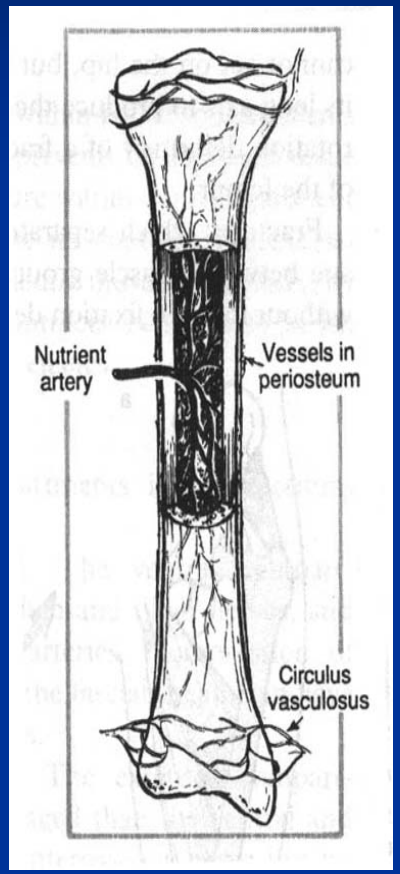
BMSc group

3 weeks

6 weeks

PLNCX2-BMP7 transfected BMSc repairing bone defect in rabbit radia（X-ray）

Construction of revascularlizated tissue-engineered bone



Key role of vascularization

- make the seeding cells alive
- provide more bone growth factors
- accelerate mineral deposit
- remodeling the bone formation

Construction of revascularlizated tissue-engineered bone

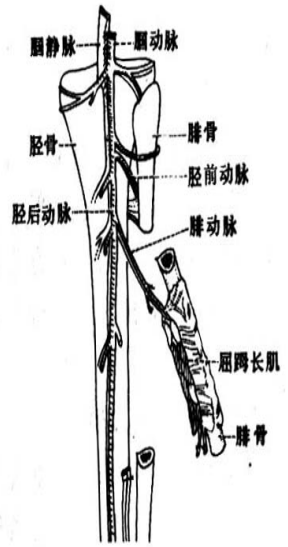


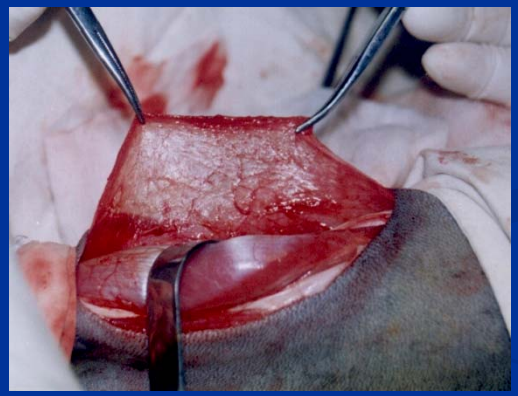
图 8-17 带血管蒂游离腓骨移植术

Methods of revascularization

- Sorts of cells seeding

  endothelial cells + osteoblasts
- Vascular endothelial growth factors
- Application of microsurgery technology

Accelerating osteogenesis and revascularization of tissue engineered bone using fascia flap in Chinese Goats tibia defect repairing



Construction and application of revascularlizated tissue-engineered bone

CHAP **TE** **FF**

Naked-eyes Observing

Construction and application of revascularlizated tissue-engineered bone

CHAP

TE

FF

Cross-section of the bone defect

Construction and application of revascularlizated tissue-engineered bone

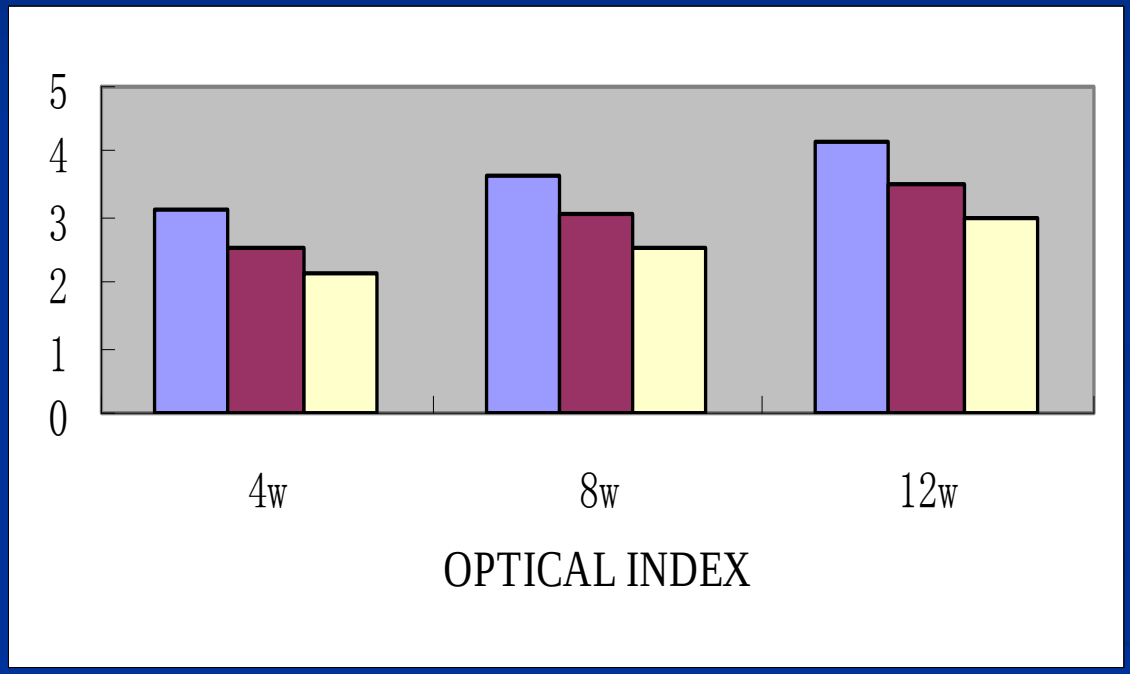
Vascular formation observed with ink intravascular injection

Construction and application of revascularlizated tissue-engineered bone

FF **TE** **CHAP**

X-ray （4 weeks）

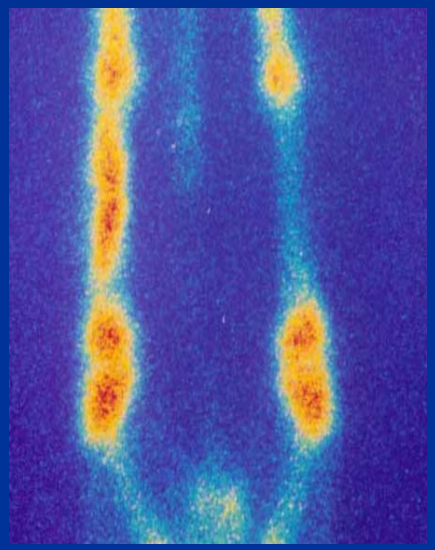
Construction and application of revascularlizated tissue-engineered bone

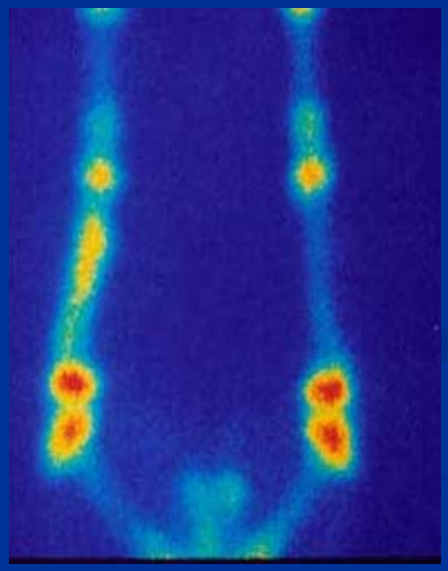


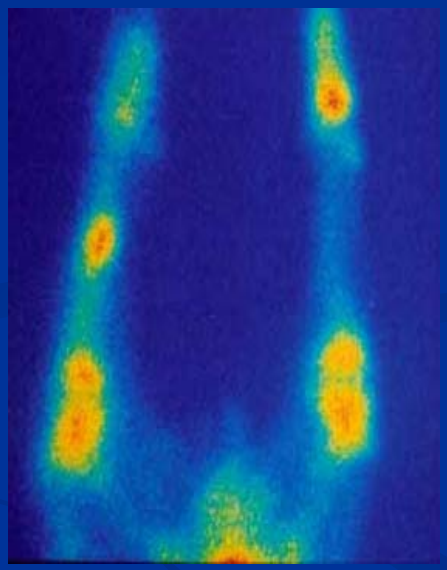
FF TE CHAP

The optical density index of X-ray film

Construction and application of revascularlizated tissue-engineered bone







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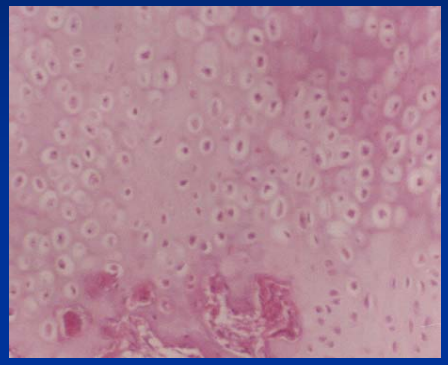
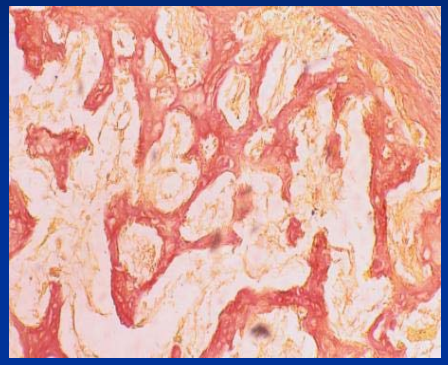
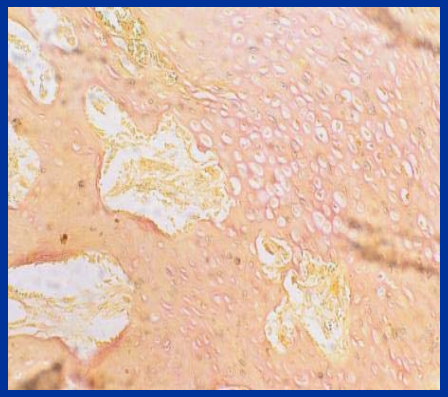
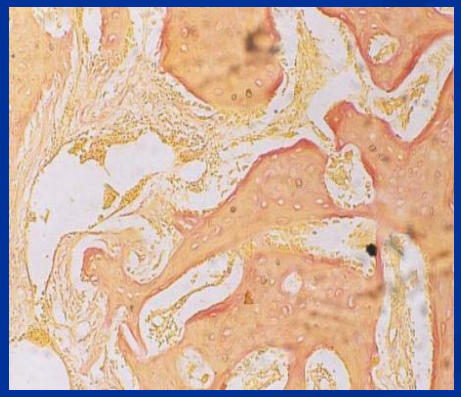
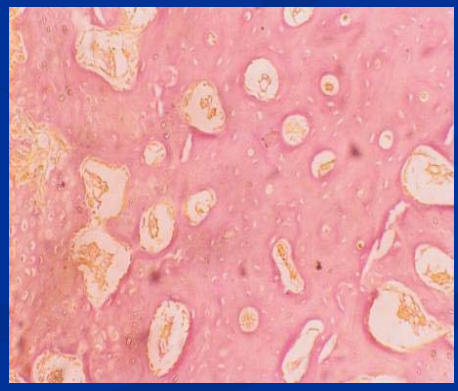
radionuclide bone imaging, ECT

Construction and application of revascularlizated tissue-engineered bone

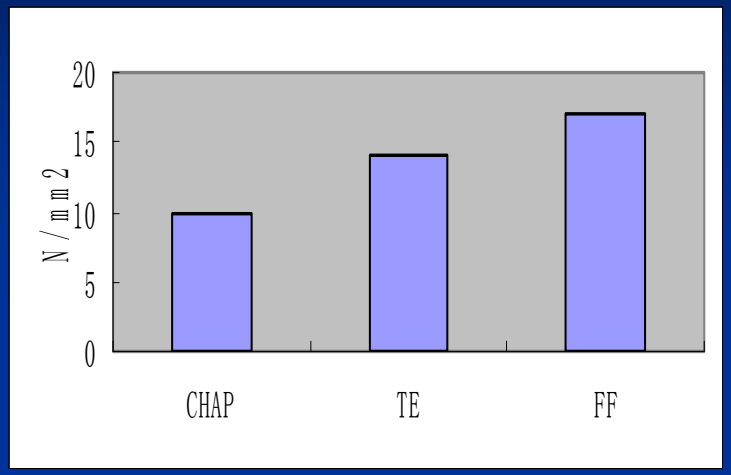



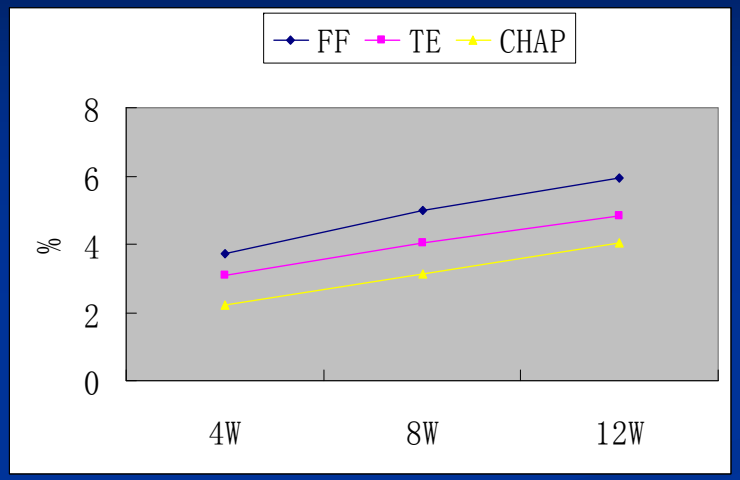

Osteogenesis (HE)

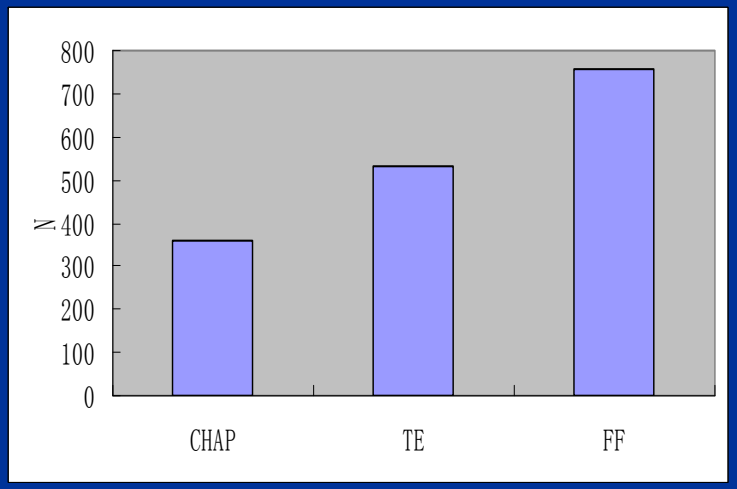




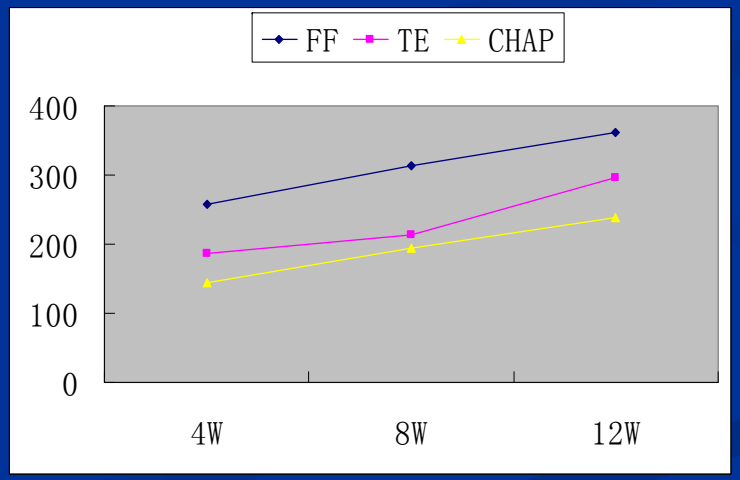
Angiogenesis (HE)

Construction and application of revascularlizated tissue-engineered bone









Biomechanics of the new tissues and vascular formation


Thank you!