BioDevice systems

Home | Data analysis (new) | Image analysis and processing | Directions of researches | Cooperation | Contact Us

For obtaining initial data we realize registration of different cell-tissue parameters in different kind of scaffold (porous and polymeric) using high-resolution methods like SEM, LSM etc.

In particular Laser Scanning Microscopy (LSM) gives possibility to obtain information from different layers of scaffold and characterize cell parameters (viability, apoptosis, mitochondrial potential, necrosis, adhesiveness, proliferation etc.) using special staining for the subsequent analysis (see next pages)









Using Scanning Electron Microscopy we obtain possibility to characterize surface structure and features of cell growth on the scaffolds





SEM HV: 20.00 kV View field: 33.07 μm PC: 9 WD: 15.0080 mm Det: SE Detector SEM MAG: 6.00 kx

Digital Microscopy Imaging



SEM HV: 20.00 kV View field: 34.21 µm PC: 9 WD: 14.9170 mm Det: SE Detector SEM MAG: 5.80 kx 10 µm Digital Microscopy Imaging

MIRA\ TESCAN Digital Microscopy Imaging 2 µm

SEM HV: 20.00 kV View field: 7.94 µm Det: SE Detector SEM MAG: 25.00 kx



<u>Transparency of some polymeric scaffolds gives possibility to investigate</u> <u>cell development (for example, chondrocyte development into</u> <u>alginate/polypeptide matrix)</u>









The use of transfection methods and nuclei staining with PI, DAPI etc. gives possibility to trace cell behavior and tissue development.







| Programm version: 1 | Experimental points number: 0 | | | |
|--|-------------------------------|--------|-------------------|-------------|
| Comments: | - | - | | |
| X (R) dimension,mm: 3 | n | h,mkm | С,нмоль/мл | U,млн кл/мл |
| Y dimension,mm: 3 | 100 | -0.0 | 80 10.6992 | |
| Z dimension.mm: 3 | 99 | 30.0 | 47.6851 10.243 | |
| Scaffold porosity.%: 50 | 98 | 60.0 | 24.9168 9.78688 | |
| Tortuosity parameter: 0.644 | 97 | 90.0 | 10.7874 9.31935 | |
| Scaffold permeability.m^2: 0 | 96 | 120.0 | 3.70736 8.84242 | |
| Filtration rate, mL/min: 0 | 95 | 150.0 | 1.07313 8.36209 | |
| Node numbers at X (radius): 101 | 94 | 180.0 | 0.293953 7.8836 | |
| Node numbers at Y (depth): 101 | 93 | 210.0 | 0.08118187.41075 | |
| Node numbers at Z (gigh): 101 | 92 | 240.0 | 0.0230887 6.94652 | |
| Iteration maximum number: 100 | 91 | 270.0 | 0.00680605 | 6.49339 |
| Step on the time,s: 100 | 90 | 300.0 | 0.00208396 | 6.05345 |
| Step on the time for stationar problem,s: 0.1 | 89 | 330.0 | 0.000663404 | 5.62847 |
| Duration of process,day: 20 | 88 | 360.0 | 0.000219663 | 5.21988 |
| Relative error of calculation, 10^-6: 10 | 87 | 390.0 | 7.56717e-05 | 4.82884 |
| Variant: 1 | 86 | 420.0 | 2.71232e-05 | 4.4562 |
| Scaffold form (1-sphere, 3-cuboid): 1 | 85 | 450.0 | 1.01149e-05 | 4.10255 |
| Nutrient: 0-oxygen, 1-glucose: 0 | 84 | 480.0 | 3.92387e-06 | 3.76823 |
| Variant of proliferation modeling (1-Michaelis-Menton kinetics): 0 | 83 | 510.0 | 1.583e-06 3.45339 | |
| Variant of diffusion modeling (0-without porosity): 1 | 82 | 540.0 | 6.63879e-07 | 3.15794 |
| Initial cell density, million/mL: 0.05 | 81 | 570.0 | 2.89283e-07 | 2.88166 |
| Maximal cell density, million/mL: 10 | 80 | 600.0 | 1.30896e-07 | 2.62414 |
| Cell volume,mcm^3: 2000 | 79 | 630.0 | 6.14627e-08 | 2.38489 |
| Kinetic const-t for nutrient consumption rate,mL/s/cell: 1 | 78 | 660.0 | 2.9926e-08 | 2.16329 |
| Kinetic const-t for rate of cell growth,mL/100nmole/day: 1 | 77 | 690.0 | 1.50967e-08 | 1.95864 |
| Michaelis-Menton constant,nmole/mL: 4 | 76 | 720.0 | 7.8837e-09 | 1.77018 |
| Relation coeff-t between concentration outside and inside of cell: | 75 | 750.0 | 4.25779e-09 | 1.59712 |
| 1.33 | 74 | 780.0 | 2.37585e-09 | 1.43861 |
| Initial nutrient concentration,nmole/mL: 8 | 73 | 810.0 | 1.36832e-09 | 1.29382 |
| Maximal nutrient concentration,nmole/mL: 80 | 72 | 840.0 | 8.12521e-10 | 1.16188 |
| Threshold nutrient concentration,nmole/mL: 5 | 71 | 870.0 | 4.96922e-10 | 1.04194 |
| Diffusivity of nutrien into fluid, 10^-9 M^2/c: 3 | 70 | 900.0 | 3.12659e-10 | 0.933169 |
| Diffusivity of cells into scafold, 10^-12 M^2/c: 0.5 | 69 | 930.0 | 2.02161e-10 | 0.834752 |
| Optimization characteristic: 0 | 68 | 960.0 | 1.34178e-10 | 0.745899 |
| Cell density optimization: 1 | 67 | 990.0 | 9.13117e-11 | 0.665853 |
| Nutrient concentration optimization: 0 | 66 | 1020.0 | 6.36423e-11 | 0.593889 |
| San Gald an analysis and institutions 0 | | | | |

Scaffold permeability properties are rather essential for nutrients and O2 transfer hence maintenance of adequate cell viability. These properties are dependent on material and inner organization of the scaffold and are essential for the following vascularisation..

| Ele Edit Search View Project Run Component Qatabase Icols Window Help [None) 호텔 환경, | Bill C++Builder 6 - Bone1 [Running] Elle Edit Search View Project Run Component Database Tools Window Help Chone> Image: Registration of the second database Tools Window Help Chone> Image: Registration of the second database Tools Window Help Chone> Image: Registration of the second database Tools Window Help Image: Registration of the second database Tools Window Help Image: Registration of the second database Tools Window Help Image: Registration of the second database Image: Reg | port Dialo |
|--|---|--------------|
| Des Central Des Control de Exerces BDE ADD InterBase Internet FastNet DRecont Dato. | Edit of data | _ 🗆 🗙 📃 |
| B PARAM.cpp EdiData.cpp Bone1.cpp Bone1.cpp Cattor Catter _ | 1 Optimization Optimised parametres | dit 🔪 |
| <pre>// Effective diffusion coefficient of nutrient REAL PARAM::ConcDiffusivity(int n) (REAL eps=ScafPor-Vcell*W.CellDens[n]; // part of liquid phase (porosity) if (eps=0) REAL alfa=Req*0.75; REAL Deff=0f*(3*alfa+2*eps*(1-alfa))/(3-eps*(1-alfa)); REAL Deff=0f*(3*alfa+2*eps*(1-alfa))/(3-eps*(1-alfa)); REAL corr=1; if (iVarD) corr=(1-ScafPor)/sqr(1+0.6+41*sqrt(ScafPor)); refurn corr*Deff;) // Furniant or cells conves function</pre> | Cell density Cells and nutrient parameters Initial cell density,million/mL Cell volume,mcm ⁻³ Cell density,million/mL Constition rate,mL/s/cell Initial cell growth.mL/100nmole/day Initial cells-Menton constant,mnole/mL Kinetic constit for rute of cell growth.mL/100nmole/day Initial cells-Menton constant,mnole/mL Seafford and and and and and and and and and an | zults pen |
| <pre>RBAL PARAM::Source(int spec, int n) { REAL 5,C=W.ConcNutr[n]: if (spec==_CONC_) (REAL eps_cell=Vcell*W.CellDens[n]: if (iVarK) // Michaelis=Menton Kinetics (S==Vnutr*C*eps_cell/(KDM+C):</pre> | Diffusion and concentration parameters Initial nutrient concentration,nmole/mL 8 Initial nutrient concentration,nmole/mL 80 Scatfold parameters Threshold nutrient concentration,nmole/mL 80 Scatfold parameters Diffusivity of cells into scatfold,10°-3 er 2/c 3.00 Scatfold parameter Figure Count parameters Image: Scatfold parameters Image: Scatfold parameter Figure Node numbers at X (radius) 101 Image: Statfold parameter Figure Iteration maximum number 100 Image: Statfold parameter 50.00 Step on the time, s 100 Initial nutries at X (radius) Image: Statfold parameter 500 | ange Save |
|) else { S=LambC* (C-Ch)* (1-W. CellDens[n]/Um)*W. CellDens[n]; if (s<0) s*=1; 541: 57 Inter \Code/ | Step on the time for stationar problem, s 0,100 Enter On default Cancel Duration of process, day 20,0 Enter On default Cancel Relative error of calculation, 10°-6 10,00 It remains 00,00 | 0:00 |







One of aim is to introduce a new method of computer simulation, reconstruction and visualization of 3-D structure of biological tissues. It includes the high-resolution scanning, computer recognition, reconstruction and simulation of 3-D structure of biological tissues.

