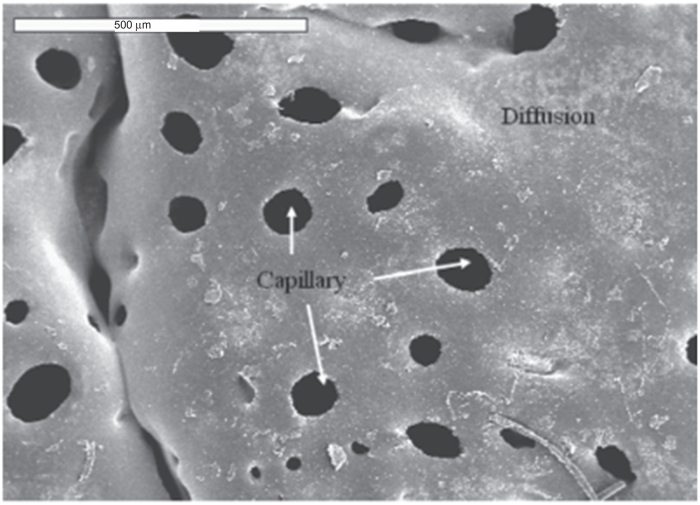

Fig. 10. SEM of a hydrogel with different pore dimensions.

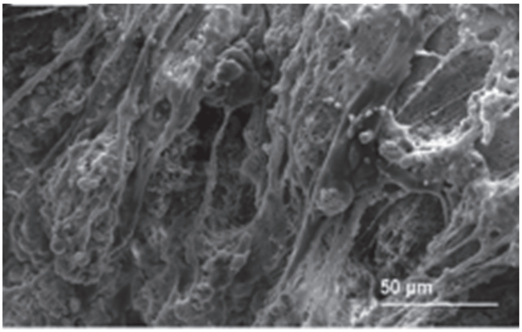

Fig. 11. Fibroblast cells attached on a scaffold surface of an alfa-Elastin hydrogel (Adapted from Annabi et al. 2010).

There are two kinds of porosity within a hydrogel; micro-porosity consists of the pores among individual polymer chains. This porosity is a result of the solvation of the hydrophilic polymer by water, which induces the polymeric chains to swell. The length scale of microporosity is on the order of 10 nm to 100 nm, which is sufficient for the diffusion of water, oxygen, salts, and low molecular weight metabolites. Macro-porosity is on the length scale of 1 µm to 100 µm. Tissue engineered scaffolds require macro-porosity to permit rapid protein diffusion, cellular migration, and ingress of microvessels from surrounding tissue (Fig. 12).

Experiments demonstrated the optimum pore size of 5 µm for neovascularization, 5–15 µm for fibroblast ingrowth, 20–125 µm for regeneration of adult mammalian skin, 100–350 µm for regeneration of bone, 40–100 µm for osteoid ingrowth, and 20 µm for the ingrowth of hepatocytes (Whang et al. 1999). Fibrovascular tissues also require pore sizes greater than 500 µm for rapid vascularization and survival of transplanted cells.