From an engineering point of view, the challenge of organ cryopreservation is a problem of heat and mass transfer. However, from a technical point of view, there are four major goals: avoiding fractures, controlling ice, monitoring the cryoprotectant concentration and having a fast and uniform rewarming. Computer Tomography (CT) can help at least with the first three of these four topics; in the case of DMSO based cryoprotectant, the high number of electrons in the sulfur atom of thismolecule makes it visible at energies around 70 KeV, where the photoelectric effect is dominant. Water, DMSO and air (fractures) have very different CT values, offering the possibility of drawing a 3D map of the status of the organ not only after the cryopreservation, but also during the loading and/or cooling steps. Kidneys and cryopreserved ovarian tissue have been monitored with a nanoCT. A spectacle of patterns and structures is revealed under the light of the X-rays. In this work we first analyze the theoretical basis behind the use of X-rays to detect the concentration of DMSO. The role of the three types of scattering are described: Compton, Rayleigh and Photoelectric. Four important vitrification agents, dimethyl sulfoxide, 1,2-propendiol, glycerol and ethylene glicol are studied thoroughly, with the conclusion that DMSO should be clearly visualized. Afterwards, we present the CT signals of different DMSO concentrations, making evident the capability of Computer Tomography for rendering a 3D map of the field of concentration of this cryoprotectant agent inside the tissue or organ. Next we show how it is also possible to detect ice: as ice is pure water, it gives a very different signal from that of the rest of the biological material loaded with dimethyl sulfoxide. Finally, in case of unappropriated cooling/warming rates, the presence of fractures in the samples are evident. All this three possibilities of Computer Tomography are applied not only to solutions, but also to two very different biological samples: ovarian tissue and whole kidneys. Two straightforward applications of this technology are under study: the optimization of the cryopreservation protocols of human ovarian tissue for transplantation, and the analysis and design of kidneys cryopreservation protocols. In the case of ovarian tissue, the nanoCT allows to predict the right cooling rate and (if cryopreserved by slow freezing) also the exact way of seeding and the right temperature to do it. In the case of whole kidneys, the presence of ice, fractures, and the concentration of DMSO during the cooling protocol, as well as the final state of the organ once vitrified is shown.