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In silico strategies for organ bio printing

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Just like any product one would like to manufacture, a bioprinted organ also needs a project. In biofabrication, this project is named blueprint. Being a biological product, in addition to the physical properties, the project of an organ encompasses a wider range of variables. In this regard, tissue engineering assists in the modeling of biological systems, initially studying the behavior of a basic living unit and then moving to its relationship with others to form a complex system. In vitro and in vivo experiments require the investment of large sums of money and time, besides being specific and complex. A viable alternative is to create the blueprint by means of in silico simulations, which is not only faster, but allows a broader flexibility in the choice and tailoring of parameters to be studied. Thus, through CAD and CAM tools, a 3D model is submitted to computational simulations that aim to generate reports on a given set of parameters. This paper proposes an interdisciplinary blueprint that uses the general ideas of simulations - such as predictive probabilistic methods and energy calculations - applied to two frameworks: Mechanical and biological. In short, the mechanical would use finite element analysis to observe mechanical behavior such as hydrostatic pressure, elasticity, and fluid flow. While the biological would use complex systems of cellular interaction to analyze behaviors such as cell division, diffusion and chemotaxis of the basic units that make up the organ. This interdisciplinary strategy for in silico simulations will make the evolution from the basic unit to the whole system much closer to reality, thus expanding new horizons in advances of biomedical engineering.

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