Many complex systems cannot be analyzed using traditional mathematical tools, due to their irreducible nature. This makes it necessary to develop models that can be implemented computationally to simulate their evolution. Examples of these models are cellular automata, evolutionary algorithms, complex networks, agent-based models, symbolic dynamics and dynamical systems techniques.

We review some representative approaches to model the stem cell niche in *Arabidopsis thaliana* and the basic biological mechanisms that underlie its formation and maintenance. We propose a mathematical model based on cellular automata for describing the space-time dynamics of the stem cell niche in the root. By making minimal assumptions on the cell communication process documented in experiments, we classify the basic developmental features of the stem-cell niche, including the basic structural architecture, and suggest that they could be understood as the result of generic mechanisms given by short and long range signals. This could be a first step in understanding why different stem cell niches share similar topologies, not only in plants. Also the fact that this organization is a robust consequence of the way information is being processed by the cells and to some extent independent of the detailed features of the signaling mechanism.