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PDE models for chemotaxis in supercritical function spaces

Chemotaxis is the movement of biological cells or organisms in response to chemical gradients. This can be described by the so-called parabolic–parabolic Keller–Segel equations

$$\begin{aligned} \partial_t u &= \Delta u - \operatorname{div}(u\nabla v), \\ \partial_t v &= \Delta v - \alpha v + u, \end{aligned}$$

and their parabolic–elliptic counterpart

$$\begin{aligned} \partial_t u &= \Delta u - \operatorname{div}(u\,\nabla v), \\ -\Delta v &= u - \alpha v. \end{aligned}$$

Here $u = u(x,t)$ denotes the *cell density* and v describes the *concentration of the chemical signal*. We develop the theory of these equations in the context of some Besov–Sobolev spaces.