In embryogenesis, vertebrate cells assemble into organized tissues. In cancer, metastasis tumor cells spreading in the circulatory system use mechanisms of adhesion to establish new tumors. At the root of these life-forming or life-threatening biological phenomena is cell adhesion, the binding of a biological cell to other cells or to a material substrate or scaffold. The most obvious fundamental question to ask is then as follows: What factors control or govern cell adhesion? For a long time, the paradigmatic answer to this question was that specific protein molecules embedded in the cell wall (or membrane) were responsible for cell adhesion, in either a key-lock fashion (in cell-cell adhesion) or a suction-cup fashion (in cell-substrate adhesion). But, a new realization has emerged during the past two decades that physical mechanisms, promoted by the the cell membrane, play an unavoidable, yet not fully understood role. Although these physical elements do not at all depend on any specific proteins, they can have a major impact on the protein-mediated adhesion and can be viewed as mechanism that control the binding affinity to the cell-adhesion molecules. In my talk I will show how these mechanisms can be studied in mimetic models both experimentally and theoretically, the result of which can be discussed in the cellular context.