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Oguz C. Durumeric* (odurumer@math.uiowa.edu), Department of Mathematics, Mac Lean Hall, University of Iowa, Iowa City, IA 52242. *Nonuniform Thickness*.

We investigate nonuniform tubular neighborhoods of submanifolds of the Euclidean space. The motivation comes from determining the ideal/tight shapes of large molecules such as DNA with nonuniform structure. The main tool of our approach is the analysis of weighted distance functions. The (differentiable) normal injectivity radius and the (uniform) thickness formula fail to explain some new phenomena arising from nonconstant weight functions. Different notions of injectivity radii and focal radii are introduced to investigate singular but injective exponential maps. If the submanifold is a union of disjoint closed curves, we obtained quantitative results and some rigidity earlier. In that case, all singularities within almost injectivity radius are of unique type and classified to be horizontal collapses. This suffices to prove a nonuniform thickness formula for curves in all cases, which generalizes the one in the uniform case. In the higher dimensions, the generalized thickness formula still holds on an open and dense subset of the weight functions. For the remaining cases, the thickness formula becomes a series of inequalities. (Received February 01, 2009)