Flory theory for the size R of a polymer chain

Mean-field theory yielding $R \sim N^{\nu}$ with $\nu = 3/(d+2)$ for a polymer in d dimension. This result is obtained by minimizing the free energy, $F_G + F_{rep} \approx (R^2/N) + (N^2/R^d)$, of a polymer composed of N monomers over the radius, R. The entropic contribution, $F_G = R^2/N$, is approximated by that of a Gaussian chain, and the contribution, $F_{rep} = N^2/N^d$, from the monomer-monomer repulsion is estimated to be $\int d^d x \rho^2 \approx N^2/R^d$, where the monomer density, ρ, is N/R^d.

The so-called "Flory exponent ν gives the inverse fractal dimension of the polymer chain, $d_f = 1/\nu$. It is analogous to the correlation length exponent ν in critical phenomena controlling the divergence of the critical length ξ as a function of temperature.