involving an SU(N) x SU(N) gauge group, with the scalars transforming according to the $(N,\bar{N}) \oplus (N,1) \oplus (1,\bar{N})$ representation. In this model there exist five independent scalar coupling constants. It is asymptotically free when $N \geq 5$.

Our original motivation for studying theories involving scalar mesons was to utilize the Higgs mechanism to break the gauge symmetry and provide masses for the vector mesons. Some of the models considered above would appear to have the potential of accomplishing this aim. Take, for example, the gauge group to be SU(N) x SU(N), and the scalars to transform according to the $(N,\bar{N})$ representation (which is asymptotically free for $N \geq 5$). The scalars are represented by an N x N matrix M of complex fields, and they transform according to: $M \to GMH^{\dagger}$. If the scalar mesons develop a non-vanishing vacuum expectation value, $\langle o|M|o\rangle = M_o$, the symmetry will be broken. The criterion that the gauge symmetry be completely broken and that all vector mesons acquire a mass is that there be no subgroup of transformations that leaves M_o invariant.[46] If M_o were an arbitrary N x N complex matrix this criterion would be satisfied. However M_o is not arbitrary, rather it is determined by the form of the Lagrangian. Thus in lowest order M_o is determined by minimizing the "potential"

$$- L_I = - \mu^2 \, Tr(MM^{\dagger}) + \lambda \, Tr(MM^{\dagger})^2 + \eta \, Tr(MM^{\dagger})^2 \qquad (6.23)$$

Now $MM^{\dagger}$ is a positive hermetian matrix and the potential is a function of the squares of its eigenvalues. When one minimizes (6.23) one finds that these eigenvalues are all equal in magnitude