definite dimensions. Let us denote these operators by $O^{(n)a}_{\mu_1\cdots\mu_n}(x,r)$, where $r(=\pm 1)$ denotes the chirality of the operator. They are given by

$$O^{(n)a}_{\mu_1\cdots\mu_n}(x,r)=\frac{i^n}{2n}\sum_{k=1}^{n} \mathrm{Tr}\{\lambda^a\overline{\Psi}(x)\partial_{\mu_1}\cdots\partial_{\mu_{k-1}}\gamma_{\mu_k}\partial_{\mu_{k+1}}\cdots\partial_{\mu_n}(1+r\gamma_5)\Psi(x)\} - \text{trace terms.} \qquad 5.17$$

We define $\Gamma_{O^{(n)a}}$ to be an 1PI Green's function with the insertion of the operator $O^{(n)a}_{\mu_1\cdots\mu_n}(x)$. This amplitude will satisfy a renormalization group equation. In particular if $O^{(n)a}$ is inserted into the fermion two-point function we obtain:

$$\left[\mu\frac{\partial}{\partial\mu} + \beta(g)\frac{\partial}{\partial g} + \gamma_n^a(g) - 2\gamma_F(g)\right]\Gamma^{(2)}_{O^{(n)a}} = 0, \qquad 5.18$$

where γ_F is the anomalous dimension of the fermion field. Since β is of order g^3 we may calculate the combination $\gamma_n{}^a - 2\gamma_F$ to order g^2 by evaluating the logarithmically divergent contributions to $\Gamma^{(2)}_{O^{(n)}}$ to order g^2. These are given by the Feynman graphs of Figure 8 and yield:

$$\gamma_n^a(g) = \gamma_n^a g^2 + \ldots = \frac{g^2}{8\pi^2}C_2(R)\left[1 - \frac{2}{n(n+1)} + 4\sum_{k=2}^{n}\frac{1}{k}\right] + \ldots \qquad 5.19$$

(in the three triplet model $C_2(R) = \frac{4}{3}$). As expected the anomalous dimensions are independent of a and r. Having performed this calculation we can now compute the scaling behavior of the nonsinglet pieces of the deep-inelastic structure functions according to Equation 5.15. If we denote by $N(x,q^2)$ one of these structure functions, say