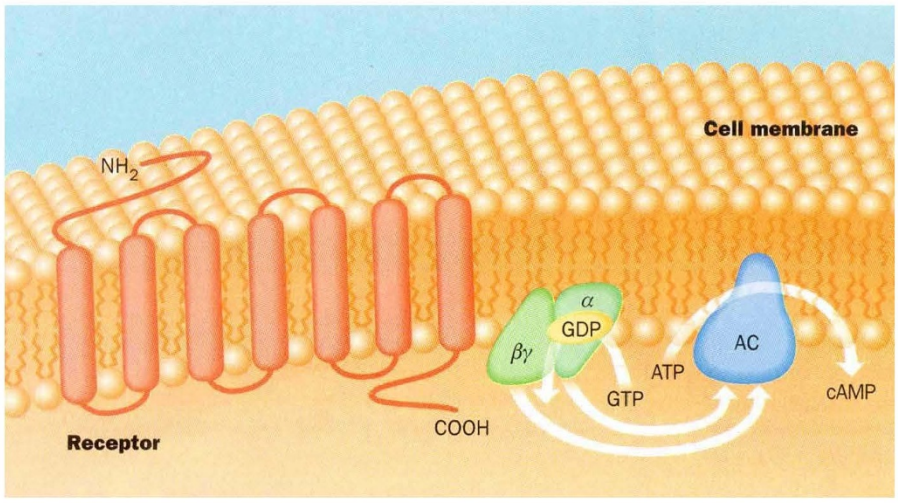

Hundreds of G-protein-linked receptors initiate a handful of signal transduction pathways, either controlling intracellular Ca^{2+}, cAMP, cGMP phosphodiesterase, or modulating ion channels[11]. Bound receptors catalyse the exchange of GDP for GTP on the G_α subunit, presumably dissociating G_α and $G_{\beta\gamma}$ which then activate enzymes and some ion channels. The G_α-GDP state is stabilized by $G_{\beta\gamma}$ binding to G_α-GDP and GTP/GDP exchange is the rate-limiting step in the cycle. Iiri *et al.* describe how at the cooler 33 °C of the testis, mutant $G_{s\alpha}$ results in high turnover and increased cAMP levels but in the rest of the body it results in $G_{s\alpha}$ degradation[1]. AC, adenylyl cyclase.

only that an adjacent cysteine-to-alanine mutation in the α-subunit of G_o causes the protein to have a reduced affinity for GDP[4], but also that $G_{s\alpha}$ is most susceptible to denaturation in its empty state[5,6]. The mutation lies in a highly conserved stretch of amino acids present in all G_α proteins which forms a loop stabilizing the guanine ring of the nucleotide (based on prior mutagenesis and crystal structure data from the α-subunit of another G protein, G_t (ref. 7)). The serine substitution for alanine presumably displaces the guanine ring and disrupts a cooperative network of surrounding hydrogen bonds. One proposal is that receptors catalyse GDP exchange by prying apart the binding cleft between the GTPase structural core and the α-helical cap region[7,8].

In a more philosophical vein, Bourne and co-workers[1] offer an alternative way by which GDP might slip from the grasp of G_α: making use once again of the known crystal structures of GTP- and GDP-bound $G_{t\alpha}$ (refs 7, 9), they suggest that GDP leaves at the opposite end of the cleft. The appeal of this idea is that this region of the cleft is where $G_{\beta\gamma}$, which stabilizes G_α-GDP and blocks G_α-effector interactions, is thought to bind. Perhaps $G_{\beta\gamma}$ normally tightens the protein's grip to close this potential GDP escape route. Although Iiri *et al.*'s experiments do not address the role of $G_{\beta\gamma}$ in the mutant protein, and the crystal structure of the $G_\alpha G_{\beta\gamma}$ heterotrimer is unknown, one possibility is that the bound receptor catalyses exchange by nudging $G_{\beta\gamma}$ out of position to allow GDP release from the G_α cleft.

One puzzle in the signal transduction field has been why G_β should be so highly conserved. Hundreds of G-protein-linked receptors must all initiate the catalysis of GDP/GTP exchange through relatively few G_α subtypes. Perhaps the conformational change in the receptor acts through a common structural $G_{\beta\gamma}$ interface. Receptor-initiated displacement of $G_{\beta\gamma}$ (the clasp) would slightly spread the G_α cleft, releasing GDP and allowing GTP to bind, so unleashing activated G_α and $G_{\beta\gamma}$ to trigger their effects in the cell.

The suggestion of Iiri *et al.* that testotoxicosis be treated by simply warming the testes to body temperature may be oversimplistic. Warming the testes over long periods may irreversibly inhibit spermatogenesis. Furthermore, cryptorchidism, or the failure of a testis to descend into the scrotum during development (so remaining at 37 °C), results in a higher incidence of cancer in the undescended testis. This leads to another interesting possibility, that testicular $G_{s\alpha}$ may participate in tumorigenesis at body, but not testicular, temperatures. □

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DAEDALUS

Fossil rubbish

WESTERN civilization floats on a rising tide of rubbish. Much of it is simply buried at landfill sites, which tend to evolve methane by biodegradation of their organic content. This, of course, is the first step in geological fossilization. In time, buried rubbish should rot down completely to something like coal or oil. Daedalus now plans to help it on its way.

Coalification is a reductive process, inhibited by oxygen but accelerated by heat. Daedalus began to consider reducing hot rubbish with hydrogen; but hydrogen is expensive. He then mused that domestic rubbish contains its own reducing agents in the form of iron and aluminium cans, and that microwaves could quickly make them red hot. Furthermore, microwaves seem to speed up chemical reactions out of all proportion to their heating effect.

So DREADCO's chemical engineers are inventing a microwave-fossilization process for rubbish. They are compacting the stuff in a big cylindrical reaction vessel, essentially a huge microwave oven with a compressive piston. Plastics will melt, paper and food wastes will degrade; metal cans will fuse and burn, removing oxygen from both the included air and the molecules of the rubbish. The resulting carbonaceous residues will soon be conducting enough to absorb microwaves strongly themselves. Thereafter the chemistry should be very fast. It may even evolve enough heat to run spontaneously, minimizing the power required for microwaves. Steam, carbon dioxide and methane will escape, and the material will compact down to its final form.

This form is hard to predict. Under geological fossilization, land vegetation gives coal, and fish and seaweed give oil. Under microwave fossilization, domestic and industrial rubbish (which contains a lot of plastics) might easily give something resembling a low-grade Bakelite, toughened by a filling of metal-oxide particles. Daedalus would be happy with such a structurally useful product, but is equally prepared to accept an oily or coaly output.

When perfected, microwave fossilization should run continuously. Rubbish would be fed into the top of the reactor, and the compacted product would be extracted from the bottom. The evolved gases would be recycled. Steam and methane could be reformed to hydrogen, which could be fed back lower down to complete the reduction process. The output, whether oil or coal or structural plastic, will do its bit to husband our shrinking resources. It may also provide geologists with material for interesting comparisons. David Jones