Even plants excrete

SIR—Excretion is usually omitted from orthodox accounts of plant physiology. It has been argued that the 'inactivity' of plants renders excretion unnecessary[1]. But, although it might be argued that the rate of metabolic activity in a non-motile autotroph produces a reduced excretory load, there is no reason to suggest that it should be altogether absent. I postulate that leaf fall (abscission) is the mechanism of excretion in vascular plants.

The traditional view of leaf fall centres on the occlusion of the vascular bundles by a seasonally produced cork layer, so that the leaf dies and is detached from the plant body. However, the shedding of leaves depends on other determinants: thus, abscission may occur in plants where an abscission layer has not formed, and leaf fall may not take place in species where an abscission layer is present[2]. 'Senescence' is widely used as a synonym for yellowing, though it is hard to conceive of a sixth-month leaf as 'senescent' when the (older) plant which produced it is in its prime. The changes that take place in the yellowing leaf are a coordinated sequence of events and although some vital indicators (including protein content and photosynthetic activity) fall during the process, others increase. Among these are levels of soluble carbohydrate and nitrogen (associated with translocation) and, significantly, RNA content and respiration rate[3].

Supportive of my view that leaf yellowing has an anabolic component is the observation that cycloheximide (which inhibits protein synthesis) arrests the process[4]. The classical reason given for leaf fall is that it obviates damage to a plant during winter. The evergreen species demonstrate that this is not obligatory, and with deciduous conifers (such as *Larix*) and genera like *Lonicera*, which include both evergreen and deciduous species of outwardly similar appearance, the picture becomes less clear. If evergreen leaves are anatomically adapted to resist winter conditions they need not be shed, but in fact they are subject to leaf fall — although it takes place continually, rather than on a seasonally-mediated basis. The shedding of all leaves at predetermined intervals suggests that functional constraints are fundamental. Non-laminar leafy structures (such as tendrils, which develop from petioles) are often retained, whereas leaf-like organs developed from stem progenitors (including phyllodes) are shed, even though they are not leaves.

It appears that these organs have two discrete functions. In addition to acting as the plant's metabolic centre, the leaf is also the structure that — at the end of its useful metabolic life — is systematically stripped of its vital constitutents and charged with metabolic waste materials. The anthocyanins and tannins which are synthesized, like the oxalates which accumulate in yellowing leaves, are in reality among the excretory products the plant needs to discard. The yellowed leaf becomes an 'excretophore', and the shedding of the leaf may be seen as the plant's excretory mechanism.

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Human $^{134}Cs/^{137}Cs$ levels in Scotland after Chernobyl

SIR—Following the accident at Chernobyl on 26 April 1986, and the subsequent appearance of caesium radioisotopes in the food chain, we have measured the ^{134}Cs and ^{137}Cs whole body activities in eighteen adult subjects, thirteen males and five females, living in the Glasgow area. The measurements were made between 11 June and 18 July 1986 using a highly-sensitive whole-body counter with a ring of six large sodium iodine crystal scintillation detectors surrounding the subject and scanning from head to foot in 1,000 seconds.

In the gamma-ray spectrum for the subject with the highest level of contamination (Fig. 1), the main contaminant photopeaks are at 620 and 800 keV and the photopeak of the naturally occurring radioisotope of potassium, ^{40}K, is at 1,460 keV. ^{134}Cs emits three main gamma rays at 570, 605 and 800 keV whereas ^{137}Cs decays to a short-lived daughter, ^{137m}Ba, which emits a 662 keV gamma ray. It has been assumed that the peak at 800 keV is due solely to ^{134}Cs, but that the peak at around 620 keV represents an unresolved combination of the 570 and 605 keV peaks from ^{134}Cs and the 662 keV peak from ^{137}Cs (via ^{137m}Ba). Because the spectra from the three radionuclides overlap, we converted the count rates in Fig. 1 into absolute activities of ^{134}Cs, ^{137}Cs and ^{40}K by observing the spectra obtained (count rate per energy interval per bequerel) with water-filled anthropometric phantoms of differing weights (35–90kg) filled with known activities of ^{134}Cs, ^{137}Cs and ^{40}K.

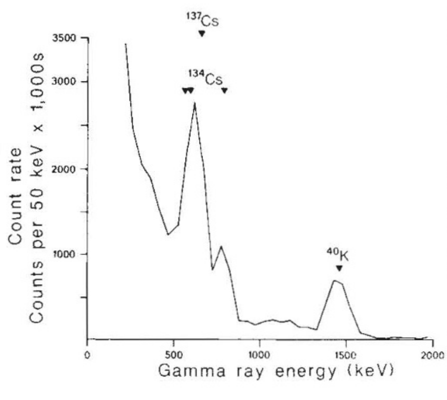

Fig. 1 Gamma-ray spectrum for the subject with the highest levels of ^{134}Cs and ^{137}Cs contamination (^{134}Cs whole body activity = 285 Bq, ^{137}Cs whole body activity = 663 Bq).

The mean ^{134}Cs activity was 172 ± 73 Bq (mean ± 1 s.d.) with no significant difference between males and females. The mean ^{137}Cs activity was 363 ± 172 Bq and the mean value for males (403 ± 172 Bq) was significantly higher than that for females (256 ± 128 Bq) ($P \leq 0.05$). The group mean whole body activity of the naturally occurring ^{40}K was 4,340 ± 532 Bq for males and 2,859 ± 576 Bq for females. These activities were equivalent to total body potassium levels (TBK) of 3,647 ± 447 mmol for males and 2,403 ± 484 mmol for females.

The ratio of radioactive Cs to K is conventionally taken as a measure of radioactive Cs contamination independent of body size and sex. By this test, there was no significant difference between the sexes for either radioisotope (total group mean values of 0.052 ± 0.021 Bq $mmol^{-1}$ for ^{134}Cs/TBK and 0.109 ± 0.047 Bq $mmol^{-1}$ for ^{137}Cs/TBK). We do not have pre-Chernobyl ^{134}Cs or ^{137}Cs activities for our subjects, but we obtained a mean ^{137}Cs/TBK ratio of 0.025 Bq $mmol^{-1}$ for three males measured in 1983 whereas a ratio of 0.0371 Bq $mmol^{-1}$ was recorded for a group of 69 subjects resident in mainland Scotland in 1978–79[1].

A significant proportion of the observed contamination is expected to come from the ingestion of milk and dairy produce. We have fitted local ^{137}C milk activities for the period 6 May to 17 July, supplied by the National Radiological Protection Board (Scottish Centre), to a single exponential function of time characterized by an initial activity of 31.2 Bql^{-1} and a half life of 60.8 days. Therefore, as the average adult in the Glasgow area consumes approximately 0.33 l milk per day[2], it is possible to predict the average activity of ^{137}Cs ingested from milk as a function of time and to use this as the input function to a simple model of Cs metabolism[3], in which 90% of ingested Cs enters a single pool with a biological half life of 110 days and the remaining 10%, which also enters the body, leaves quickly with a half life of 2 days. On the assumption that contamination occurs only from milk ingestion, the model predicts that ^{137}Cs whole body activity rises to a maximum of 390 Bq after 110 days and declines to half that over the next 200 days; the predicted value at the midpoint of the present measurement period is 318 Bq. If we postulate that the