Table II. Effect of Reserpine on DA and NE content in the rat cortex

Treatment (mg/kg i.p.)	Rat cortex DA (μg/g)	NE (μg/g)
None	0.44 ± 0.03	0.38 ± 0.06
Reserpine 5	0.25 ± 0.01 [a]	0.08 ± 0.08 [a]

Each value is the average ± S.E. of at least 15 determinations. Reserpine was given 2 h prior to sacrifice. [a] $P < 0.01$ in respect to control values.

aspects of behavior. On the other hand, the finding that the human cortex has the lowest catecholamine concentration amongst the species analyzed, should be kept in mind when considering the role of these amines in memory and intellectual functions[5,6].

Riassunto. Nella corteccia di uomo la dopamina (DA) è presente in concentrazioni quattro volte maggiori della noradrenalina (NA). Nella scimmia, nel gatto e nel ratto il rapporto DA/NA è rispettivamente di 1.5:1, 2:1 e 1:1. Nel ratto la DA corticale è depletata dalla reserpina.

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Radiometric Estimation of the Amount of Solid Gastrointestinal Contents

In studies on body composition in vivo, unknown and varying amounts of gastrointestinal (GI) contents present a main source of sytematic errors, especially when large ruminants are used[1]. Therefore, it has been investigated whether the volume of GI tract contents, i.e. dry matter and fresh minus dry matter (water) of the solid or liquid phase, can be estimated by dilution techniques employing radioactive markers.

For the experiments, 78-week-old bulls were used. As marker of the solid phase ^{152}Eu was employed since this radionuclide indicated no measurable radioactivity in the supernatant of the ruminal contents after centrifugation (30,000 × *g*, 10 min) and about 100% recovery in the feces[2]. The liquid phase was marked by ^{14}C-PEG. Inactive polyethylene glycol 4000 (PEG) as carrier similar in amounts to those in turbidity measurements[3] was added to the radioactive tracer because PEG in low concentrations tended to be adsorbed to intestinal contents[4]. The

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Radiometric (in vivo) and gravimetric (post mortem) estimations of gastrointestinal contents (dry matter, DM) in twelve 78-week-old bulls

Weight of bulls (kg)	DM intake per unit time [b] (kg/h)	^{152}Eu measurements			Dry matter contents (kg)					
		Delay time (h)	Turnover rate k_f (h^{-1})	Concentration C_o at $t = 0$ $\left(\frac{\text{ppm}}{\text{g DM}}\right)$	Rumen		GI tract		Intestine	
					post mortem	in vivo	post mortem	in vivo	post mortem	in vivo
456 [a]	0.264	10	0.0466	3635 [a]	5.48	5.92	7.95	8.94	1.29	0.28 [a]
405	0.126	10	0.0390	2316	3.02	3.23	3.90	4.48	0.44	0.43
526	0.333	6	0.0484	1099	6.42	6.88	8.59	8.88	0.93	0.91
420	0.275	11	0.0428	1223	6.86	6.43	8.85	9.45	0.92	0.82
463	0.300	7	0.0484	1193	5.73	6.20	7.40	8.29	0.82	0.84
483	0.303	5	0.0582	1477	5.13	5.21	6.36	6.72	0.84	0.68
555	0.361	6	0.0614	1361	5.88	5.88	8.19	8.06	0.99	0.74
550	0.351	6	0.0598	1309	8.00	5.87	9.55	7.98	0.83	0.76
450	0.305	6	0.0501	1393	5.80	6.09	8.13	7.92	0.86	0.72
505	0.318	6	0.0627	1708	5.56	5.07	7.03	6.97	0.89	0.59
524	0.347	10	0.0777	1956	5.90	4.99	7.99	7.94	1.12	0.51
538	0.326	9	0.0550	1187	6.46	5.93	8.39	8.86	1.05	0.84

[a] Reduced feed intake and diarrhea from 28 to 53 h post dosing. [b] Average totals for 6 days.

markers were administered in aqueous solutions via stomach tube or rumen fistula. ^{152}Eu was assayed in a NaI-detector, ^{14}C-PEG in a liquid scintillation counter after oxygen flask combustion of the dried samples and absorption of CO_2 in a system of toluene/methanol/phenethylamine[5].

Tests with fistulated bulls indicated an exponential decay with time t of the concentration C of ^{152}Eu in the solid, or of ^{14}C-PEG in the liquid phase of rumen content or feces, according to

$$[1] \quad dC/dt = -kC \quad \text{or} \quad C = C_o e^{-kt},$$

where k was the turnover rate constant for the marker and C_o its concentration at $t = 0$. The reciprocal $1/C_o$ yielded the amount of contents of the compartment to be analyzed by dilution techniques when C-values were expressed as fraction of input activity per mass of ruminal or fecal material in reference.

Except for ^{14}C-PEG in ruminal liquid, all the other turnover rate constants k for ^{152}Eu and ^{14}C-PEG in rumen or feces appeared to be almost identical. Therefore, the solid phase in cattle GI tract can be described with a one component model whereas to describe the fluid phase in young bulls at least 2 components are necessary. This justified the use of ^{152}Eu fecal excretion measurements for determining the turnover rate of the ruminal solid phase even if the different C_o-values indicated different compartments to be assayed by fecal and ruminal estimations (Figure).

For further analysis the rate of dry matter intake dM/dt, and the amount of dry matter M in the rumen or total GI tract at any time t were assumed to behave like

$$[2] \quad dM/dt = qM \quad \text{and} \quad M = M_u(1 - e^{-qt}),$$

where q is the intake rate constant of dry matter into the rumen or GI tract and M_u the amount of dry matter contents at $t \to \infty$.

In a study on 12 bulls, the ^{152} Eu fecal turnover rate constants k_f and the ruminal or gastrointestinal dry matter intake rate constants q_r or q_g were determined. The turnover rate constants k_f were obtained from ^{152}Eu fecal

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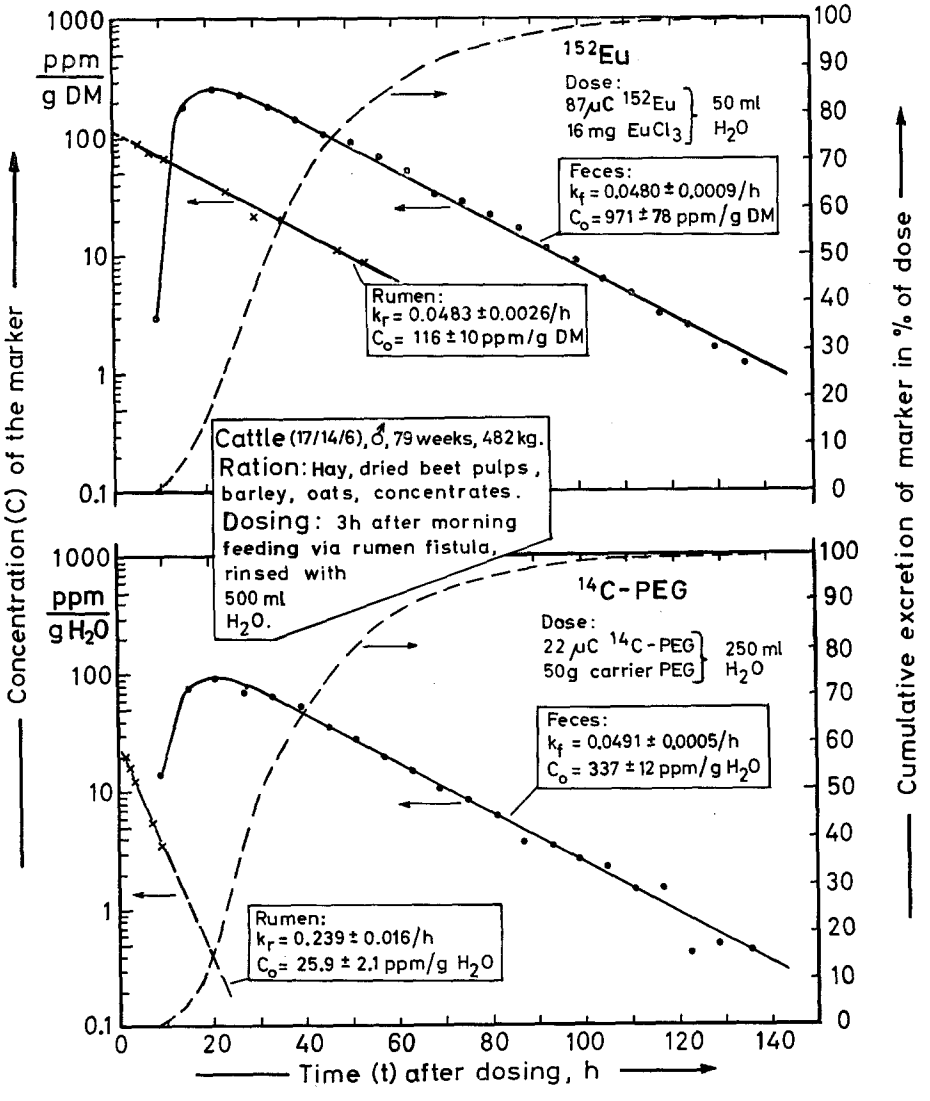

Concentrations of ^{152}Eu (upper plot) and ^{14}C-PEG (lower plot) in fractions (ppm) of applied dose as related to dry matter (DM) or water in ruminal or fecal samples (left-hand scale) and cumulative excretion of the markers (right-hand scale) versus time after administering the markers to a fistulated bull.

excretion measurements (example in Figure). For the estimation of the values q_r or q_g, the differential coefficient dM/dt was replaced by the difference ratio $\Delta M/\Delta t$ in the left hand equation [2]. Then the rate constants q_r or q_g could be calculated from the means of dry matter uptake per unit time $\Delta M/\Delta t$ as obtained during the experiment, divided by the amounts of ruminal or gastrointestinal dry matter M_r or M_g as determined at the end of the marker excretion after slaughtering the bulls without prior interruption of the feeding. The mean values of k_f and q_r were almost the same (Means $\pm$ SD: 0.054 $\pm$ 0.010 h^{-1} and 0.051 $\pm$ 0.007 h^{-1}). This was also the case for the means of the ratio $k_f/(1 + \tau k_f)$, where τ is the delay time between administration and first appearance of the marker in feces, and of the value q_g (Means $\pm$ SD: 0.039 $\pm$ 0.005 h^{-1} and 0.038 $\pm$ 0.006 h^{-1}).

As a consequence of these findings, the amount of dry matter in the rumen M_r or the total GI tract M_g could be estimated from the amount of dry matter uptake per unit time $\Delta M/\Delta t$, and k_f and τ of ^{152}Eu measurements with

$$[3] \quad M_r = \frac{1}{k_f} \cdot \frac{\Delta M}{\Delta t} \quad \text{or} \quad M_g = \frac{1 + \tau k_f}{k_f} \cdot \frac{\Delta M}{\Delta t}.$$

Values obtained by this procedure in vivo demonstrated good agreement with gravimetric measurements after slaughter (Table). Furthermore, the amount of dry matter in the intestine corresponded fairly well to the values $1/C_o$ from radiometric measurements on healthy bulls. This indicated that ^{152}Eu dilution analysis might be of use for the estimation of the amount of solid contents in the intestine (Table).

The application of the method does not require complete fecal sampling. Healthy animals must be used although transient reduction of feed intake or short lasting diarrhea did not seem to affect the turnover rate constants k_f whereas erroneous results might be produced in case of C_o or $1/C_o$ (Table, first animal). Altered marker administration (time, application route) had no observable effect on the value of k_f, and changing rations did not influence single exponential pattern of ^{152}Eu fecal excretion.

However, without further measurements or assumptions, wet content of the rumen or GI tract cannot be obtained. Of help might be the mean figure of GI tract water contents of 85.7 $\pm$ 0.7% of wet material or, as tested in this study, the relation

$$[4] \quad M_r/M_g = W_r/W_g,$$

when the amount of ruminal water W_r can be determined by dilution techniques (e.g. ^{14}C-PEG), and known values M_r and M_g from ^{152}Eu fecal excretion measurements allow the estimation of GI tract water contents W_g.

Zusammenfassung. Durch Messung der pro Zeiteinheit aufgenommenen Trockensubstanzmenge, der Überführungskonstante des inerten Markers ^{152}Eu in den Kot und dessen Verzögerungszeit bis zur erstmaligen Exkretion liess sich bei zwölf 78 Wochen alten Bullen die Trockensubstanzmenge im Pansen sowie im Gastrointestinaltrakt ermitteln.

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Morphological Changes in *Thermobia domestica* under the Influence of *Acorus calamus* Oil Vapours

The essential oil of *Acorus calamus* L. has been reported to show insecticidal activity[1–4] and the vapours to control the hatching and moulting of the first instar nymphs in *Dysdercus koenigii* F.[5]. It was observed that the oil also prevented the oviposition in stored grain pests like *Callasobruchus chinensis* L., *Corcyra cephalonica* Stainton and *Trogoderma granarium* Everts[5].

The present paper reports the effect of *Acorus calamus* oil vapours on the development of the ovaries of the firebrat *Thermobia domestica* (Pack.).

Laboratory reared[6] females were used as in earlier studies[7], freshly ecdysed and immediatedly before oviposition. 5 females and 5 males were kept with small Petri dish (6 cm diameter), loosely lidded and containing filter paper impregnated with oil[5]. Those were placed in another Petri dish (14 cm diameter) tightly sealed and were kept in incubator. Controls were kept separately using acetone impregnated filter paper. The first observations were made after 1 week and then the Petri dishes remained unsealed. Subsequent observations were made twice a week. Insects were dissected in insect Ringer solution, the ovaries were fixed in Carnoy's fluid, stained in Mayers' haematoxyline and borax carmine and mounted as whole mounts.

Different abnormalities were observed in more than 200 affected females, after having used doses 3, 5, 7, 9 and 11 and 13 ml of 100 ppm oil in acetone[5]. Only the results of 3, 9, and 13 ml doses are considered here, as shown in the Table.

The action of *Acorus calamus* oil vapours is the same as with classical chemosterilants[8] and JH[9] or its analogues[7], when the external appearance of affected firebrat ovarioles is considered. Differentiation of oögonia and prefollicular cells continues in the adult[10] to be fully impeded by the action of various substances. Classical chemosterilants inhibit the division of the prefollicular cells, thus causing a

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