tors. SMG-CM may supply the growth requirements necessary for cellular proliferation of progenitor cell subpopulations in the tumor-bearing animal. Another alternative may be that the tumors may act directly or indirectly to reduce total marrow cellularity. Clerici et al.[16] found that administration of 8.5×10^5 tumor cells reduces total marrow cellularity by 60–80%. Although our decreases were of considerably less magnitude and despite the fact that normal quantitative levels were reached by day(s) 18/19, it remains possible that a tumor-induced marrow depletion selective for cells that are unreactive to CSA may explain the inordinate increase noted in the responsive cellular elements reported here. Lastly, it cannot be ruled out that the tumorigenic states may in themselves mediate a leukemoid type augmentation, such as that seen by Burlington et al.[10] in the case of a spontaneous mammary adenocarcinoma.

This report demonstrates that a change does take place in the CSA response pattern of the femoral marrow cells taken from a tumor-bearing animal. There is a profound increase in the proportion of progenitor cells that are responsive to colony-forming factors found in SMG-CM and that are evident in the marrow populations of tumor-bearing animals. Further work is planned to ascertain whether the effects reported here are attributable to the SMG elaboration of 'unique' growth-regulating substance(s) or whether the effects reflect tumor-induced changes in the murine medullary progenitor cell compartment.

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Glutathione peroxidase, superoxide dismutase and catalase in the red blood cells of GSH-normal and GSH-deficient sheep[1]

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Summary. Levels of glutathione peroxidase (GSH-Px), superoxide dismutase (SOD) and catalase were measured in the red blood cells of glutathione(GSH)-normal and GSH-deficient sheep. There were no significant differences in any of the 3 enzyme activities measured in the 2 groups of sheep. Also, there was no relationship between GSH level and the enzyme activity. These results suggest that inspite of large differences in GSH levels, the red blood cells from GSH-normal and GSH-deficient Merino sheep appear to have similar response to oxidative stress against which GSH is credited to play a major role.

GSH is a widely occurring peptide that is found in relatively large amounts in the liver, kidney, red cells and the lens[3]. The contributions of GSH to the metabolic economy of the red blood cells have been extensively studied and it has been suggested that GSH protects intracellular components from oxidative attacks and thus plays a significant part in maintaining the viability of the red blood cells[4]. Considerable variation exist in red cell GSH concentrations both within and between domestic mammalian species[5]. Because these variations are not always associated with haemolytic disease, the comparative biochemical analysis of GSH metabolism in different species has provided an insight into the relative significance of the different aspects of red cell GSH metabolism[5].

GSH metabolism in sheep red cells has been well studied[5]. Sheep exhibit 2 biochemically distinct forms of inherited GSH deficiency known as the Merino type and the Finn type. The biochemical lesion responsible for the Merino type GSH deficiency is a diminished activity of γ-glutamyl cysteine synthetase, the first enzyme of GSH biosynthesis. The Finn type GSH deficiency is due to defective amino acid transport across the red cell membrane; the enzymatic machinery required for GSH synthesis in these sheep cells appears to be normal. Based on haematological investigations, it appears that the red blood cells with the Merino type GSH deficiency are not detrimentally affected under normal conditions. However, studies on Finn type GSH deficiency suggests that these red cells may be more susceptible to oxidative stress than normal red cells[5].

We have studied several physiological and biochemical parameters of GSH-deficient and GSH-normal Merino sheep[5]. In continuation of these studies, we now report our results on the levels of 3 enzymes (GSH-Px, SOD and catalase) that are associated with GSH metabolism and the

role this tripeptide plays in the protection against oxidative stress.

Materials and methods. 25 GSH-normal and 25 GSH-deficient Merino sheep were selected on the basis of GSH level[5]. The methods used for the preparation of haemolysates and measurements of enzyme activities were those of Beutler[6] (for catalase and GSH-Px) and McCord and Fridovich[7] (for SOD). The assays were carried out at 37 °C in a cuvette having a light path of 1 cm and a final volume of 1 ml, using a Carl Zeiss recording spectrophotometer. All the reagents were purchased from Sigma Chemical Co., St. Louis, USA.

Results and discussion. The level of GSH in the red blood cells of GSH-deficient sheep were about 20% of the normal sheep (table). However, there were no significant differences in any of the three enzyme levels measured in the 2 groups of sheep (table). We also analyzed our data to find if there was some relationship between GSH level and the enzyme activity or between one enzyme level and the other. None of these correlations reached the level of significance. No report appears to have been made on catalase and SOD and so we cannot compare our results. Reports on GSH-Px are conflicting[5].

Andrewartha[8] found that GSH-deficient sheep had about 30% lower activity of GSH-Px than normal sheep and also confirmed a previous report[9] that the administration of selenium (Se) level decreases GSH in the red blood cells implying that higher levels of Se somehow reduces GSH levels, which in turn is associated with low GSH-Px activity. Although we did not measure Se level, the fact that all sheep were taken from one flock indicate that Se level would be, at least on theoretical grounds, similar.

In summary, these results in confirmation of our previous results and those of others[5] suggest that in spite of large differences in GSH levels, the red blood cells from GSH-deficient and GSH-normal Merino sheep appear to have similar response to oxidative stress against which GSH is credited to play a major role. GSH deficiency per se is not sufficient to cause cell damage but that additional chemical challenges are required as suggested by Kosower and Kosower[10].

After submitting this abstract, we have also come across a paper by Atroshi et al.[11] which suggests that GSH-Px activity in Finn sheep is genetically determined. Low GSH-Px animals show better performance such as larger weight gain and wool production and lower mortality rate of their offspring. In confirmation of our results presented here, they also reported an absence of correlation between GSH-Px activity and GSH.

Levels of GSH, GSH-Px, catalase and SOD in the red blood cells of GSH-normal and GSH-deficient sheep

		GSH-normal sheep	GSH-deficient sheep	P
GSH	μmole/gHb	9.44 ± 0.34	1.90 ± 0.34	-
	mg/dl RBC	97.1 ± 4.7	20.6 ± 3.6	-
GSH-Px	IU/g Hb	89.58 ± 14.14	105.17 ± 18.34	NS
Catalase	$\times 10^4$ IU/g Hb	1.662 ± 0.147	1.745 ± 0.141	NS
SOD	$\times 10^3$ units/g Hb	2.404 ± 0.377	2.744 ± 0.286	NS

Values are means ± SD; NS, not significant.

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Dissociation of estrous cycle and activity rhythm in rats

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Summary. When rats were kept in continuous light there was a time-lag between the onset of activity arrhythmia and that of persistent estrus. When animals showing both arrhythmias in continuous light were kept under a LD 21:3 photoperiod, the activity rhythm returned to normal but the estrous cycle did not.

In continuous light (LL), many circadian rhythms in nocturnal mammals initially show a free-running rhythm followed by a loss of apparent rhythmicity, a state known as periodicity fade-out[1,2]. Many kinds of animal behavior, for example wheel running (WR), show a circadian rhythm. The general activity in nocturnal animals usually continues in LL as a free-running rhythm with a circadian period and terminates in arrhythmias[1,3-5]. Since the rat's estrous cycle is known to be based on the circadian rhythm[6,7], exposure to LL leads first to a free-running rhythm and then to a fading out of the estrous cycle[2,8]. The latter condition is eventually characterized by persistent estrus (PE), cystic follicles, and anovulation.

In the normal light cycle (LD 12:12 or 14:10), the behavioral and estrous cycles are maintained and entrained to the light cycle and hence are synchronized with each other. The present study was designed to determine whether activity arrhythmia and persistent estrus develop simultaneously or