and light source. Total weight, including drainage tubes and cables, is 500 g. Maximum power dissipated by incandescent light source and camera is 1.2 W, a level which produces no noticeable thermal effects on abdominal organs. Flexible ribbon cables, which pass through an incision in the flank of the animal, connect the camera to the processing circuitry in a pack mounted on the back of the animal, allowing the ewes full freedom of movement in their pens. The output image is annotated, monitored, and stored on time-lapse recorded video-tape using modified commercial television equipment.

Chambers were fixed in the abdominal cavity of 3 ewes for periods of up to 14 days before removing the chamber for observation. During this time, the animals behaved normally, moved freely within their pens, and followed their usual sleeping and eating patterns. Small amounts of clear serous fluid accumulated inside the heparinized chamber, and 5–10 ml were drained daily. Some oedema developed and was apparently responsible in part for an increase in ovarian volume evident 5 days after placement. At the time of removal after 14 days, the ovary was somewhat reddened and swollen, and the chamber was walled off by loose omental adhesions. The photograph and the selected video-taped images in the figure show an ovary on the day of implantation, and 1, 5, and 14 days later.

The video-taped pictures were obtained with a CCD array of 100×100 photosites which imaged an object field of 36×48 mm. Arrays having a greater number of photosites are now available and will add considerable detail to images, but the array used is adequate to demonstrate the effectiveness of CCD cameras in monitoring an abdominal organ.

Before this development, continuous observation of abdominal organs was not feasible without applying considerable restraint and usually anaesthesia to the animal; long-term continuous observation was impractical. Now, future applications of bio-implantable CCD cameras seem to be limited only by the requirements: a) that the tissue of interest be isolated for viewing, and b) that the axial orientation of tissue and camera be maintained (a restriction useful in itself in following morphologic changes). Research areas involving studies of ovulation are likely to benefit most from the promise of regular and continuous observation allowing to isolate particular short-term events such as rupture of the graafian follicle.

1 Supported by research grants from the Ford Foundation (700–0615A) and the Medical Research Council of Canada (MT–5692).

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Possibility of using ^{131}I-albumin as a marker for the estimations of microbial protein synthesis rates in the rumen

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7 December 1976

Summary. Total microbial protein synthesis rates in the rumen of buffaloes were estimated by isotope dilution technique, using ^{131}I-albumin treated with tannic acid as a marker. The animals were fed groundnut cake treated with formaldehyde to meet 50% of their digestible crude protein (DCP) requirement and 2.5% urea molasses mixture was given to meet the remaining requirement of DCP. Wheat straw was fed as the basal roughage. The total average microbial protein synthesis was 58.14 g/day.

Methods for the in vivo measurements of either bacteria or protozoa production rates in the rumen using isotope dilution technique have been described earlier[1-7]. In this communication, ^{131}I-albumin treated with tannic acid to protect its degradation in the rumen was used as a marker for the estimation of total microbial proteins (both bacterial and protozoal) synthesis rates.

Materials and methods. 2 male Murrah buffaloes (*Bos bubalis*), about 3 years old, fitted with permanent rumen cannulae were used in the present experiments. Animals were fed groundnut cake treated with formaldehyde[8] (5% w/w of crude protein content) to meet 50% of their digestible crude protein (DCP) requirement and 2.5% urea molasses mixture was given to meet the remaining requirement of DCP. Wheat straw was fed as the basal roughage. Mineral mixture and vitamins were added according to their requirements. The animals were kept on pre-experimental feeding period for 4 weeks, and thereafter the animals received their ration in 12 equal parts at 2-h-intervals for a period of 3 weeks. The residue, if any, at the end of each 2-h-interval was removed and weighed. ^{131}I-albumin procured from Bhabha Atomic Research Centre, Trombay, was treated with 10% tannic acid solution for 18 h to protect its degradation in the rumen and was resuspended in 100 ml iso-osmotic saline with the help of all glass Potter Elvehjem homogenizer. An aliquot was taken for the estimation of radioactivity and the albumin solution was injected into the rumen in a single dose. The contents of rumen were mixed by hand simultaneously. Samples (16 ml) from the rumen were drawn at various time intervals upto 10 h from 4 different sites and were processed for estimating the radioactivity. Total rumen liquor was taken in equal volume of 20% TCA to make the final concentration 10% and centrifuged at $27,000 \times g$ for 15 min in a Sorvall Superspeed Refrigerated Centrifuge model RC 2B. The pellet was digested twice in 10% TCA at 80 °C for 15 min, and centrifuged. The pellet was further extracted with ethanol, acetone and finally with

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ether and was then dried at 60 °C for 2 h. The samples were transferred after weighing into tubes for counting in Gamma-Rays-Spectrometer, and were processed for nitrogen estimation (micro-kjeldahl). True nitrogen was estimated in the feeds.

Specific radioactivity was expressed as cpm/mg nitrogen and the decline in the specific radioactivity with time was used to calculate the turnover time and the production rate of total true protein nitrogen in the rumen, which included the true protein nitrogen of the feed and microbes. The difference between the production rate of total true protein nitrogen over 24 h and that of the dietary source indicated the quantity of microbial protein nitrogen produced per day.

Results and discussion. The microbes in the rumen degrade a large proportion of dietary protein and utilize some of the degradation products for their body protein synthesis. These microbes can also utilize non-protein nitrogen compounds and upgrade the dietary proteins of low biological value into microbial proteins which are of good biological value[11,12]. Therefore the measurements of the production rates of rumen bacteria and protozoa are important for examining the utilization of nitrogenous sources of a particular feed in a short time. Earlier methods[1-7] describe the measurements of rumen bacteria or protozoa using labelled microbes as a marker, where separate experiments were required to measure the bacteria and protozoa production rates on 2 consequent days. In the present communication, attempts were made to overcome this problem. ^{131}I labelled albumin, after treatment with tannic acid to protect its degradation in the rumen, was used as a marker. The animals were offered groundnut cake proteins treated with formaldehyde to bypass rumen degradation. 2 assumptions are inherent in the present experiments. Firstly the albumin after treatment with tannic acid will not be degraded in the rumen[9,10] and secondly the pellet of the rumen liquor after processing for the determination of nitrogen will only contain nitrogen of protected true proteins of feed and that of microbes of the rumen. The results are presented in the table. The total average microbial protein synthesis was 58.6 g/day which was about 37.5% of the available nitrogen (non-protein nitrogen) to the microbes. The source of nitrogen in the rumen available to the microbes was of urea and NPN compounds of groundnut cake and wheat straw. Since the amount of amino acids available to the microbes for their protein synthesis was negligible, this might be the reason for low microbial growth rates in the present experiments. The present method, although it accounts for both bacterial and protozoal proteins, may have limited use only in animals offered protected proteins and/or NPN compounds as the sole source of nitrogen.

Production rate of bacteria estimated by using ^{131}I-albumin as a marker

Particulars	Animal I	Animal II
Radioactivity injected as labelled albumin (cpm × 10^4)	238.33	238.33
Specific radioactivity at time 0 (cpm/mg N)	578.00	419.00
Pool size (N mg)	4123	5688
Turnover time (min)	231.8	367.2
Production rate of N (g/day)	25.61	22.30
True protein N intake (g/day)	19.70	16.00
Microbial nitrogen production (g/day)	5.91	6.30
Microbial protein synthesis (g/day)*	56.28	60.00

*Bacteria contain 10.5% nitrogen[13]

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