



**ROBERT GORDON
UNIVERSITY•ABERDEEN**

OpenAIR@RGU

The Open Access Institutional Repository at Robert Gordon University

<http://openair.rgu.ac.uk>

This is an author produced version of a paper published in

Proceedings of the Nutrition Society (ISSN 0029-6651, eISSN 1475-2719)

This version may not include final proof corrections and does not include published layout or pagination.

Citation Details

Citation for the version of the work held in 'OpenAIR@RGU':

HEYS, S. D., PARK, K. G. M., McNURLAN, M. A., MILNE, E., KEENAN, R. A., MILLER, J. D. B., BROOM, J., EREMIN, O. and GARLICK, P. J., 1990. Stimulation of colorectal tumour protein synthesis, in vivo, by nutritional support. Available from *OpenAIR@RGU*. [online]. Available from: <http://openair.rgu.ac.uk>

Citation for the publisher's version:

HEYS, S. D., PARK, K. G. M., McNURLAN, M. A., MILNE, E., KEENAN, R. A., MILLER, J. D. B., BROOM, J., EREMIN, O. and GARLICK, P. J., 1990. Stimulation of colorectal tumour protein synthesis, in vivo, by nutritional support. *Proceedings of the Nutrition Society*, 49 (2), 165A

Copyright

Items in 'OpenAIR@RGU', Robert Gordon University Open Access Institutional Repository, are protected by copyright and intellectual property law. If you believe that any material held in 'OpenAIR@RGU' infringes copyright, please contact openair-help@rgu.ac.uk with details. The item will be removed from the repository while the claim is investigated.

Stimulation of colorectal tumour protein synthesis, in vivo, by nutritional support. By S. D. HEYS^{1,2}, K. G. M. PARK^{1,2}, M. A. McNURLAN¹, E. MILNE¹, R. A. KEENAN², J. D. B. MILLER², J. BROOM², O. EREMIN² and P. J. GARLICK¹, ¹Rowett Research Institute, Bucksburn, Aberdeen AB2 9SB, ²Department of Surgery, University of Aberdeen, Foresterhill, Aberdeen AB9 2ZD

Malignant disease is frequently accompanied by weight loss and malnutrition, which are associated with an increase in patient mortality and morbidity. Supplemental nutrition has therefore been provided in an attempt to reverse this weight loss and improve nutritional status, but a major concern has been a possible stimulation of tumour growth. Animal experimental studies have shown that nutrition can stimulate tumour growth (Torosian & Daly, 1986), but to date there is no evidence for stimulation of human tumour growth in vivo. Growth of a tissue depends on an excess of protein synthesis over degradation. However, experimental studies have shown that in malignant cells in culture, protein synthesis is the primary determinant of cell growth (Baccino *et al.* 1980).

The measurement of human tumour protein synthesis in vivo using the 'flooding dose' technique has been previously described (Heys *et al.* 1989). This approach has now been applied to investigate the effect of intravenous nutrition on patients with colorectal cancer.

Patients with localized colorectal carcinoma with no evidence of metastatic disease were studied. They were randomly allocated to one of two groups: (1) to be fasted for 24 h before surgery (*n* 9), or (2) to receive intravenous nutritional support for the 24 h before surgery (*n* 9). Nutritional support comprised 1.25 g protein/kg body-weight (Vamin-9-glucose) and 105 kJ (25 kcal) energy/kg body-weight, with 40% of the total energy as glucose and 60% as lipid. The nutritional status of both groups before inclusion in the study was similar. Measurements of colorectal tumour protein synthesis were made at the end of this 24 h experimental period, by intravenous injection of L-[1-¹³C]leucine, 4 g/70 kg body-weight, 19.6 atoms % in 200 ml saline (9 g sodium chloride/l). Biopsies from the tumour were then taken endoscopically, immediately after induction of anaesthesia, allowing 60–90 min for incorporation of the isotope into protein. The fractional rates of protein synthesis were calculated from the increase in enrichment of protein-bound leucine in the tumour and the average free leucine enrichment in the plasma, determined by isotope ratio and gas chromatography–mass spectrometry.

The mean rate of protein synthesis in colorectal tumour tissue was 22.6 (SEM 1.9)%/d in the fasted patients, but rose significantly to 43.9 (SEM 3.4)%/d (*P* = 0.002) in the group receiving nutritional support. This increase in tumour tissue protein synthesis provides evidence, in vivo, that nutritional support might lead to stimulation of human tumour growth.

Baccino, F. M., Tessitore, L. & Bonelli, G. (1980). *Toxicologic Pathology* **12**, 281–287.

Heys, S. D., Keenan, R. A., Wernerman, J., McNurlan, M. A., Milne, E., Calder, A. G., Buchan, V.,

Eremin, O. & Garlick, P. J. (1989). *Proceedings of the Nutrition Society* **48**, 101A.

Torosian, M. & Daly, J. M. (1986). *Cancer* **58**, 1915–1929.