Table I. P/WB (plasma/whole-blood) amino acid concentrations in carotid artery, portal and hepatic veins. Amino acids for which P/WB ratio is not different from 1 are not presented.

	Artery	Portal vein	Hepatic vein
Lys	$0.51^{a} \pm 0.02$	$0.58^{b} \pm 0.02$	$0.56^{b} \pm 0.02$
Thr	0.91 ± 0.02	0.90 ± 0.04	0.92 ± 0.01
Cys	1.27 ± 0.03	1.31 ± 0.05	1.31 ± 0.05
Gly	0.69 ± 0.005	0.69 ± 0.01	0.68 ± 0.01
Glu	$0.66^{a} \pm 0.08$	$0.64^{a} \pm 0.09$	$0.87^{b} \pm 0.06$
Gln	1.72 ± 0.09	1.66 ± 0.1	1.68 ± 0.1
Asp	0.36 ± 0.05	0.42 ± 0.05	0.38 ± 0.04
Asn	1.8 ± 0.11	1.76 ± 0.17	1.54 ± 0.25
Arg	1.31 ± 0.03	1.31 ± 0.05	1.32 ± 0.03

Ratios on the same line with different superscripts are significantly different ($P < 0.05$).

Communication no. 32

In vivo plasma and whole blood amino acid exchanges across the liver in pig.
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Amino acid metabolism studies have often been restricted to changes in the concentrations or movements of amino acids in the plasma compartment. Nevertheless, some authors have demonstrated that erythrocytes contribute to inter-organ amino acid exchanges (Elwyn et al., Am. J. Physiol. 222 (1972) 1333–1342; Houlier et al., Reprod. Nutr. Dev. 31 (1991) 399–410; Lobley et al., Br. J. Nutr. 75 (1996) 217–235). In pigs, there are no data available regarding the respective contributions of erythrocytes and plasma to the amino acid transport across the portal drained viscera.

Plasma and whole blood amino acid exchanges across the liver were examined in three hourly fed Large-White pigs (30.5 kg, mean live weight) which were surgically prepared with chronic insertion of catheters into four vessels: a mesenteric vein, the portal vein, an hepatic vein and the carotid artery. Blood flow was measured during 6 h of continuous PAH infusion through the mesenteric catheter. Whole blood, plasma amino acid and PAH concentrations were determined in the carotid artery and in portal and hepatic veins.

Lys, thr, gly, glu, asp and orn were present at higher concentrations in whole-blood than in plasma, whereas cys, gln, asn and arg were more abundant in plasma than in whole blood (*table I*). Except for lys and glu, the plasma/whole blood (P/WB) ratios showed no significant difference in the diverse vessels. The lysine P/WB ratio was significantly higher in the portal than in the artery suggesting that absorbed lysine was preferentially transported in the plasma. The glu P/WB ratio was higher in the hepatic vein suggesting that glu released from the liver was mainly transported in the plasma. The liver balance showed negative values for all amino acids except for glu, which exhibited a positive balance.

These data show that the contribution of plasma and whole blood to amino acid transport can be different according to the amino acids and the tissue under consideration. As a consequence, attention should be paid to the choice of blood sampling sites during amino acid metabolic studies.

Table I. Tissue protein content, absolute protein synthesis (ASR) and ribomosal capacity (Cs) of male chickens exposed to 22 or 32 °C from 4 to 6 weeks of age.

		22 °C	32 °C
Muscle	protein content (g)	14.97 ± 0.62	11.42 ± 0.25***
	ASR (mg/d)	1689 ± 73	845 ± 44 ***
	Cs (mg/g)	9.5 ± 0.2	6.8 ± 0.2***
Liver	protein content (g)	6.47 ± 0.48	4.77 ± 0.24**
	ASR (mg/d)	5308 ± 324	3724 ± 366**
	Cs (mg/g)	55.5 ± 1.9	48.6 ± 2.2*

Data represent the means ± SE for six chickens per group.
Statistical significance: * < 0.05, ** < 0.01, *** < 0.001 compared with 22 °C.

Communication no. 33

Protein metabolism in heat-exposed chickens. S. Temim, F. Alleman, A.M. Chagneau, R. Peresson, J.P. Caffin, J. Michel, S. Tesseraud (Station de recherches avicoles, Inra, 37380 Nouzilly, France)

Heat-exposed chickens exhibit a decreased feed intake, a lower growth rate and also a depressed protein gain, which suggests an alteration in protein metabolism (Geraert et al., Br. J. Nutr. 75 (1996) 195–204).

The aim of this study was to examine the effect of chronic heat exposure (32 °C versus 22 °C) on protein metabolism in 4- to 6-week-old male broiler chickens. The protein synthesis rate was measured in vivo (by flooding dose of [^{3}H]-Phe) in the *Pectoralis major* muscle and in the liver of six birds from each treatment. It was expressed as ASR (amount protein synthesised/day). The ribosomal capacity (Cs) was estimated for each tissue using the ratio of RNA to protein. The activities of two key liver enzymes involved in amino acid catabolism, aspartate amino transferase (ASAT) and glutamate dehydrogenase (GDH), were also determined. Nitrogen excretion was measured in representative animals from both treatment groups ($n = 8$).

Chronic heat exposure significantly reduced the protein content, Cs and ASR irrespective of the tissue studied (*table I*). These variations were more pronounced in the *Pectoralis major* muscle than in the liver, suggesting that protein turnover responsiveness to heat exposure is tissue dependent. The ASAT and GDH activities, expressed in mmol/min per g, tended to be higher in heat-exposed animals compared to those maintained at thermoneutrality (+15 %, $P = 0.15$; +22 %, $P = 0.22$, respectively). This tendency is in agreement with the slightly increased nitrogen excretion (expressed in g/kg BW) recorded for birds maintained at the higher temperature (+15 %, $P = 0.25$).

In conclusion, chronic heat exposure in broiler chickens resulted in a significant depression of tissue protein synthesis rates, especially in skeletal muscle. This was mainly related to a lower ribosomal capacity. The underlying mechanisms responsible for these alterations in protein metabolism await clarification.