rier. Of various possiblities, variation in density of surface receptors for iron has not been investigated. Our results are compatible with the findings of Wheby et al.[1], who determined mucosal 'uptake' and 'transfer' of iron from closed loops of rat duodenum and proximal jejunum by counting radioactivity of ^{59}Fe in gut and carcass.

Normally, there is more storage iron in liver, spleen and kidneys in mature female rats than is contained in these organs in mature male rats[3–6]. Linder et al.[5] have provided evidence indicating that the greater accumulation of iron in mature female rats is related to a higher level of ferritin synthesis, at least in the liver. Since the level of intracellular ferritin reflects cellular uptake of iron[11], Linder et al.[5] suggested that female rats absorb iron more efficiently from the gut than do male rats. Long ago, Otis and Smith[12] noted better absorption of dietary iron by female rats. Our findings suggest that this difference could be due to more efficient absorption of dietary iron from the duodenum in females. As shown in figure 1, the blood iron curves after absorption of iron from the duodenum differed significantly in male and female rats, yet there was no significant sex difference in the curves when iron was absorbed from the proximal jejunum. The reason for the sex difference in absorption from the duodenum is unknown, but cannot be ascribed to iron deficiency in females with ample stores of iron.

The blood iron curves shown in Figures 1 and 2 indicate that absorption was continuous during the 2-h interval and that egress of iron from the blood never exceeded ingress. The curves are compatible with first order absorption kinetics or perhaps with Michaelis-Menten kinetics (mixed first and zero order). However, the highest dose given (40 µmoles) could have damaged the absorbing cells in the gut since blood iron levels diminished precipitously after a rapid initial rise and no plateau level developed.

The possibility that there are differences in surface densitiy of receptors for inorganic iron along the course of the small intestine deserves detailed investigation.

1 This research was supported by grant RO1 AM 12381 from the National Institute of Arthritis, Diabetes and Digestive and Kidney Diseases, National Institutes of Health.

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Cold-induced changes in fatty acid composition of rat brown fat during the perinatal period

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Summary. Cold exposure of the newborn rat has little effect on the fatty acid composition of triglycerides and phospholipids up to the 14th day. During the 3rd week, cold exposure inhibits the involution of brown fat observed in the warm-exposed rat.

Brown adipose tissue (BAT) is known to be a site of non-shivering heat production in newborn rats as well as cold-adapted adult animals. Changes in fatty acid composition occur during the development of BAT[1,2] and after several weeks of cold exposure of the rat[3,4]. Furthermore, it has been observed that the increase in BAT weight is larger in newborn rats exposed to cold than in animals kept at the mother's thermal neutrality, despite a drop in the lipid content of the former[5]. In the present paper an attempt is made to analyze the fatty acid composition of the triglycerides and phospholipids of BAT from foetuses and newborn rats in relation to development and ambient temperature.

Material and methods. Female Sprague-Dawley rats were placed at either 16 °C or 28 °C on the 15th day of gestation. At birth, the newborns were kept with their mother at these ambient temperatures. 20-day-old foetuses and 1-, 3-, 7-, 14- and 21-day-old rats were killed by decapitation; interscapular brown adipose tissue (BAT) was rapidly removed, weighed and immersed in liquid nitrogen.

Total lipids of BAT and of milk from the stomach of 2-day-old littermates were extracted according to procedure of Folch et al.[6]. Triglycerides (TG) and phospholipids (PL) were separated by TLC on silica gel. Phospholipid phosphorus was determined using Bartlett's method[7]. TG weight was obtained from the difference between the total lipid weight and the PL weight. The relative amounts of the various TG or PL fatty acids were estimated using GLC.

Results and discussion. Triglycerides. The total lipid content of BAT was low in the foetuses (4.7%) (fig. 1) and about 70% of these lipids were TG. Their fatty acid composition (fig. 2) was characterized by a predominance of saturated fatty acids (more than 50% palmitic acid). No difference was observed in relation to the mother's ambient temperature.

From birth to the 3rd day post-partum, after the onset of suckling, the total lipid content of BAT increased more rapidly in 28 °C-exposed than in 16 °C-exposed rats (fig. 1). The fatty acid composition was greatly changed (fig. 2); there was a decrease in palmitic acid and an increase in oleic and linoleic acids. On day 3, in both groups, the fatty acid composition of brown fat TG was very similar to that of the milk (about 8% lauric and myristic acids; 5% palmi-

toleic and stearic acids; 25% palmitic, oleic and linoleic acids). These results correlate with previous ones obtained in warm-exposed newborn rats[1,2]. No significant influence of environmental temperature was observed.

Up to the end of the 2nd week of life, few changes occurred (fig. 2); only an increase in the proportion of shortest fatty acids (lauric acid and myristic acid) could be noted, with a decrease in the mono-unsaturated ones. No effect of temperature was observed.

After weaning, the fatty acid composition of BAT from 21-day-old rats was quite similar to that found in the 6-month-old adult rat[4] except for its higher levels of lauric and myristic acids. Some cold-induced differences were observed, namely, a decrease in palmitic acid content and an increase in that of linoleic acid (fig. 2), resulting in an increase in the mean chain length and in the index of unsaturation (fig. 1).

Phospholipids. In foetuses, the PL content was about 1.5% of BAT weight and 60% of total lipid content (fig. 1). As in TG, the major fatty acid was palmitic acid, but high levels of polyunsaturated fatty acids (linoleic and arachidonic acids) were recorded. Expressed in percent of BAT weight, the PL content was not modified at birth; however, the amount of PL in total lipids was strongly decreased during the first 3 postnatal days due to the large increase in total lipid content (fig. 1). From day 3 on, the total PL in BAT was larger in the 16 °C group than in the 28 °C one; the highest difference was observed on day 21; this fact suggests a cold-induced hyperplasia of the tissue.

As previously observed[2] the fatty acid composition of PL

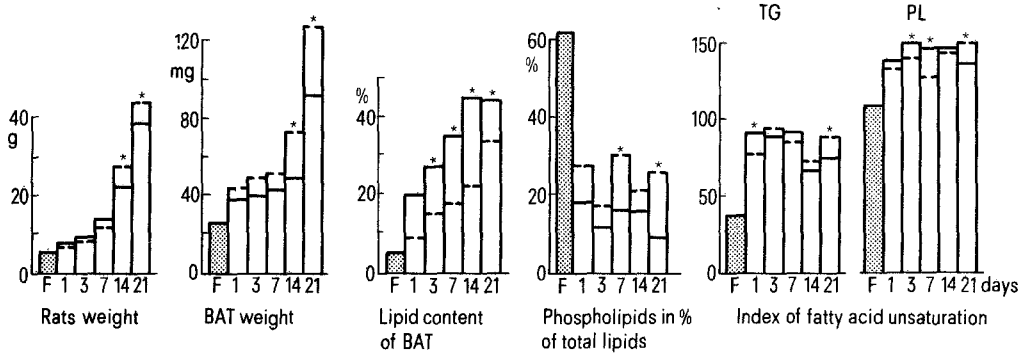

Figure 1. Some characteristics of brown adipose tissue during the perinatal period.
The columns represent the results obtained in foetuses (hatched colums) and 1-3-7-14-21 day-old rats (white columns). At the bottom of the columns are represented the values of 28 °C exposed rats (straight lines) and the values of 16 °C-exposed rats (dash lines). The index of unsaturation was determined as follows: the percentages of the various unsaturated fatty acids (multiplied by the number of double bounds) are added.
* Significant differences between 28 °C- and 16 °C-groups, 10–12 animals in each group.

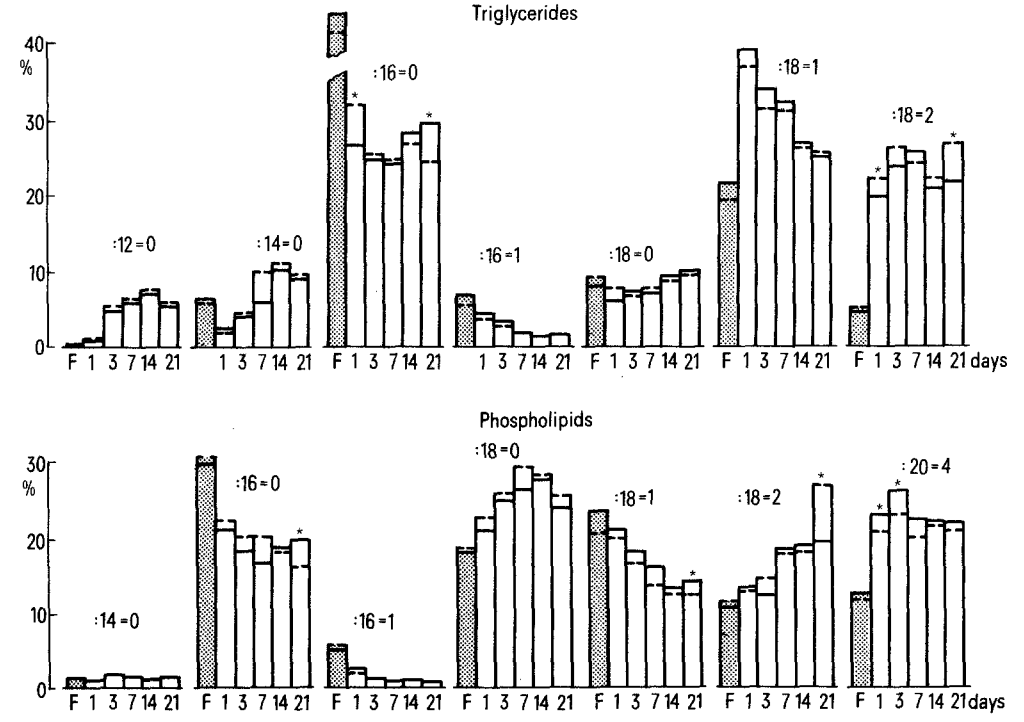

Figure 2. Fatty acid composition of triglycerides and phospholipids of brown adipose tissue. Same legend as in figure 1. Triglyceride composition is represented in the upper part and phospholipids in the lower part.
* Significant differences between 28 °C- and 16 °C-group, 4–5 determinations in each group.

was modified after birth, bringing about a decrease in palmitic acid and an increase in stearic acid (fig. 2).
Contrary to TG, the linoleic acid content increased progressively during the 1st post-natal week, despite a large supply from the maternal milk. On the contrary, arachidonic acid content was doubled during the 1st day (fig. 2). As the latter acid is derived from the former, it can be deduced that strong stimulation of its synthesis occurs just after birth. Arachidonic acid is the precursor of prostaglandin E_2 whose tissue level has been found to increase 10-fold on the 2nd post-natal day[8]. As PGE_2 has an antilipolytic effect on rat brown adipocytes by inhibiting adenylate cyclase[9], this phenomenon, combined with an increase in lipoprotein lipase activity[10] could favour TG accumulation in the tissue during the first postnatal days.
Except for an increase in fatty acid unsaturation up to day 3 (fig. 1), cold exposure had no significant effect on PL fatty acid composition during the first 2 post-natal weeks. However, at the end of the 3rd week, a higher level of linoleic acid was observed, whereas the levels of palmitic and oleic acids were lower (fig. 2). Similar variations have been observed following cold-acclimation of the adult rat[4].
Conclusion. It can be concluded that in the early postnatal period, the large increase in lipid content of BAT, which is reduced in cold-exposed rats, would mainly be due to the uptake of fatty acids provided by maternal milk. Cold exposure has only a weak effect on the fatty acid composition of both triglycerides and phospholipids up till the end of the 2nd week. However, during the 3rd week, cold-dependent differences are observed, showing that the involutional process occurring in the brown fat of a growing rat could be stopped by cold-exposure.

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Low ambient oxygen tolerance in some freshwater teleosts[1]

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Summary. Measurements of the asphyxial oxygen level for *Rhinomugil corsula, Tilapia mossambica, Puntius sarana* and *Carassius auratus* at 30 and 35 °C revealed that at 35 °C the lethal oxygen level was higher for *T. mossambica* and *P. sarana* and lower for *R. corsula*, but it remained the same for *C. auratus* at 30 and 35 °C.

The importance of adequate ambient oxygen in an aquatic environment cannot be over-emphasised. Studies of the dissolved oxygen requirement of several fishes at different ambient oxygen concentrations have shown that most of the fishes have the ability to sustain complete or partial lack of oxygen[3-9]. But information on low ambient oxygen tolerance in fishes is lacking especially in the case of tropical species which are more likely to be exposed to conditions of low oxygen and high temperatures, in view of their ecophysiological characteristics[10].
Four freshwater teleosts viz. mullet, *Rhinomugil corsula* (Hamilton), cichlid, *Tilapia mossambica* (Peters), minor carp, *Puntius sarana* (Cuvier and Valenciennes) and goldfish, *Carassius auratus* (Linnaeus) were acclimated to freshwater at 30±0.5 °C or 35±0.5 °C for at least 15 days before the experiment. A modification of Fry's respirometer (capacity 3 l) was used and the design of the respirometer was such that the diffusion of gases into and out of water in the respirometer was minimized[11]. The experimental fish was exposed to oxygenated water (air saturated) and the dissolved oxygen was reduced by the respiration of the fish until it was asphixiated (loss of equilibrium). Thus, asphyxial oxygen concentration is the low lethal level of oxygen, below which fish cannot survive. Winkler's technique[12] was followed for the estimation of dissolved oxygen in the water samples.
The asphyxial oxygen concentration for the 4 species tested are given in the table. The species tested can be arranged in the decreasing order of tolerance of low oxygen: *C. auratus, T. mossambica, P. sarana* and *R. corsula* at 30 °C. At 35 °C, the order of tolerance changed slightly, the position of *T. mossambica* and *P. sarana* being reversed. It is significant that the order of hypoxic tolerance is the same as that of the anaerobic abilities as judged from the magnitude of the respiratory quotients[7-9].
The temperature effect (30-35 °C) on the asphyxial oxygen level is not evident. But it is noted that the lethal oxygen level is higher at 35 °C for *T. mossambica* and *P. sarana*, though the difference is only statistically significant ($p < 0.05$) for *T. mossambica*. The mean value for *R. corsula* is lower at 35 °C (table) but it is statistically not significant ($p < 0.05$). Since in all the experiments, after asphyxiation,

Asphyxial oxygen concentration (mg O_2/l) of 4 freshwater teleosts acclimated to 30 and 35 °C and tested at the acclimation temperature

Species	30 °C	35 °C
Rhinomugil corsula	0.86±0.018 (16)	0.84±0.015 (10)
Tilapia mossambica	0.36±0.071 (9)	0.56±0.015 (11)
Puntius sarana	0.41±0.025 (10)	0.49±0.250 (10)
Carassius auratus	0.28±0.015 (8)	0.28±0.236 (9)

The values in parentheses indicate the number of determinations. In each case ± SE is indicated.