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This Week's Citation Classic

Brück K. Temperature regulation of the newborn infant.
Biol. Neonate **3**:65-119, 1961.
Inst. of Phys., University of Marburg, Frankfort, Fed. Rep. of Germany]

The demonstration showed that, in the neonate, the actions of the thermoregulatory control elements are more or less adjusted to the heat loss conditions which are determined by factors related to body size. It disproved the widespread concept of a grossly undeveloped thermoregulatory system. It is not the unresponsiveness but the very sensitive thermoregulatory reactions which require the observation of special environmental conditions for the well being of the neonate. [The *SCI*® indicates that this paper has been cited over 200 times since 1961.]

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"This paper appeared after the pediatric wards had been provided with thermosta tized cribs —'incubators' —which made it possible to rear the low-birth-weight neonate at any desired thermal condition. However, at this time nobody knew exactly which ambient thermal condition was to be considered optimal. Like other functional systems, the neonatal thermoregulatory system was thought to be characterized merely by deficiencies in comparison with the adult. The paper not only showed that, unlike a poicilithermic organism, the neonate (including low-birth-weight neonates) is able to activate all effector elements known from the adult thermoregulatory system — thermogenesis, peripheral blood flow, sweat secretion —but that the temperature thresholds for the actuation of these control actions are appropriately adjusted to the smaller body size. In particular, it was shown that the increased heat production, which compensates for the enlarged heat loss in a cool environment, is based on a 'non-shivering' mechanism, whereas in the adult this heat arises solely from shivering.

"In a series of subsequent studies in my laboratory and in others it was shown that the neonate possesses a special tissue-brown adipose tissue — in which the extra heat is generated under the condition of cold exposure.[1]

"It could be inferred from our studies that the optimal environmental temperature is that at which the least thermoregulatory effort is needed to maintain deep body temperature at the normal value. This temperature—thermal neutral temperature — is much higher in the neonate (33-34° C) than in the adult (ca. 27° C).

"The plan for the experimental studies developed while I was working in the department of pediatrics, University of Hamburg. There. no technical means for performing such studies were then available. So I went back to physiology (University of Marburg) where I was able to develop the required methods and to interest the department of obstetrics and gynecology in these studies which were then carried out with the help of my wife, Monika, and an obstetrician, Horst Lemtis, in the Women's Hospital.

"The most delicate problem was to con-vince the nurses and parents that our machines would not harm the newborn babies. Our daughter helped us a great deal here. She was born in this hospital right at the time our set-up was ready for the first examination. She became our first 'subject' — the ice was broken. The first results of these studies were published in *Pflügers Archive* in the German language.[2,3] The *'Citation Clas□sic'* was the first publication in English and it was thought of as a review of the preceding German papers.

"The studies in human neonates were followed by animal studies when we became interested in the neuronal and biocybernetic aspects of the interlocked control of shivering and nonshivering thermogenesis and the mechanism of long term adaptation of functional systems It was felt that this could improve the understanding of the peculiarities in the neonate which have a lot in common with the special modifications in functional systems found during adaptation."

1. **Brück K & Wünnenberg B.** Studies on the significance of the multilocular brown adipose tissue for the thermogenesis in the newborn guinea pig. *Pflügers Arch.* **283:**1-16, 1965.
2. **Brück K, Brück M & Lemtis H.** Skin blood flow and temperature regulation in newborn infants. *Pflügers Arch* **265:**55-65. 1957.
3. ..... Thermoregulatory changes on energy metabolism in mature neonates. *Pflügers Arch.* **267:**382-91, 1958.