

## Seasonal Changes of Circadian Rhythms of Human Birth in Northern Finland

Although the first statistics concerning the timing of human delivery are only 125 years old, it seems to have been accepted even before this that most births occur at night<sup>1</sup>. Numerous authors point to a very regular birth rhythm which takes the form of a sinusoidal curve, with a peak at about 03.00 and a trough at about 14.00–18.00<sup>2–5</sup>. In some publications in which the day is roughly divided into 4 six-hour periods, or a simple dichotomy, night versus day, is used, this birth rhythm is represented in an inexact and inadequate form (e. g. table I in<sup>6</sup>). When analysing the influence of induced labor, parity, still-birth, instrumental delivery or the administration of oxytocics on the diurnal analysis of deliveries the results may be contradictory. For example, HOOGENDOORN<sup>5</sup> has shown that the very marked peak for first-born children is about 6 h later than the peak for subsequent children, while ERHARDT et al.<sup>6</sup> state that birth is just as likely to occur at any hour of the day among primiparae as among multiparae.

Very little attention has been paid to the influence of the season of the year on the hour of birth. The importance

of the length of day has been pointed out in regulating via hypophysis the daily distribution of births<sup>7</sup>; but contrary to this assumption, some later results reveal no seasonal differences<sup>5</sup>.

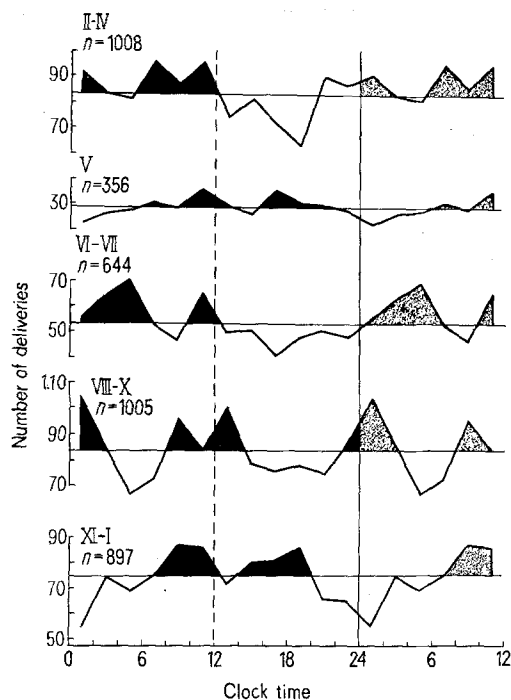
In order to obtain some information on any possible seasonal influence on the circadian rhythms of birth from a region with extreme variations in illumination, data was collected from 3910 cases of spontaneous delivery in northern Finland during the years 1948–1971. Most of the deliveries reported took place in the maternity ward of the Inari-Utsjoki Communal Hospital at Ivalo (68° 38' N, 27° 35' E); about 3% of the cases originate from the Finnish Red Cross Cottage Hospital at Outakoski (69° 35' N, 26° E). Both are situated in the subarctic region of Lapland where the Lapps form the majority of the inhabitants. In midsummer the sun remains above the horizon for 58 days in Ivalo and 68 days in Outakoski, and correspondingly, in winter it remains below the horizon for 34 days in Ivalo and 47 days in Outakoski<sup>8</sup>.

Figure presents the distribution of deliveries in various months. The most striking feature is that in winter the deliveries occur mostly in the 'day-time' and the deepest trough appears just after midnight. In the other months there are 2 distinct phases: nocturnal and diurnal. Their position and mutual size varies with the season. The exceptional shape of the curve for May may indicate either the same diurnal patterns as the curve for November–January or, in respect of the flatness of the curve, imperfect synchronization with the natural light-dark-cycle under the prevailing extreme light conditions.

Similar phase-shift of locomotor activity has been demonstrated earlier in some small mammals and some fish species also inhabiting the northernmost parts of Europe<sup>9–11</sup>. The results presented here (Figure) do not suppose other bodily functions to have the same phase-shift or the same phase relationship. On the contrary, certain circadian rhythms in the same body can be dissociated. LOBBAN<sup>12</sup> has studied shift-workers at Spitzbergen and has demonstrated this in the case of urine excretion: 'In fact, the miners on nightshift behave as nocturnal animals for potassium excretion, and as diurnal animals for the excretion of water'.

*Zusammenfassung.* Die Verteilung der Geburten im finnischen Lappland auf die Tagesstunden zeigt eine jahreszeitliche Schwankung der Phasenlage in der Geburtenrhythmik. Zur Mittwinterzeit fallen die meisten Geburten in die Zeit von 08.00 bis 20.00 Uhr, während sie in den anderen Jahreszeiten auf die Nacht und den Vormittag fallen.

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Distribution of human deliveries in Finnish Lapland in various seasons. Vertical broken line, noon; vertical continuous line, midnight. On the right-hand side the curve has been partly duplicated to provide a better survey.

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<sup>13</sup> Supported by a grant from the National Research Council for Sciences (Finland).