LITERATURE CITED

1. V. I. Belyaev, Byull. Éksp. Biol. Med., No. 9, 268 (1978).
2. G. Yu. Volynkina and N. F. Suvorov, Neurophysiological Structure of Human Emotional States [in Russian], Leningrad (1981), p. 118.
3. N. S. Zalkind and V. Yu. Shlykov, Neirofiziologiya, No, 1, 19 (1974).
4. Ya. M. Kots and V. I. Krinskii, Fiziol. Zh. SSSR, No. 7, 784 (1967).
5. E. I. Pal'tsev and A. M. Él'ner, Biofizika, 12, 1064 (1967).
6. N. D. Platonov and L. S. Romanova, Byull. Éksp. Biol. Med., No. 8, 18 (1975).
7. Yu. M. Shtykhno and V. I. Udovichenko, Byull. Éksp. Biol. Med., No. 4, 403 (1977).
8. P. J. Delwid and P. Delbeca, in: New Developments in Electromyography and Clinical Neurophysiology, Vol. 3, Basel (1973), pp. 336-341.
9. M. Hugen, in: New Developments in Electromyography and Clinical Neurophysiology, Vol. 3, Basel (1973), pp. 277-297.
10. J. W. Magladery and D. B. L. McDougal, Bull. Johns Hopkins Hosp., 86, 255 (1950).
11. S. Rossignol and G. M. Jones, Electroenceph. Clin. Neurophysiol., 41, 83 (1976).

ENERGY HOMEOSTASIS AND NATURAL BIOLOGICAL MODELS

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One of the principal homeostasis control circuits is interaction between energy flows (1, 3]. This interaction takes place in accordance with the principle of reciprocity [5]. It must therefore be postulated that linked functional processes, with discrete energization, can be used as a model with which to study some aspects of homeostasis. It was in fact shown previously [2] that insolation has unequal effects on the duration of two coupled phases of systole, namely isometric contraction (Ic) and ejection (E) which, as we know, have reciprocal energization [4].

It was accordingly decided to compare the dynamics of the duration of these phases of systole during seasonal fluctuations in the energy background (winter, summer), allowing for the possible effect of typological and sex differences in homeostasis.

EXPERIMENTAL METHOD

Tests were carried out on 375 normal persons aged 18-20 years (244 men and 131 women). As was described previously [2], the phases of the cardiac cycle (CC) were determined by recording physiological parameters during a period of 10-12 h in January and in July. After analysis of the data by Student's test they were analyzed for the group of subjects as a whole, and also for separate groups of persons of both sexes with a background duration of CC of 0.65, 0.75, 0.85, 0.95, 1.05, or 1.15 sec.

EXPERIMENTAL RESULTS

The duration of energy-consuming phases of systole was shown to be definitely dependent on seasonal fluctuations in the energy background. However, although Ic and E are linked functional processes, the character of this dependence showed significant differences for each of the phases of systole. For example, in persons of both sexes low and almost equal correlation between values of Ic and CC was observed in summer, but in the winter season this correlation changed in opposite directions in men (a decrease) and in women (an increase). Conversely, high correlation between E and CC was stable only in men, for it increased appreciably in women in the summer season of the year.

Two basic facts can be discerned in the typology of duration of Ic and E (Fig. 2). First, during a change in the background value of CC from 0.65 to 1.15 sec, the trend of E was almost linear, but not that of Ic. Second, different degrees of energy-dependence of the phases of systole compared were found in the subjects of the separate groups. High energy dependence

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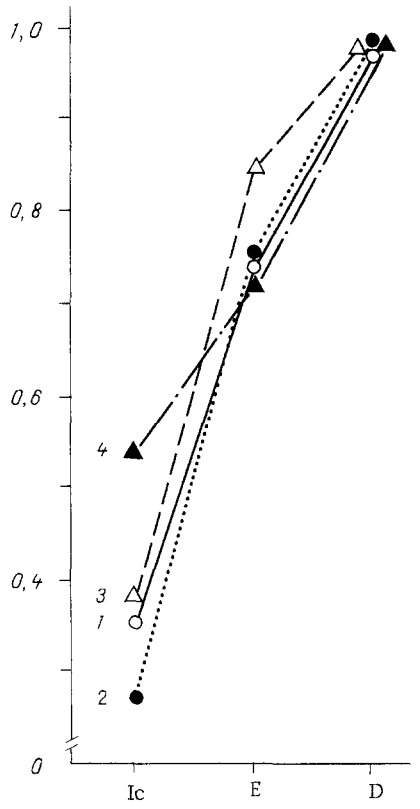

Fig. 1. Correlation between duration of CC and duration of phases of isometric contraction (Ic), ejection (E), and diastole (D) in normal subjects of both sexes in different seasons of the year. Ordinate, coefficient of correlation. 1, 2) Men, 3, 4) women. Open symbols — summer, filled — winter.

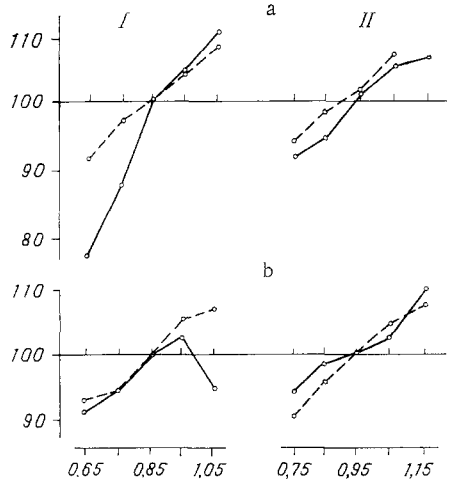

Fig. 2. Changes in duration of Ic (continuous line) and E (broken line) in persons of both sexes differing in background duration of CC in different seasons of the year. Abscissa, background duration of CC (in sec); ordinate, duration of phases of systole (in percent of mean duration of each phase for whole group of subjects tested. I) Women, II) men. a) Summer, b) winter.

of E was in fact characteristic of persons of both sexes who had both a high and a low heart rate. High energy dependence of Ic was found in women with all values of CC, but in men only in those with extreme values of CC.

The results thus indicate that the time dependence of Ic and E shows a regular trend of change in structure from winter to summer. Taking the principle of reciprocity [5] into account, this trend can be explained by a change in the flow of physical and metabolic energy and in the character of their coupling. Meanwhile, analysis and comparison of the data (Figs. 1 and 2) confirm the role of interaction between these flows of energy in determination of both typological and sex differences in this phenomenon. As was shown above, significant differences as regards all the features discussed were found between the successive functional processes of systole. It can accordingly be concluded that the two phases of systole with reciprocal energization [4] can be regarded as a natural biological model that is sufficiently informative to evaluate the dynamics of interaction between these energy flows.

LITERATURE CITED

1. Human Adaptation to Various Climato-Geographic and Industrial Conditions [in Russian], Vols. 2 and 3, Novosibirsk (1981).
2. G. I. Loginov, Z. R. Yunusov, V. I. Yakovenko, et al., Byull. Éksp. Biol. Med., No. 7 (1983).*
3. A. N. Medelyanovskii, Usp. Fiziol. Nauk, No. 3, 96 (1982).
4. V. V. Parin and V. L. Karpman, in: Physiology of the Circulation. Physiology of the Heart [in Russian], Leningrad (1980), pp. 215-240.
5. Regulation of Energy Metabolism and Physiological State of the Organism [in Russian], Moscow (1978).

*As in Russian original — Publisher.