Response of a Living Body to 8-Tesla Magnetic Field(Crystal Growth, Chemical Reaction and Biology)

Response of a Living Body to 8-Tesla Magnetic Field*

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Synopsis

A study was made to investigate body function in high magnetic field of 8-tesla. In order to avoid magnetic-field effect on the measuring system, long distance was placed between a experimental animal and the measuring system. Changes in contractility of the heart were measured from frogs. Heart and respiratory rates were recorded from rabbits. Contractility of the heart was increased with increasing magnetic fields from 0 to 8 tesla in frogs. Heart and respiratory rates were decreased with increasing magnetic fields from 0 to 8 tesla.

I. Introduction

There are many reports on the effect of magnetic fields on living bodies but few reports on them in a super high magnetic field. Thus we investigated responses of heart and respiratory function in frogs and rabbits to a high magnetic

*The 1945 th report of Institute for Materials Research

field of 8-tesla, newly designed by the Institute for Materials Research, Tohoku University.

II. Methods

Since a high magnetic field affects a body-response-measuring system and elicits distortions of the record, the experiments were carried out 3m apart from the animal to the measuring system.

When the breast of a frog was opened by thracotomie, one tip of a 3m-long string for measuring heart movement, was attached to the apex of

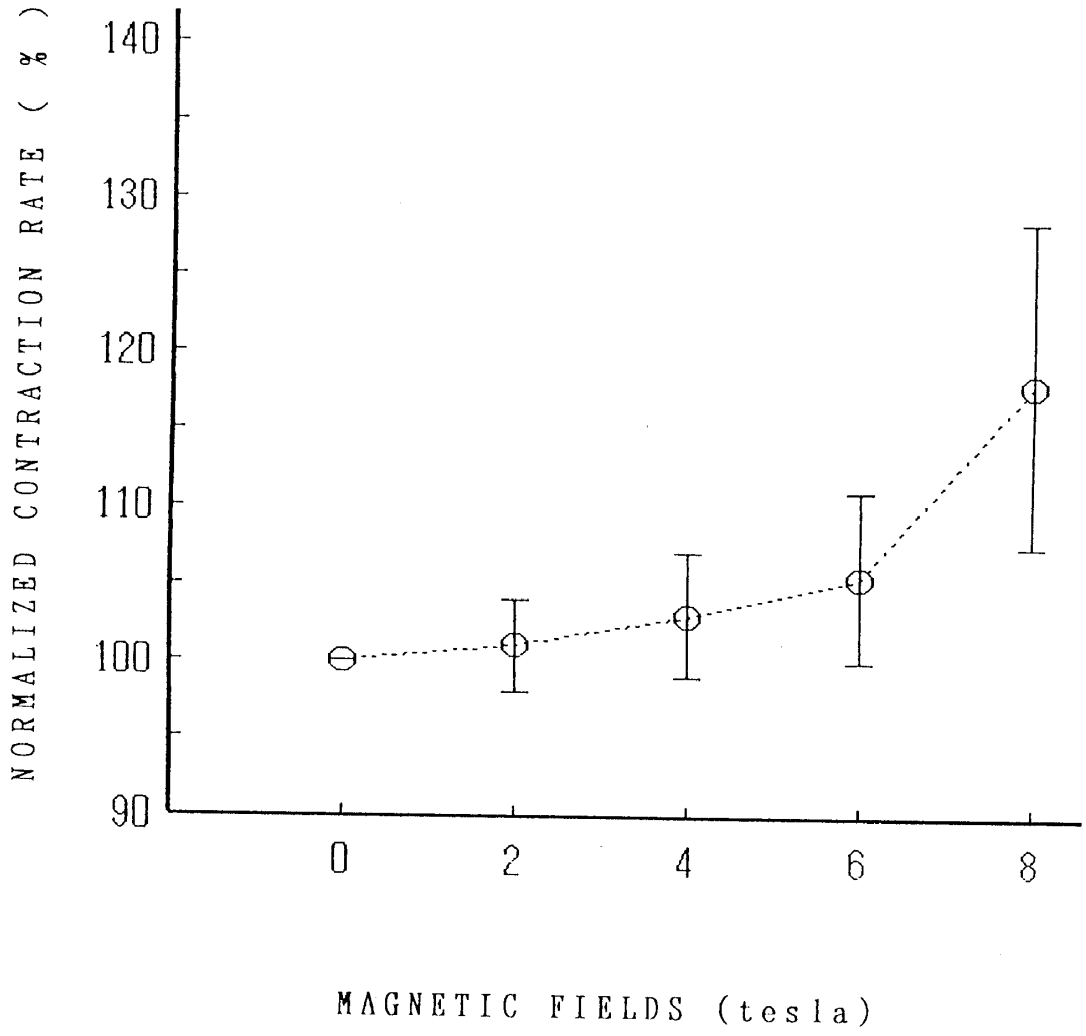

Fig. 1. Normalized contraction rate of frogs in magnetic fields.

the heart and another tip of the string was attached to the measuring system. By this maneuver measurement of contractility of the heart was recorded as pulsatile pulling the string. Consequently the amplitude of the contractility is measured as the pulling speed (F) or contraction rate, that is dF/dt. Heart rate was calculated from pulsatile contraction rates per minute.

Heart and respiratory rates were recorded from rabbits. Heart rate was measured by a photoelectric transducer implanted at the root of right

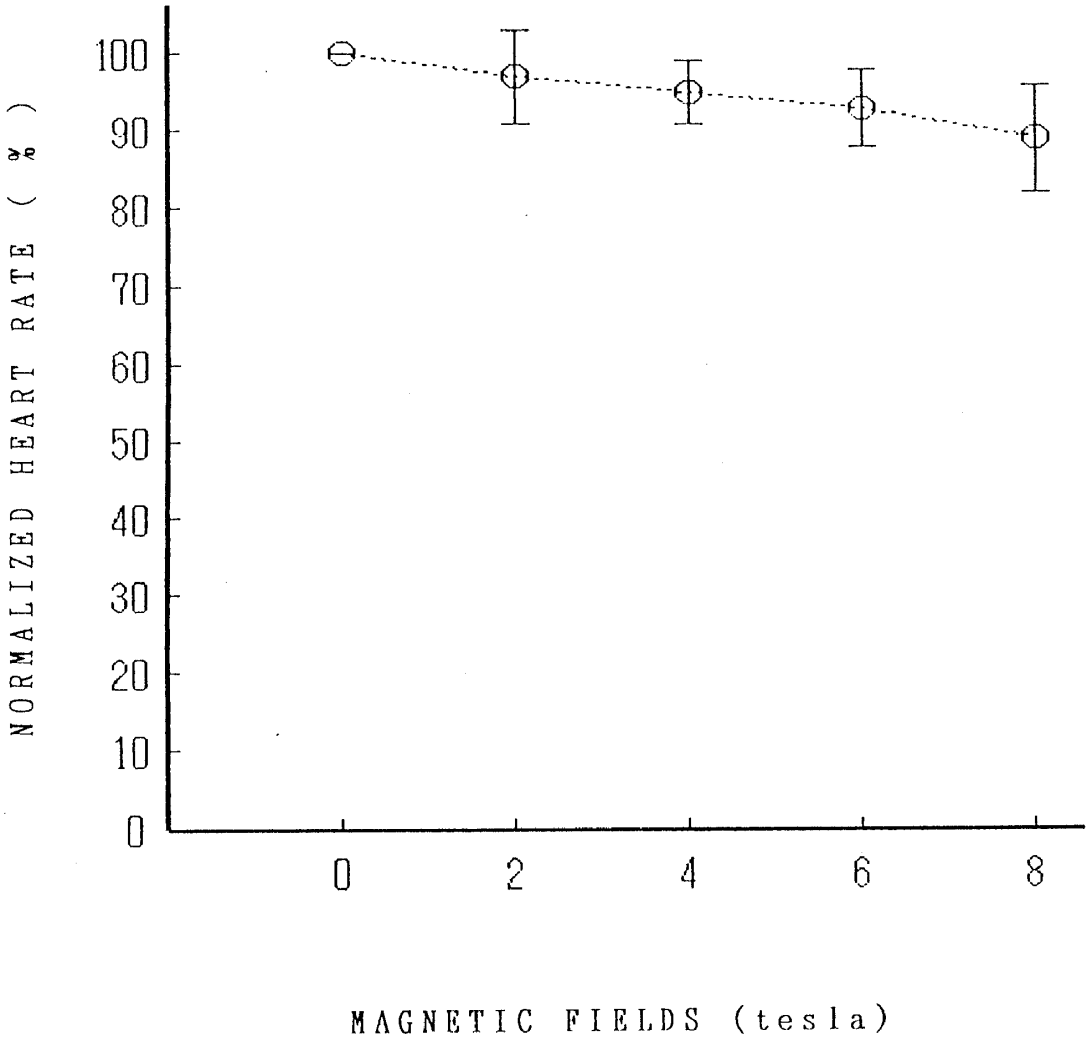

Fig. 2. Normalized heart rate of frogs in magnetic fields.

ear. Pulsatile changes of blood area due to blood flow per minute were taken as heart rate. Respiratory rate was measured by the semiconductor transducer, whereby the breast of the rabbits was wound. Pulsatile movements of the breast per minute were regarded as the respiratory rate.

III. Results and Discussion

Since few studies exist thus far on effects of high magnetic field of 8 tesla on living

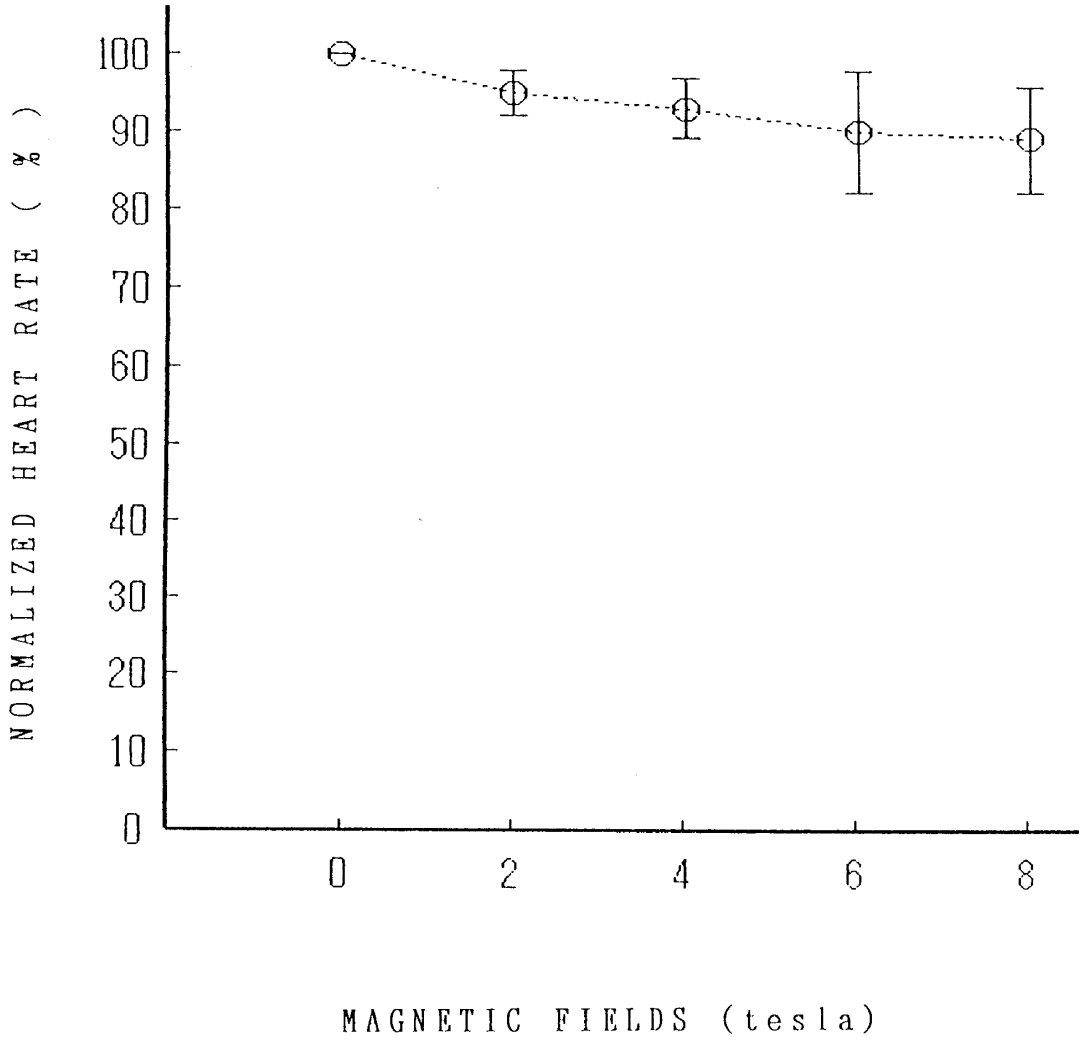

Fig. 3. Normalized heart rate of rabbits in magnetic fields.

bodies, the next experiment is carried out.

Pulsatile contractility of 6 frogs, namely dF/dt in the magnetic field range of 0 to 8 tesla was recorded. Normalized contraction rate, namely dF/dt in the magnetic fields divided by dF/dt in the control were measured as shown in Fig. 1. Contraction rate was significantly increased with increasing magnetic fields. Heart rate calculated from pulsatile contraction rate was shown in Fig. 2. Heart rate decreased with increasing magnetic fields.

Heart and respiratory rates of 6 rabbits in

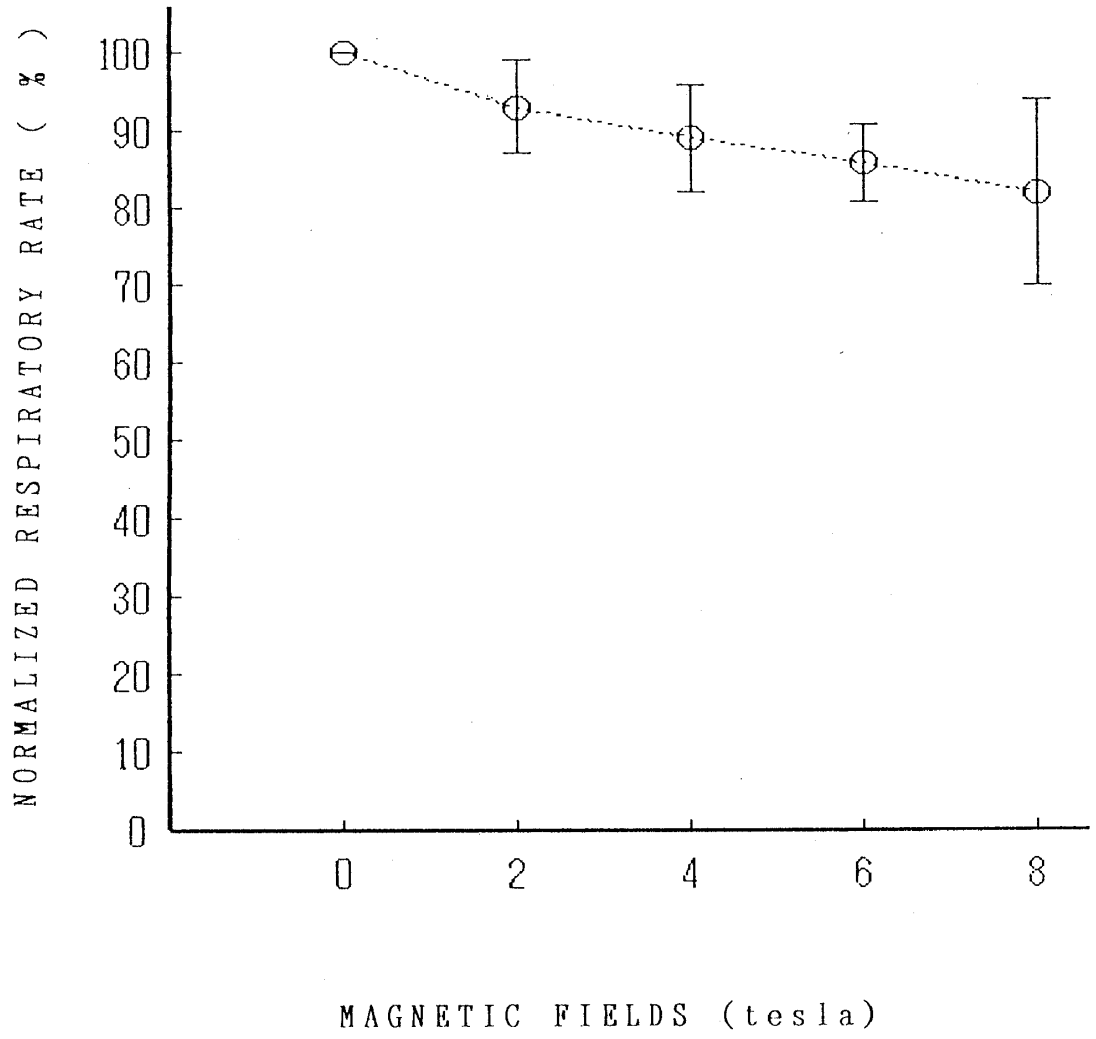

Fig. 4. Normalized respiratory rate of rabbits in magnetic fields.

the magnetic field range of 0 to 8 tesla were measured. The rates in the control were compared with the ones in the magnetic fields. The normalized heart and respiratory rates, namely the rates in the magnetic fields divided by the rates in the control were depicted in Fig. 3 and Fig.4, respectively. Both rates were significantly decreased with increasing magnetic fields.

The tissue fluids have a greater viscosity with increasing magnetic fields(3), suggesting a decrease in heart and respiratory rates. Same things were reported(1,2). The heart-and-respiratory-rate decrease links to a cardiac decrease. Oxygen shortage due to this decrease may bring about an increase on contraction rate of the heart.

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