TRAINING

WITH THE HEART RATE MONITOR

- Take control over your training
- The latest products and trends
- Advice for beginners and advanced athletes

KUNO HOTTENROTT

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Training with the Heart Rate Monitor

NB: For the sake of convenience, we have used the male form of address to include male and female.

Training with the Heart Rate Monitor

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Meyer & Meyer Sport

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1 WHY EXERCISE WITH A HEART RATE MONITOR?

These days, the electronic measurement of the heart rate in therapeutic, fitness and competitive sport is taken for granted, and is the most important way of controlling and monitoring load intensity. However, measurement is still not really a training aid in itself. A heart rate monitor is only really useful if the user can correctly evaluate the data it measures.

In addition, many people lack the background knowledge that would allow them to make their own decisions. Knowledge of how the heart works, heart rate variations due to training, stress and health problems, will enable you to make the right decisions. Nobody can do this for you. By improving your own knowledge, you will also be able to take more responsibility for your own training. You will be able to adapt training plans to your own individual requirements, according to your performance level, current trainability and state of health. Regular measurement of your heart rate and the correct interpretation of the data will enable you to come very close to doing the right training in the right way at the right time, at the right intensity and for the right duration.

The right training load is a basic requirement used by all athletes to allow them to meet their personal goals. Perhaps you want to improve your endurance ability, lose weight or just improve your well-being. To meet these goals, it is very important to listen to your body's signals as you train and to use them for your benefit.

These goals often seem unattainable because training loads are not adapted to individual ability. If the training intensity is too low, the desired result of improving endurance will not be achieved. On the other hand, training that is too intensive with insufficient recovery, will inevitably lead to **overtraining**, and stagnating or a drop in performance. For training to be effective, it is necessary to find the optimal load intensity.

If you only assess loading using your subjective perception or estimated data, you can often make mistakes, but your heart does not "lie." It shows whether training is effective or not at the moment of testing.

The heart is an extremely sensitive organ and bears only a passing resemblance to an engine that changes revs with more power. The rhythm of the heartbeat is individual and everyone has their own rhythm. When accurately analyzed, it is like a personal fingerprint.

Resting heart rates can vary by 50-60 beats for people of the same height, weight and age. There are also big differences between the sexes, as women's heart rates are faster than men's, due to the smaller size of the female heart.

Electronic heart rate monitors measure the electrical impulse of the heart, the number of beats per minute at which the heart pumps blood into the body. The electrodes in the transmitter belt sense the heart's electrical impulse and send the information to a receiver in the form of a watch (wrist unit).

Why exactly is the heart rate (HR) such an important monitoring and control parameter for endurance sports? The HR at rest, at submaximal and maximal loads and in the recovery phase gives information about the load intensity, volume and efficiency of the cardiovascular system and the muscles. The training HR increases in a straight line within certain limits with the intake of oxygen, and therefore also with performance. The angle of increase of the HR curve gives information about the endurance ability of the athlete [6].

Since the development of the portable heart rate monitor, it has had several fields of application. It can be used as a performance diagnosis tool, a load measuring tool and as a recovery management tool. First and foremost, ongoing HR measurement helps the wearer to implement and monitor the prescribed training intensity. The HR also helps to monitor one's physical condition.

The HR offers numerous advantages compared to other parameters. It can be determined simply and accurately and can also be measured while exercising with a portable HR monitor. The continuously measured HR therefore gives a very accurate picture of our physical condition and how it changes. It is, in a manner of speaking, a reflection of the load.

Without great financial outlay, the athlete can determine his HR at any time and be informed at any moment during his workout of the stress his body is under. He himself can check whether he is performing at the desired load intensity as well as whether he is training above or below the levels required by his training program. It enables you to feel better, avoid excessive speeds and loads, monitor and optimally design the training management and planning by yourself. Thus, heart rate monitors work as excellent bio-feedback and monitoring tools because they display the reactions of the heart to different factors reliably and as accurately as an ECG.

By measuring your heart rate, you will learn how to work out at the optimal intensity for your physical condition and individual performance goals. You will no longer have to rely on pure guesswork to determine how hard you train, but will be able to listen specifically to the rhythm of your own body.

Paying attention to your individual heart rate also helps to strengthen your cardio-vascular system gradually and to noticeably improve your ability, so that you can meet your training goal. You will quickly be able to see individual limitations or possibilities

for improvement by tracking your heart rate. The results will be a noticeable improvement in fitness, condition and well-being.

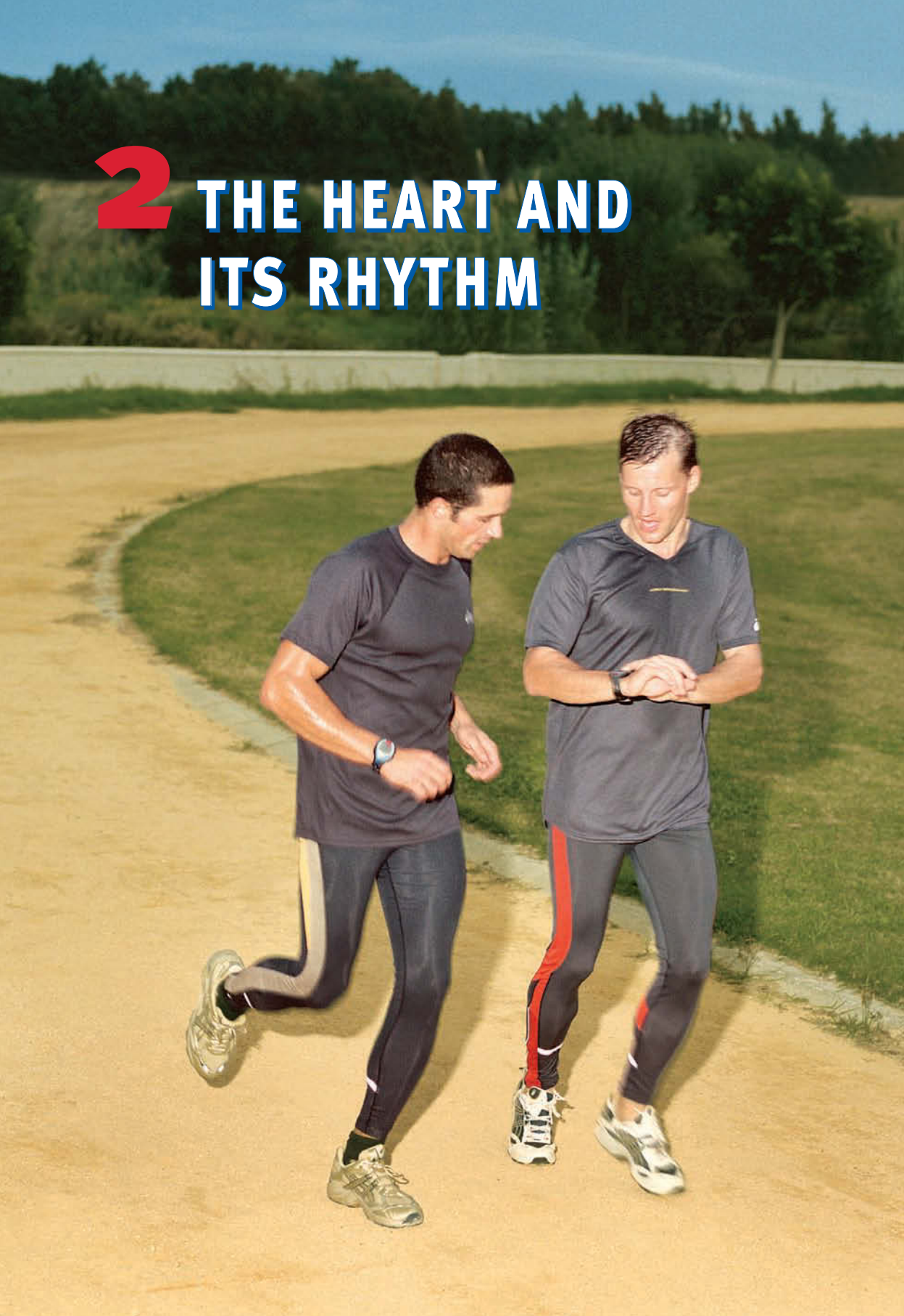
For competitive athletes who are aiming for a specific training goal, the heart rate monitor serves as a tool for fine-tuning.

So, if you are looking for an easy, effective and intelligent way to monitor your own body during loading and obtaining feedback that one normally could only get in a laboratory, then it makes sense to train with a heart-rate monitor.

There are many arguments in favor of using a heart rate monitor to manage your training:

- **Improve well-being:** If you train in your personal HR zone, you will improve your well-being and avoid overtraining.
- **More effective use of training time:** Training at the right intensity is a more effective use of training time.
- **Improve performance and fitness:** If you know your individual HR zone, you can plan your training better and more efficiently, and improve your performance more quickly.
- **Spot health problems more quickly:** If you check your HR before, during and after working out, you will spot health problems more quickly and be able to treat them immediately. This reduces the risks of physical activity.
- **Keep motivation:** Motivate yourself with the amount of calories burned in training calculated for you by the heart rate monitor.

2 THE HEART AND ITS RHYTHM



2.1 The Heart – A Sensitive Organ

The Heart – Working Non-stop

What we feel as our heart beats is the action of waves of blood, triggered by the heartbeat, hitting the vessel walls. After a long, exhausting endurance run, your breathing speeds up and you feel your heart beating more strongly. The heart ensures that the brain, organs, muscles and skin receive an adequate supply of blood via the blood vessels. The heart pumps ceaselessly, as we cannot live for more than 2-3 minutes without oxygen.

From a morphological and functional point of view, the heart is a masterstroke of nature; as the center of the circulatory system, it reacts to every demand, even from the furthest extremities of our bodies.

The heart beats from the fourth week of fetal development. With every heartbeat, it sends life-giving blood around the body. Every cell in the human body must be supplied and then evacuated – a task that the circulatory system can only manage with the help of the heart. This is as true for an unborn child as it is for a marathon runner.

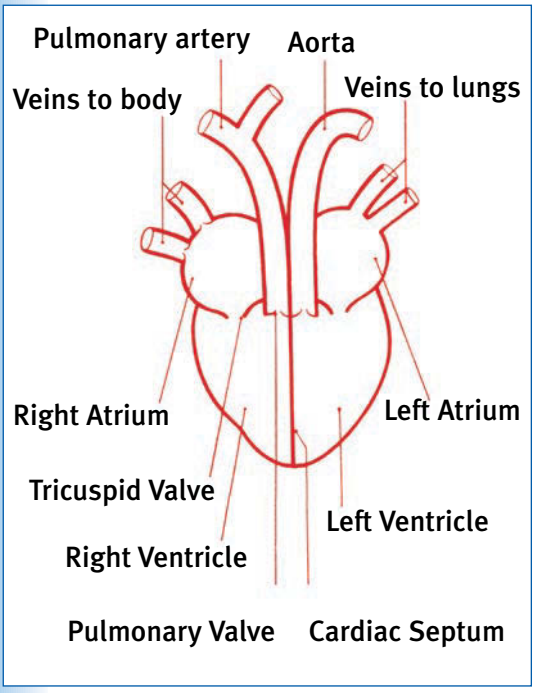


Fig. 1/2.1: Structure of the heart

An adult's heart is somewhat larger than a man's fist and weighs about 300g. It is located in the chest cavity and is almost completely surrounded by the lungs and protected by the sternum, ribs and spine, together with the ligaments and the muscles of the chest wall. An adult heart is about 6 inches long by 3 inches wide and 2.5 inches thick.

It is a hollow muscle, which contracts regularly, thereby pumping blood into the body and down special blood vessels into the heart muscles. The inside of the heart is divided into two parts by the heart wall. Each half consists of a smaller atrium and a larger ventricle, which are separated by valves. The valves allow blood to only flow one way, from the atrium to the ventricle (figure 1/2.1).

The Heart – The Tireless Pump

The heart beats about 70 times per minute at rest, which makes 100,000 beats every day and about 2,500,000 times in a human lifetime.

The actual number of beats may even be higher, as the body is active for much of the day and the heart has to beat faster to adapt the blood supply to the demands of the working muscles. The amount for people with endurance ability will be well below this though, as their hearts beat only 40-50 times per minute at rest, which represents an economy for the cardiovascular system.

An adult's blood volume makes up 8 % of his bodyweight, i.e., 12 pints for a person weighing 165 lb. At rest, the heart sends out 70 ml of blood per minute (stroke volume) and about 10 pints per minute (cardiac output). That makes 17,000 pints per day. Under heavier loads, the cardiac output can even reach 80-100 pints.

The Circulation of the Blood

The atrium of the heart has thin, elastic walls and receives its blood from large veins, which then flows through the bicuspid valves into the thick-walled part of the pump, the ventricle. The heart muscle (myocardium) then squeezes the blood through two more valves into a large artery. The right pump sends the blood to give up carbon dioxide and take up oxygen in the lungs.

After flowing through the lungs, the blood arrives in the left pump, which then distributes the blood throughout the body. Once it has delivered oxygen and picked up carbon dioxide there, the blood returns to the right ventricle via the veins.

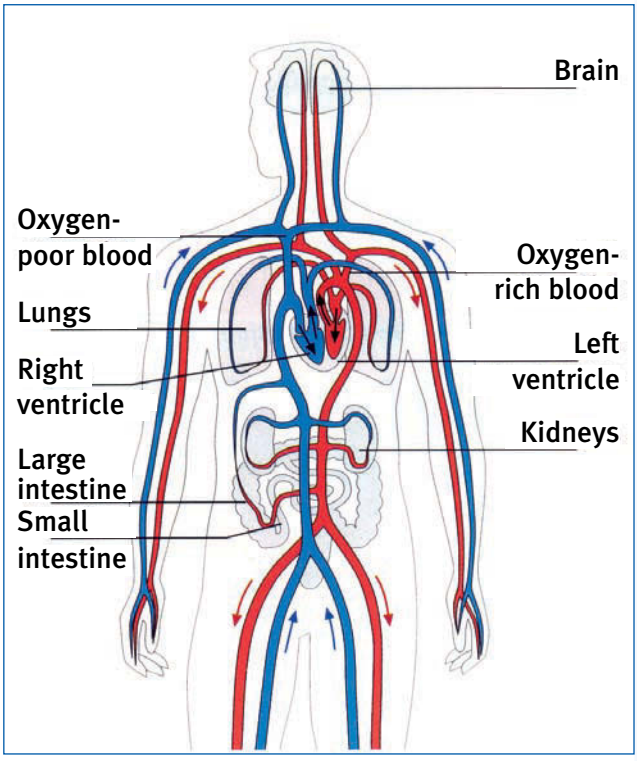


Fig. 2/2.1: The circulation of the blood

The Oxygen Requirements of the Heart

All tissue, particularly working muscles, requires oxygen. This includes the heart, a ceaselessly active muscle. It is true that a great deal of blood flows through the atria and ventricles, but it moves too fast and the muscle walls are too thick for the heart to be supplied directly by the blood that flows through it. This is why the heart also has a supply circulation: 5 % of the blood sent out by the heart is diverted for its own use.

The Electrical Stimulation of the Heart

For the heart to beat, it must be stimulated. The stimulation of the heart muscle occurs inside it, with no external influence. Even a heart that has been removed from the body will continue to beat under certain conditions.

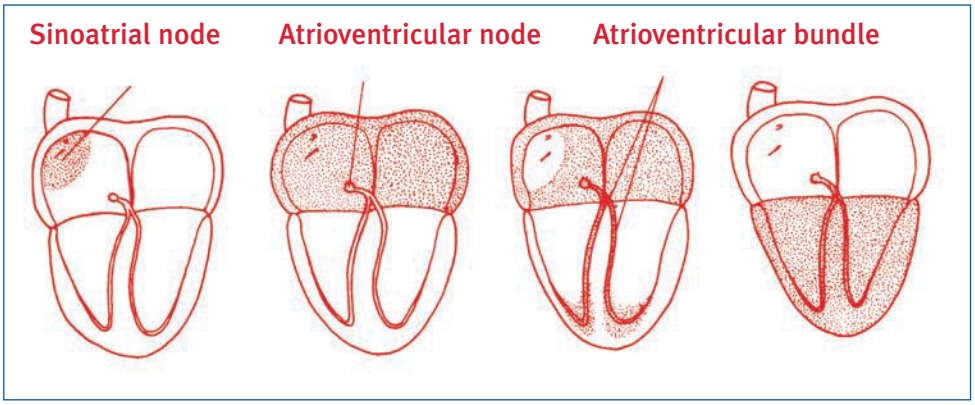


Fig. 3/2.1: Stimulation generation/sequence in the heart

The heart possesses its own system for generating electrical stimuli, which are then transferred around the whole heart. The basic rhythm of the heartbeat begins with a group of "pacemaker cells" in the right atrium, which form the sinoatrial node. The stimulus generated in the sinoatrial node not only stimulates the heart muscle, but is also transmitted to the surrounding tissue, as all body tissues are good conductors.

Although we are not aware of the stimulation passing through the heart, it does reach as far as our skin and can be measured on its surface with the appropriate equipment. It can be recorded by means of an electrocardiogram (ECG), an invaluable medical diagnostic tool. The ECG gives information about the condition, frequency and rhythm of the heart, the location, diffusion and regression of the stimulation, as well as any disruptions.

Fig. 4/2.1: Electrocardiogram (ECG) at rest

The difference between an ECG and a heart rate monitor is as follows: an ECG gives a picture of the complete heart rhythm, while the heart rate monitor only gives the duration and number of heartbeats.

The Cardiac Cycle

The heartbeat, the contraction of the myocardium and its subsequent relaxation, is called the **cardiac cycle**. A normal cardiac cycle lasts about 0.8 seconds. The contractile phase, during which blood is pumped into the large arteries, constitutes **systole**, while its relaxation phase, during which the ventricles are filled with blood, is called diastole. The activity of the heart can accordingly be divided into two groups: at the start of systole, the ventricles are stretched and filled with blood, while the atria are contracted. Heart valves prevent blood from flowing back into the afferent blood vessels. The blood is pushed through the valves into the ventricles. The process of filling the ventricles with blood is called **diastole**. Now both ventricles push together into the atria. The blood is pumped into the body and the lungs. This process is called **systole**. The pressure wave of systole is felt as the pulse in the arteries, e.g. on the wrist or at the temples. At the end of systole, the ventricles are almost empty. Meanwhile, blood from the body is streaming back into the heart. When the atria are full again, the whole process is repeated.

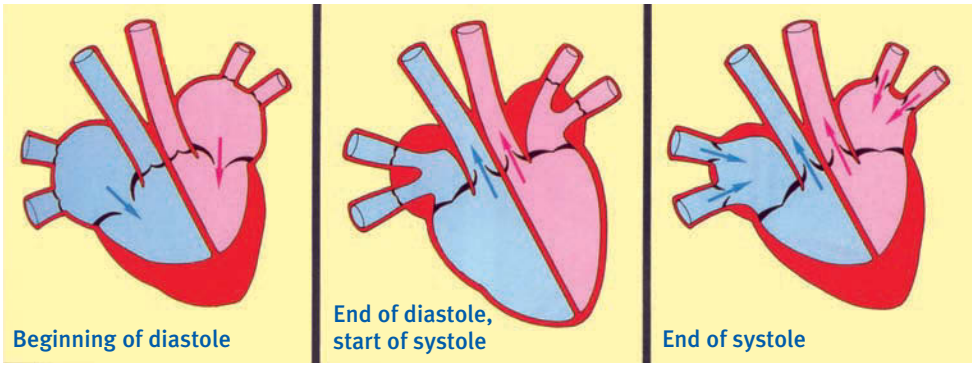


Fig. 5/.2.1: The cardiac cycle