## The scientific basis of the Bailine system

Bailine is a system designed for women who have a need to lose weight and/or reduce their figure measurements. It incorporates the use of an individual training and figure-shaping plan, combined with a personally tailored nutritional program. In conjunction with these programs, a computer controlled training simulator is used that has been specially developed for Bailine. The Bailine system is of a Scandinavian (Norwegian) origin.

Bailine takes a scientific approach not only in regards to the electronic training; but also in regards to nutrition, physical exercise and motivational methods. Bailine utilizes exercises that were initiated by Svein Hetland, a trainer from 'Norges Idrettshøyskole' (Norwegian University of Sport and Physical Education).

Some of our critics are skeptical about the use of our electronic training simulators. We substantiate this by drawing a parallel to the electro training used by medical personnel to help build up muscle mass on patients.

The training simulators used at Bailine are an integral part of the overall plan as they allow the clients muscles to be activated prior to starting a reduced diet.

The reason why so many people experience a weight gain after slimming is that muscle mass was reduced instead of fat. In conjunction to this we can refer to a scientific project that showed that unfit people can lose up to 41% of their muscle mass when on a diet, whereas with a little exercise they can lose 23% of their muscle mass. (Ref: Article by Phd. Strømme, 'Norges Idrettshøgskole' (Norwegian University of Sport and Physical Education), in the journal 'Norsk Legeforening' (Norwegian Medical Association)

The use of the electro training, both before and after slimming, will build up and maintain the muscle mass during the period of slimming so that even if the muscle mass increases, the body measurements will decrease and the client will look visually slimmer. This is because one pound of fat occupies four times as much space as one pound of muscles.

The use of electro training may help people to break the vicious circle that obese people find themselves in when trying to fight the metabolic syndrome. A person who has an unfit, weak, and obese body and is slimming on a meager diet will easily lose muscle tissue, as there isn't much to begin with. To someone like this, electro training can be a vital start.

There are many research reports that document the fact that electro training builds up the muscle mass on damaged patients. The Danish researcher Dr. Thomas Mohr has established that the electronic stimulation of paralyzed muscles gives an increase in the maximum oxygen intake of 20-100 % - and an increase of muscle mass of up to 40 % (dadlnet.dk the 10th of April 2000). Patients report that the electronic exercises gave them a feeling of well-being - similar to the feeling you get during, and after exercising. There is also documentation that states that electro training has a pain relieving effect and that it can benefit people with chronic pain.

Surveys in Sports Medicine 14 (2): 1992 show that even healthy people can benefit from the effects of the electronic muscle exercises and gain stronger muscles. J. M. Kots (1971) established the fact that the muscle power can increase from 38 % to 50 % after only 19 days with electro training. Research reports establish that the strength gain is not only achieved by normally healthy people, but also for well-trained athletes.

The Russian weight lifters made use of Electro training in the München Olympics in 1972. Electro training was also used to maintain the muscular system of the personnel onboard military submarines. NASA has made use of electro training on the astronauts in their space research program to prevent the loss of muscle mass at weightlessness.

At Bailine we also recognize the fact that it can act as an efficient motivation for women who have no time for the gym. Our own surveys show the majority of those who participate in a Bailine program are motivated to get more physically active – on their own account.

At Bailine we do not disagree with those who are of the opinion that it is more effective to exercise and to run for hours in the fields or meadows rather than relying on electro training: but experience shows that this simply is not desirable for many people.

This is why we regard Bailine as a good alternative to people who do not have the opportunity or the desire to take the time to go to a gym or to go running in fields.

We can also refer to statements of satisfied customers from the Bailine salons worldwide.

*The above is a translation of documentation in Norwegian.*

## How Does Electronic Muscle Training Work

The activity in the nerves and muscles in human beings are of an electric nature. The nervous system transports signals from one place to another. Its functions are partly sensory and partly activating. They are sensory as impulses are lead from the sensing organs in the body and to the brain along the so called afferent nervous fibres. And they are activating, as the brain sends out signals in the form of nervous impulses along the so called motoric nerves to stimulate muscle contraction.

No matter how the muscles are stimulated, either it is done normally, through the nervous system or through electric or chemical stimulation; each nerve fibre will increase in thickness and strength if the muscle stimulation is repeated consistently. The musculature is dense with veins. Round the muscle fibre there is a web of capillary veins. When the muscles are resting, most of these capillaries will be closed. With physical activity, these small veins open and the blood runs through the muscles. The blood supply increases with physical training. (Re. Professor Dr. Christian Devon M.D., professor of nutrition at the Nutritional Institute at the University of Oslo.)

The purpose of electric stimulation of nerves and muscles in human beings is to imitate the natural process. When a device delivers electronic impulses that correspond to those that normally go through the nerve cell membrane in a nerve impulse, we get exactly the same muscle contraction as under normal circumstances.

In short, electrodes, or so called "pads", are attached to the skin at certain points on the muscle groups. The device sends out weak electronic impulses that can be regulated in strength and duration to suit each individual. The impulses create a rhythmic interchange between contraction and relaxation, just as during efficient physical training.

It is important to stress that there is therefore no difference in principle between the normal electric activity in nerves and muscles, and the electric stimulation that is created with an electronic simulator.

## Electro-treatment Is Nothing New

Electro-exercises were used by the Russian weight-lifters during the Olympic Games in Munich, 1972. Electro-exercises are also used on military submarines to keep the personnel's musculature fit. NASA has used electro-exercises for their astronauts in space programmes to prevent muscular deterioration during weightlessness.

Ancient physicians used electric fish to give electric shocks to the head to treat head aches and other ailments. They created static electricity by rubbing amber and applying it to the painful area. In 1600, Elizabeth I's physician, William Gilbert, used the word "electric" for the first time in a paper – derived from "electra", the Greek word for amber – as a term for the power that made the senses quiver and the limbs to move.

The Italian physician and professor of anatomy in Bologna, Luigi Galvani (1737-1798), discovered in 1780 that the muscles in a frog leg contracted when they were influenced by electricity. Even though the Greek physician Claudius Galenos already in 1320 had classified the nerve cells in motoric and sensory, this was rediscovered by Charles Bell (1174-1842) and Francois Magendie (1785-1855), who initiated the first experiments with so called electro puncture – electricity through needles into muscles and nerves.

The French physician Guillaume Benjamin Duchenne (1806-1875), researched and improved the electrotherapy throughout the 1830's, and he may well be called the father of electrotherapy. Duchenne was the one who started applying electrodes to the skin.

The development of electrotherapy and technology for different purposes has been fantastic the past hundred years. Patients with certain paralyses and other nerve injuries have a new and better life; others receive help for chronic pains and epileptic seizures. For many who want to reduce their weight, it has recently become a useful aid. Electro-exercise can also show a skin toning effect.

**Thomas Mohr: Electronically Stimulated Muscle Training of the Lower Extremities for People With Injuries to the Spinal Cord.**

An extract of a 6 page overview article in dadlnet.dk, April 10, 2000.

(Complied for Bailine by Olav Nøkling, M.Sc.)

An injury to the spinal cord will upturn the patient's life in seconds, usually a young person. The past few years, there has been intense research in starting muscular activity through electric exercise, so that the injured can stand, walk, grip and breathe alone. The development has been from the simple and primitive to complex, computerized stimulation, but there is still a long way to go.

Electrically stimulated bicycle training is used for spinal cord damages all over the world, and is in many ways better than exercising the muscles that are not affected by the injury.

The first months after the injury, we see significant muscle atrophy, hardly any muscle activity, low sensory ability and blood stream, and deterioration of the cardiac musculature. We often also experience insulin resistance, usually diabetes II, and loss of minerals in the skeletal tissue.

Electric stimulation of paralysed musculature gives a sense of well being, increased maximum oxygen intake, increased muscle mass, increased insulin stimulated glucose intake and better mineral status in the lower extremities.

Electro-exercise is now computerized, with sequential stimulation of several muscle groups, so that the movements are similar to those of rowing or cycling. Electrodes are placed on the skin over the muscles that shall be exercised, and have a monophased, pulsing currency 10-30 Hz, with a pulse width of 200-400 micros and a currency of up to 150 mA. Some series have used up to 300 mA, but for safety reasons only 150 mA is used in commercially accessible equipment. A currency of 60-80 mA is very painful to people with normal sense of pain.

**Physiological Effects of Electro-exercise**

The exercises will often last 15-30 minutes at a time, once or several times a week. After a few minutes electro-exercise, the heart rate increases with 30-50%, which is far less than with sub maximal work in non-back core injured. The heart's minute volume is doubled – from 4 to 8 litres per minute – and the blood stream in the legs increases accordingly, just like the oxygen intake after 5-10 minutes will increase from a normal resting level of .2 litres/min to 1-1.5 litres/min. The patients report that the electro-exercise yields well being, about in the same way as non-injured feels after exercise.

Maximum oxygen intake is the usual measure of physical form. After a few weeks electro-exercise, the maximum oxygen intake increases, and it increases even more after some time if the intensity of exercise increases. Increases of 20 to 100 % have been reported, just as with non-injured.

Electro-exercise has increased the circumference of the thigh by 5 %, but the actual cross section of the thigh has increased by 12 %, as shown in MR scans. Even after 20 years of paralyses one has achieved almost normal musculature after a few months of electro-exercise. A few studies have looked at the glucose metabolism after electro-exercise, and after a longer period of exercising, one has found increased insulin stimulated glucose intake and increased glucose transport protein (GLUT4) in muscle cells, and hence diabetes 2 is prevented.

**Conclusions and Perspectives of Electro-exercise**

Inactivity over years yields serious changes in spinal cord injured, but many of them can be reversed through electro-exercise. But this exercise takes time and recourses, and the positive effects will only be achieved if the exercise is regular and lifelong. It has been shown that the users generally are more keep a more lasting and better interest in exercising if it is done in a training centre instead of at home.

There is significant evidence that electro-exercise will be used in many more fields. Therefore, in 1995 an international body was formed, The International Functional Electrical Stimulation Society, with annual conferences.

As a curiosity, we would like to mention that in USA they sell devices for stimulating completely intact musculature. The idea is to use electric stimulation instead of awkward and uncomfortable exercises. The device is sold with no scientific documentation under the slogan "no more sit-ups", and they promise visible and tangible results after 30 days. Is this perhaps the way forward for that part of the population who are prone to inactivity related life style diseases for some reason or other?

(Thomas Mohr is physician and researcher at the anesthesiological department of the general hospital [Amtssygehuset] in Glostrup, Denmark)

**Positive Effects of Electro-exercise With the Bailine Simulator**

(Prepared for Bailine by Olav Nøkling, M. Sc.)

Electro-exercise has been used systematically in medicine and sports for at least 40 years, but little has been reported in serious scientific literature until recently. The effects have however been so positive, that the Russian weight-lifters increased their strength even more with electro-exercise in addition to normal exercise, even before the 1972 Olympic Games in Munich.

The Danish physician and researcher Thomas Mohr has written a 6 page article in electro-exercise with spinal cord injured on dadlnet.dk, April 10 2000, where a series of positive effects of electro-exercise – similar to normal strength exercise – are confirmed.

The Norwegian State Council for Nutrition and Physical Activity show in their report 1/2000, chapter 6, an overview of the research based knowledge about "Obesity and physical activity". There it is stressed for the first time from official Norwegian authorities that strength exercise is of vital importance for metabolism and overweight, and *not* endurance exercise. That does not mean that one should not go for a long walk, as well, but for *other* good reasons. The council says: "Musculature that is not stimulated and used sufficiently will in time be weakened and become smaller. Because the muscle mass is the body's largest energy consumer, reduced muscle mass will result in the body using less energy throughout the day, and the resting metabolism decreases. The lower muscle mass, the lower resting metabolism."

The total amount of energy used during physical activity comprises both the energy that is spent during the activity itself and also the energy that is spent in restitution, and weight training seems to yield a better after effect than normal aerobic training, the Council says, and adds: "This after-effect of physical activity is not unessential. This applies specially to upholding reduced weight."

The Council continues: "Because the resting metabolism (RMR) normally represents the major part of the energy spent in a day, even a small increase in RMR will be of relatively large importance. As mentioned earlier, the body's total muscle mass has decisive impact on the size of RMR. Therefore increased habitual physical activity will lead to increased RMR through increased muscle mass. Most studies conclude that if the fat free body mass (FFM), which is muscle mass, increases, RMR will increase. Largest effect is found after intense weight training, but normal aerobic training can also stimulate RMR." The Council also states quite clearly: "Weight training can be useful in treatment of obesity. During such training it might happen that the muscle increase and the decrease of fatty tissue outweigh each other, so that the body weight remains unchanged."

Since Thomas Mohr has established that electro-exercise works in the same way as normal strength training, we may assume that muscle activating with the Bailine simulator has the same positive effect as those mentioned by the Council. Nevertheless, the Bailine simulator must only be regarded as an aid – a flying start – for healthy but obese women, to start normal strength training and also some endurance training. However, experience shows that people with a sedentary life-style need all possible help and motivation to become more physically active in their everyday lives, and therefore electro-exercise will be a valuable supplementary training for many in addition to their own physical exercise.

Strength training has a number of disease-preventing effects, especially against diabetes, and again, electro-exercise might be just the agent to set things moving.

## The History of Electro-exercise

### *The Pioneers*

The history of electricity is the history of electrotherapy. Ancient physicians used electric fish – especially the electric ray, or torpedo fish – to give electric shocks of 100-150 volts to the head to treat headaches and other ailments. They created static electricity by rubbing amber and applying it to the painful area. In 1600, Elizabeth I's physician, William Gilbert, used the word "electric" for the first time in a paper – derived from "electra", the Greek word for amber – as a term for the power that made the senses quiver and the limbs to move. This was static electricity, which was later used by Benjamin Franklin and many others to treat paralysis.

But in the 18th and 19th centuries, there came a whole new systematic approach to electrotherapy. The Italian physician and professor of anatomy in Bologna, Luigi Galvani (1737-1798), discovered in 1780 that the muscles in a frog leg contracted when they were subject to electricity. And during the next six years, he discovered that it was not necessary to induce electricity from the outside; the muscles contracted when two different metals that were in contact with each other were connected to a nerve and a muscle. Galvani had in reality discovered electric current, but he was not aware of it himself. His interest in neuro-physiology led him to view his experiments as a proof for the existence of *animal electricity*.

It was professor of physic in Pavia, Alessandro Volta (1745-1827), who came to realize what it was Galvani had discovered, because in 1795 Volta showed how to make electricity without using animals at all, by simply connecting two metal pieces through a liquid or a damp cloth, and hence creating the first electric battery, called Volta's column. Galvanic batteries soon became a necessity in all well-equipped laboratories, even though they were expensive.

The English chemist and physicist Michael Faraday (1791-1867), must also be mentioned, because he devised no less than the modern science of electricity through his great work, published between 1831 and 1856: *Experimental Researches in Electricity.* Thus electricity was something that could be produced in adequate quantities and forms for many different electrotherapeutical ends:

- Galvanic currency to what was called galvanisation orgalvanotherapy.
- Induction currency for faradisation.
- High frequent currents for diathermy – heat treatment.
- Static electricity for franklinisation.

Even though the Greek physician Claudius Galenos already in 1320 had classified the nerve cells in *motoric* and *sensory*, this was rediscovered by Charles Bell (1174-1842) and Francois Magendie (1785-1855), who initiated the first experiments with so called *electro-puncture* – electricity through needles into muscles and nerves, which resembles very much today's acupuncture. They got the intended muscle contractions, but also pain and they really didn't know what to use the discovery for.

But the French physician Guillaume Benjamin Duchenne (1806-1875) did not give up electro-puncture, but researched and improved it throughout the 1830's, and he may well be called the father of electrotherapy. It was Duchenne who started with electrodes applied *on* the skin, and his source of electricity was the generator for alternating current Faraday had constructed in 1831. Duchenne let his patients sit half naked and bare-footed with their feet on a copper

plate which was connected to one of the poles on the generator, whereas the other electrode was a wet sponge or the therapist's hand on the place on the body that needed treatment.

Duchenne was the most gifted neurologist of his time; his determined and time consuming methods of experiment set a standard in neurology that still prevails. It would take many pages just to list his most important contributions to neurology, but in his book on electrophysiology, *De l'Electrisation localisée*, he writes a model clinical description of poliomyelitis, which has been of great help for physicians to this day. The academies of Rome, Madrid, Stockholm, St. Petersburg, Geneva and Leipzig honoured him with fellowships and other signs of respect, and he was invited to King Philip IV of Spain and to Queen Victoria. But in France he never experienced anything like this, even though the other neurologists called him their friend and mentor. He preferred academic independence and the intense discussion – welcome at all clinics, but not tied to anyone.

In the 1840's some researchers started to observe injured muscles with electricity, and discovered that paralysed muscles reacted to galvanic currents, but not to faradic. And it was also discovered that duration and intensity of current was decisive for if the muscle would contract, but it was only in 1916 that the English physician, professor and later Nobel Prize laureate Edgar Douglas Adrian (1889-1977) drew duration/intensity graphs for intact muscles in human beings and for muscles with various degrees of injuries to the nerves.

The heart muscle was also in time studied and stimulated electrically. Already in 1887 Augustus Waller (1856-1922) proved electromotoric changes in the heartbeats, which he later published in the form of electro cardiograms. And in 1931 the cardiologist Albert Hyman did the pioneering work that lead to the pacemaker, by showing that animals with cardiac arrest could be saved by electricity. In 1952 Paul Zoll showed that an artificial pacemaker could keep a human heart running, at least for a limited period of time. And in 1958 Seymour Furman and John B. Schwedel managed to help a patient with a pacemaker for 96 days without any kind of complication. Today millions of people walk round with implanted pacemakers – living proof for one of electrotherapy's greatest triumphs.

**Electrotherapy Today**

The last century has seen a formidable development of electrotherapy and electro technology for most aims. Paralysed patients and others with injuries to the nerves have a new and better life, others are helped with chronic pains and epileptic seizures, and many more examples could be mentioned.

The Danish physician and researcher Thomas Mohr has written a six-page article for the Danish association of physicians (dadlnet.dk, April 10 2000) about "Electronically stimulated muscle training of the lower extremities for people with injuries to the spinal cord", and we shall bring an excerpt of it:

An injury to the spinal cord will upturn the patient's life in seconds, usually a young person. The past few years, there has been intense research in starting muscular activity through electric exercise, so that the injured can stand, walk, grip and breathe alone. The development has been from the simple and primitive to complex, computerized stimulation, but there is still a long way to go. This article only deals with muscular training.

After an injury to the spinal cord, we see degenerative changes in several tissue and organ systems that resemble ageing. The first months after the injury, we see significant muscle atrophy and a shift in the relation between muscle fibres of type I and type II, with a large loss of the slower type I fibres and an increase in mass of the glucosystic and fast type II fibres.

The muscle atrophy, the lack of muscle work, decreased sensibility and blood stream increase the risk of sores from pressure and lying – decubitus. The heart muscle also becomes smaller and the ability to take in oxygen to the blood gets worse with the paralysis, just like with other inactive people. Cardiovascular diseases are therefore common among paralysed, and at a younger age than in the rest of the population. Several of the metabolic parameters that are seen as risk factors for cardiovascular diseases are alarmingly high in physical inactive people with injuries to the spinal cord: Excessive total cholesterol, lower HDL-cholesterol, low glucose tolerance, weakened insulin resistance and several cases of diabetes 2. The injured will also have skeletal tissue halved during a year, with subsequent heightened risk of bone fractures.

Many spinal cord injured train their upper bodies to keep fit, but the effect on the condition of the complete body is not great, and absolutely not on the paralysed lower extremities, so electro-exercising them has more benefits than normal training. Many kinds of electro-exercise have been tried, both stimulation of a single muscle group and computerized stimulation of several muscle groups. In USA one has concentrated especially on electro bicycle training, with electrodes applied to the skin over the muscle groups in question, and with feedback from a sensor on the bicycle's crank, so that the paralysed lower extremities can do cycling motions to varying resistance. This electro-exercises takes place one or more times a week, 15-30 minutes each time, and after a few minutes exercise the pulse rate goes up by 30-50% - which is far less than with the same kind of exercise in non-paralysed people – and the heart's volume per minute increases from 4 to 8 litres. Both blood stream and oxygen intake is highly improved in the paralysed body parts during exercise. The electro-exercise gives the paralysed person enormous joy and happiness – not least by seeing the legs move and work – and by the good feeling of being tired afterwards. Such bicycle training has increased the cross section of the thigh by 12 %, and even after 20 years of paralysis and inactivity, some patients have regained normal musculature after only a few months of training. The persevering type II A fibres increase, as do capilarisation and several aerobe, persevering type I fibres. The glucose metabolism also improves, with a resulting lower risk for diabetes 2

This exercise takes time and recourses, and the positive effects will only be achieved if the exercise is regular and lifelong. It has been shown that the users generally are more keep a more lasting and better interest in exercising if it is done in a training centre instead of at home.

We see today that electro-exercise will be used for an increasing number of purposes, and therefore an international organisation, *The International Functional Electrical Stimulation Society*, was formed in 1995, to hold annual conferences. Today, there are commercial devices for stimulating completely intact musculature, sold under the slogan "no more sit-ups", and they promise visible and tangible results after 30 days. Is this perhaps the way forward for that part of the population who are prone to inactivity related life style diseases for some reason or other?

So far Thomas Mohr, who worked at the council hospital in Glostrup, Denmark, when he wrote this article. There is every reason to believe that more directed *strength training* would have increased both muscle strength and volume far more than the reported 12 % increase in thigh-diameter, and in connection with weight-loss and obesity, *that* is an important factor. Anyhow, the reports of the safe and health-bringing effects of electro-exercise are the main points in Mohr's article, based on new and scientifically provable research. He pioneers could absolutely report positive effects of electrotherapy on their patients as well, but they were clinical accounts, that to us today bear more resemblance of anecdotes. With the new,

international organisation for electrotherapy, we can expect more research, publications and specialist development, also regarding intact musculature with the overweight and obese.

From 1945 and far into the 1970's, it was commonly thought that electrical stimulation could make neither healthy people nor patients stronger. But we who worked with weight-lifters new better. During the Olympic Games in Munich in 1972, I was psychologist for Leif Jenssen, the Norwegian gold-medallist in weight-lifting. I cooperated with the psychologist for the Bulgarian weight-lifting team, an ardent anti-communist. He told me in detail how the Soviets used electricity in addition to normal strength training to achieve their fantastic results, and although he didn't say it in so many words, it was clear that the Bulgarians did the same. Bulgaria was the best weight-lifting nation in Munich, and that didn't make my interest in electro-exercise any less!

According to the nature of the problems and challenges we work with and dream of solving, we tend to see the *different* parts of the jigsaw-puzzle in the world around us. The weight-lifter wants to become even stronger, and has a select attention to everything that can contribute to just that in research and training. But at the same time he doesn't want his competitors to become as good as he is. The weight-lifter and his team will *not* write enthusiastic articles for their colleagues about their last ingenious discoveries. The results of the effects of electro-exercise in weight-lifting and other power consuming athletic disciplines seldom leak from the leading research institutes in this field. In Norway the weight-lifters are those who know most about strength training, but they have actually never tried electro-exercise.

The physician, physiotherapist and the neurological patient dream of regaining as much of the normal strength and functions as possible, so that the patient can manage through everyday life. And they write about their discoveries in prestigious specialised publications. Maximal strength has *not* been their foremost interest; neither has such things as coordination of movement and fine motoric, naturally.

**New Challenges**

Now that the obesity-epidemic rolls over country after country, with the metabolic syndrome diabetes 2 in its wake, it is however becoming important to more people than just weight-lifters to know how to obtain strong, powerful muscles through electro-exercise. Not because they want to break world records, but to get out of the vicious circle that obesity and metabolic syndromes draw around their victims. Headstrong exercise of an untrained, weak body – on a lean diet – will take its toll on the muscle tissue, which the obese person really doesn't have too much of to start with. Correctly dosed electro-exercise of the large muscle groups can be the rescue, as a flying start to get along on one's own with a well-founded and tailor made strength training – as well as walks in the neighbourhood. They can become more demanding in good time.

People with long experience in training overweight persons – like Bailine with its many salons in several countries through 25 years – and knowledgeable weight-lifters, can become a strong combination. A professor in sports – former Nordic champion in weight-lifting – and a couple of first rate Dutch muscle physiologists, who can do research to find the right doses for a tailored electro-training for the obese, will be the punch line of my dream of efficient training and electro-exercise for all overweight persons who are, or will be, caught in the metabolic syndrome.

This is by the way more than a dream, because Professor Rolf Ingvaldsen and his physiologists are alive and well at NTNU in Trondheim, and so are the weight-lifters and their

organisation. Through 25 years, I have worked on and off with Kurt Bai and Bailine, and I see no reason to end that cooperation, not only because Kurt Bai is a pioneer in computerised electro-exercise of thousands of overweight ladies, but because the clients in Bailine are a far more interesting and relevant target group in this context than the ever slimmer sports students I teached during my 31 years at The Norwegian University of Sport and Physical Education. And the future – which always marks the end of history up to now – starts every day, right at this moment!

## Healthy and Slimming Exercise

Fad diets *without* exercise have never worked over a longer period of time. You get hungry, slack and lethargic, and you give up time and again. And you grow fatter and fatter, with increasingly less food. American researches have studied the connection between calories, obesity and physical activity, and have identified something they call *set point*, a kind of fat-thermostate that keeps the fat percentage in the body more constant than the food intake should signify. Set point is connected to a controll centre in the brain, in hypothalamus. What is it that affects this set point, and what can we do ourselves to come down to a healthy and low level, so that the fat percentage is less than it is wshen we are overweight?

There is a connection between obesity and diabetes 2. Diabethologists can have an interesting approach to overweight and physical exercise. Richard K. Bernstein is a ground-breaking diabethologist, and his book, *The Sollution to Diabetes*, is now available also in Norwegian. Bernstein has had diabetes I for over 50 years, he was an engineer before he became a physician, and he has an experimenting and tough approach to diabetes treatment and physical exercise. We can draw on his experience, his insight and his training advice.

## The Significance of Physical Activity

The physical activity in itself does not have much effect on the rolls of fat. When we walk, we only use 5 calories a minute, and because there are 7000 calories in one kilo of fat, we have to walk a little over 23 hours to get rid of that amount of fat, or 1 hour 40 minutes every day for two weeks. But the effect of physical activity is much larger that that, because in addition to the direct energy consumption, physical activity has other benefits, such as:

- a lower set point
- enhanced metabolism
- maintained and increased muscle mass
- better health and extra energy to *even more* physical activity.

If you diet *without* doing any physical activity, you lose the same amount of muscles and fat, through a process called *glykoneogenesis*, which means converting protein to glucose. This process breaks down the muscle tissue – instead of sugar – in order to get enough energy when you are not eating much. When you go on the scales to weigh yourself it looks good, but it is a double catastrophe: You loose valuable musculature, which you probably had too little of already, and the ability to burn fat diminishes. Both carbohydrate and protein can be transformed into fat and stored, but fat can't be transformed the other way. Fat can only be burned in active, working musculature.

What kind of physical activity is good for excess fat? It is normal to recommend light endurance training, like slow jogging in easy terrain. But if you study the bodies of those who have done this – *and only this* – consistently for a long time, you will see that they lack muscles and are far too weak. The worst thing is that they run themselves to neuters and their legs suffer fatigue fractures at a young age. When so-called experts only recommend this kind of exercise, you can be quite sure that they have no experience with strength training and heavy manual labour themselves. No, an obese and untrained needs *both* endurance and strength.

If you plan to get rid of your fat fast and brutally, by eating less and exercising more, you have to start with strength training *first*, especially strengthening the large muscle groups; legs, buttocks, back and stomach, because it takes time to adjust the muscles, sinews and tendons to proper strength training – six weeks for the back-stretching muscles.

**Strength Training**

For an untrained and overweight person, the heavy body is itself a good enough weight to lift, in exercises such as knee-bend. But many exercises will be far more efficient with a weight bar, so we recommend one highly. Few PE-teachers and other people with athletic education know much about strength training, but *weight-lifters* have great knowledge.

The muscles are the largest energy consumers in the body. One kilo muscle tissue needs about 100 calories a day, but one kilo fat tissue needs only 4 calories. That's why the obese benefits doubly from exercising the muscles: They make you strong, and they are cannibals on your fat if you eat properly and avoid carbohydrates. Stop moaning that you don't want muscles! It's rolls of fat on top of your weak muscles you *don't* want. Your sexual hormones will make sure that the fat under your skin adjusts itself nicely and womanlike round your well-trained muscles, and give you the *female* curves that can't be mistaken.

When you train strength – with or without a weight bar – you will achieve different results with different weights on the bar. We talk about how many repetitions – or *reps* – you can manage, and if the bar is heavy, you will of course not manage as many reps. We can use the following table:

| | | |
|---|---|---|
| Very large load/weight | Gives maximum strength | 3-5 reps |
| Large load/weight | Gives larger muscles and strength | 6-8 reps |
| Medium load/weight | Gives strength and endurance | 8-10 reps |
| Light load/weight | Gives endurance | 10-15 reps |

Slow and thorough warm-up, at least 15 minutes, is important to avoid injuries, and always the same movements that we shall do with the weight bar or another load later. Then the cartilage in the back, knees and other places will have time to swell and form an extra thick and supple buffer between the bones in the joints. Running or cycling is a misunderstood form of warm-up for strength training; weight-lifters warm up with the bar! In the intervals between the warm-up exercises, we can do some knee-bends.

In exercises such as clean and jerk and snatch we must relieve the spine by up to 40 % by largely increasing the abdominal pressure. We do this by drawing the breath – up to 75 % of maximum – and holding the breath to keep the abdominal pressure up both when we lift and when we break down. When the bar is up, we breathe out, draw a new breath and keep the same abdominal pressure when we break the bar down as we did when we lifted it up. It is a greater strain on the knees and spine to break the bar down than it is to lift it up, but it gives even better strength training.

When we shall lift something heavy, such as when we do a clean and jerk or a snatch, it is important, but difficult, to keep a small sway in the back. By looking up into the ceiling in front of you, that is to say to keep a sharp angled neck, it is easier to keep the back swayed. And by protruding your bottom – like Donald Duck – it becomes even easier. The world's best weight-lifters do both.

Novices to clean and jerk have a tendency to user their arms too early, and then the lift is unsuccessful. Weight-lifters say that the arms are only there to hold the bar, and that all the work is done with shins, thighs and buttocks – except a small jerk with the arms at shoulder height at the end of the lift. To learn to *not* use the arms too early, we can stand upright with a relatively light weight on the bar and jump resiliently two to three times without stopping, and then jerk the bar in the same rhythm, also without stopping. "Look how easy it was *now*," is the spontaneous reaction. And hence, the road to *more* resilience and strength with heavier weights lies open, in the finest and most difficult of all strength exercises.

For the novice it is important to lift *correctly*. First with the bar itself, and after a while with weights attached. Think of speed and resilience – not toil. When the technique is reasonably good, it's time to move on to heavier loads, but that will put your performance on the test. With a lighter weight on the bar again, it will be easier to repeat correct technique, before you move on to heavier weights again.

Strength training with heavy weights is *anaerobe* exercise, which leaves you out of breath, craving for a pause. Take that pause! We are *not* training endurance and fitness with the weight-bar. Breathless, unceasing lifting is misunderstood as strength training, but rather common in endurance sports, where the athletes lack both strength and the knowledge of how to achieve it.

After half an hour with concentrated lifting, you will start to get the right agility and resilience, and at the same time it starts getting easier and easier to lift the bar. Then you can keep on at bit longer – this is the enjoyable part of the exercise. But stop training whilst the going is good, before you are downright fatigued, and always with a successful lift.

**Anaerobe and Aerobe Exercise**

Strength training is *anaerobe* exercise, where you don't fetch enough oxygen through the lungs, so you have to fetch some oxygen through the muscles as well. So the muscles tire quite fast and the need fourteen times the amount of glucose to do the same work as with *aerobe* exercise. In anaerobe exercise the muscles will be broken down the first 24 hours, and then built up again the next 24. There is therefore no use in hard strength training more than every other day.

The muscles contain long fibres that contract during work, and they use high-energy ATP-molecules. These molecules are formed by destructing glucose or fatty acids. Some muscle fibres use a process called *aerobic metabolism* to form ATP (adenosintriphosphate) from small amounts of glucose and large amounts of oxygen. These fibres are not so strong, but enduring, good for calm running, cycling or cross-country skiing. Other muscle fibres are stronger, but less enduring. They need energy quickly and must therefore produce high-energy ATP faster than the heart can pump blood to deliver oxygen. They manage this by a process called *anaerobic metabolism*, which takes large amounts of glucose and hardly any oxygen.

The fall in blood sugar levels during and after anaerobe activity is much greater than during aerobe activity, and to acquire enough glucose for the muscle cells – when the muscles increase in strength and volume – the glucose transporters in these muscle cells will increase immensely, and also in the liver and other places. As a result, the insulin's ability to transport glucose and suppress glucose production in the liver becomes much better, and therefore we need lower levels of insulin. The benefit is double: lower fat percentage and less risk of diabetes II.

Anaerobe metabolism produces lactic acid, which is deployed in the active muscle and hurts. If you stop the activity, it stops hurting immediately, so in anaerobe training there is much talk of *will and motivation*, and it doesn't hurt to know about this pain. Research has showed that people who do much anaerobe exercise – especially strength training – have a better self-image and are more sure of themselves than other athletes. And that might not be so peculiar, because a person who has broken barriers by going through anaerobe mists of self inflicted pain and toil, has a better self knowledge than before and knows what she stands for. Anaerobe training environments are rather reckless, with a happy and care-free aggression, where jokes and self-irony reign. There are of course no limits on age and sex in such environments. Try to join up with a gang like this, or create your own. You will never regret it, and never quit.

**Aerobe Quantity Exercise**

Experience shows that we need at least 7 hours of brisk, hard activity a week, distributed over *all* the days of the week. More than three sessions of strength training – up to one hour every second day – is not recommended. Then we have at least four hours left for quantity exercise of aerobe intensity, or more, if you want. For the novice it is important to start off carefully, to avoid too much strain on tendons and joints. Good foot-wear and a friendly surface is important, but also variation in activities and physical surroundings. Chose rough and soft terrain instead of flat and hard. Don't just think of feet and road, but arms and oars, pedals and wheels. *Walk* to work if you can – grab a spade and dig the garden, saw and chop firewood. If you have children or grandchildren, *carry them* when they get tired.

You don't have to be as reckless and forceful to do quantity exercise as with anaerobe training, but you need to change your habits and life-style. A dog or a friend to go for walks with can help when hours and hours of inactivity shall be replaced with daily activities. Or take out the old bike. Our society gives us less and less encouragement to do such activities, so it is important that you find out for yourself what is to be a part of your daily routine. We meet those who have managed, in all kinds of weather, on their way to and from work or in the woods. They look strong and content, and many of them are absolutely not young. You too can become one of them!

**What Is So Good About Strength Training?**

Most of our energy is spent producing heat – thermogenesis – to keep the body temperature up. Thermogenisis is the sum of:

- resting metabolism
- thermic effect of physical activity
- thermic effect of nourishment
- adaptive and regulatory thermogenisis.

The resting metabolism amounts to 65-75 % of the energy consumption, and decreases with age if the muscle mass decreases. Women have a lower resting metabolism than men, mainly because they are smaller and have smaller muscles, but in the week before menstruation, the resting metabolism increases by approximately 5 %, probably because of increased production of progesterone, which produces extra heat. But otherwise it is the amount of well-trained muscles that determines the resting metabolism, and not if you are man or woman, young or old.

The thermogenisis increases significantly with heavy muscular labour, depending on how active you are. With hard and heavy strength training, the energy consumption can be 10-15 % higher than when you are resting, and it stays higher up to 48 hours after such training, or for as long as it takes to build up the deposits of glucose after such hard exercise. The energy consumption in strength training is therefore many times higher than what we new only a few years ago, before the extra energy consumption *after* training had been measured. In the hours subsequent to hard strength training, the thermic effect of food and oxidation of fat also increases.

Research shows that we eat far less than the extra energy we use the fist to months after we embark on a solid strength training programme, and the difference is fetched from our fat deposits! Food intake and energy consumption will be balanced after a couple of months, but not if we increase quantity and intensity in the training. With a reckless motivation and will, we can keep the energy consumption higher than what we eat to replenish it for even a few more weeks or months, so that the fat deposits are depleted even more before fat percentage, muscle mass and muscle quality is stabilised at the desired level. The resting metabolism becomes so much higher and better as the strength training improves the balance between fat and muscles!

Many overweight people have insulin resistance with associated high production of insulin to reduce the excess glucose, or the beginning of diabetes. This excess gathering of insulin in the blood implies enhanced stimulation of lipogenisis in both the liver and the fatty tissue, not only in connection with meals, but also with an increased level of fasting plasma insulin. Solid strength training will probably work as a wonder cure to this insulin driven problems associated with overweight, largely because the muscles are capillarated and come in better shape, less because they get stronger and least because the fat percentage decreases. Strength training also stimulates the protein synthesis.

Research shows that through diets *without* strength training, 50-70 % of the weight-loss is fat, and the rest is loss of muscles. If you diet without using the muscles, the resting metabolism also decreases by up to 30 %, and the ability to burn fat decreases accordingly. This reduction in resting metabolism is far too large to be explained by loss of muscle mass alone. The body probably tries to counteract the negative energy balance – the under-nourishment – through adaptive thermogenisis, and the reduction of muscle mass is only a part of this adaptation. Repeated fad diets without muscular training makes this adaptation happen faster and faster, and it will take longer and longer time before the resting metabolism reaches a normal level again, and in the worst cases, the reduction of resting metabolism becomes chronic.

Strength training will effectively counteract a reduction in resting metabolism, also if the fat percentage should not decrease much. But by combining strength training with a change of diet towards lower glycolic content, that is to say more proteins and less fast carbohydrates, we get a super-effect: Larger and stronger muscles, less fat and far lower risk of diabetes and cardiovascular diseases.

Research shows that strength training makes middle-aged women (Miriam E. Nelson) and men (William j. Kraemer et. al. 1999) far more energetic and "younger" than any other form of exercise. In men, the hormonal vitalisation – increased testosterone, among others – has been shown in detail, and there is reason to believe that the same applies for women, because Miriam Nelson let 40 women past their menopause train strength for a year, twice a week, 40 minutes each time, with the following results:

- Increased bone density.
- Their strength increased to what is normal for women in their late 30's or early 40's.
- Fat was substituted by muscles – 9 % increase in muscle mass and most of them went down several sizes in clothing.
- Happier, more energetic, active and self-assured women.

People who don't train strength loose a third of their muscle mass when they grow older, and the decay starts already around 35 years of age, mainly due to physical passivity. That's what leads to fragility, not age itself.

If you are afraid of getting large, bulky muscles when you train strength – like a bodybuilder – you can rest assured. That won't happen. Women and men who start effective strength training *do* get larger muscles – the first six months – but after that it is the *quality* of the muscles that improves, not the quantity. But what is the reason that bodybuilders get these large, bulky muscles? The answer is simple: Anabolic steroids and similar dope!

**Olav Nøkling M. Sc.: Insulin and the Metabolic Syndrome**

Insulin is a hormone that is produced in the pancreas, and that regulates our blood sugar. Blood sugar, or glucose, is formed by the food we eat – especially food that is rich in carbohydrate, like sweets, bread and potatoes. Glucose is the most important fuel when the body produces energy. During and after a meal, the glucose level increases and is regulated by increased deployment of insulin from the pancreas. The insulin ensures that the blood sugar comes over to the cells in the liver and muscles, but when the glucose deposits in the muscles and liver are filled up, the insulin makes sure that the excess blood sugar is deposited as fatty tissue. The insulin increases this fat-depositing by stimulating and enhancing an enzyme in the fat cells – lipoprotein lipase – which brings the fat-molecules from the blood and into the fat-cells. The insulin also causes the deployment of more fat-cells, and even when the insulin cooperates with *cortisol*. The hormone cortisol increases when we suffer from psychological problems and stress.

*More* insulin in the blood means obesity and *more* obesity when food intake and physical activity is kept at a constant level. *More* insulin also means better appetite. Insulin is a vital hormone since it transfers glucose from blood to cells, so with insulin deficiency, the glucose level in the blood will become dangerously high. That's *diabetes mellitus* or type I in a nutshell. Diabetes type II, on the other hand, is not caused by a deficiency in insulin, but that the cells for one or more reasons are resistant to insulin, so that transferring blood to the cells becomes difficult.

Overweight people have far too much insulin in their blood – hyperinsulinism – all the time, also when they are fasting, just like people with diabetes II, and at least 80 % of these diabetics are overweight. Hyperinsulinism is most frequent among people who are fat around the stomach. Overweight people also *produce* much more insulin than others, often from childhood, and this is believed to have genetic origin, that it is passed on from previous generations. In reality, this means hypersensitivity to carbohydrates. The increased insulin production causes the body to react by producing even more insulin, to manage the constantly more difficult task of getting the blood sugar out of the blood circulation! Wrong diets and too little hard muscle work increases the insulin production even more, and at the same time the effect of the insulin gets worse. This dramatic and dangerous condition is called *insulin resistance*.

It was believed earlier that overweight was the cause of hyperinsulinism. We now believe – bordering on certainty – that insulin resistance is inborn, but that the condition gets worse with wrong diet and too little physical activity. The diet is dominated by fast carbohydrates – both in food and drink – in a manner that is almost impossible to brake away from, and attempts at light exercise, for instance walking, will cost almost as much valuable fatty tissue as harmful fatty tissue.

Most overweight people have insulin resistance to a certain degree, and already have diabetes II, or are on the verge of getting it. The insulin resistance causes higher production of insulin, and that brings us to the core of obesity, because *more* insulin means that the glucose is transformed into fat and deposited at places where there already is too much fat. *More* insulin also means that the fat deposits are used less when the body needs energy. This double effect of *more* insulin means greater desire for sugar in the food, faster metabolism and use of the sugar we eat, and a need to eat more often and more. *More* insulin therefore means larger fat-deposits, and that they are defended better.

Insulin resistance causes the glucose level to increase dramatically in connection with a meal, a powerful signal for more insulin, so much that the blood sugar decreases rapidly, often to a dangerously low level. This calls on other hormones to increase the blood sugar, but then the body's sugar deposits are depleted. The overweight person has undersized sugar-deposits and gets little energy from the fat she has deposited, so she will often be weary, exhausted – and hungry. Her hunger often has a desperate character – because the energy is running out – and is directed towards the most easily digestible carbohydrates there is; sweets, white bread, cakes and chocolate. This is, by the way, less hunger than a desperate need to counteract the awful weariness caused by a dangerously low or steeply falling glucose level. In these desperate meals a lot of food is eaten fast, and new fat-masses are deposited.

If the overweight person pulls herself together and does not eat in such desperate situations, and just continues physical activity, the protein in the muscles will be broken down and used as energy. If this happens frequently, the muscles will grow increasingly smaller, and because the metabolism is related to muscle mass, the metabolism will get lower and fewer calories will be used than before. With fewer muscles and less fatty tissue, stamina and strength will deteriorate, and the fat woman will move slower when she has to move, and less if she doesn't have to.

Will-powered fat women can in this way lose a lot of weight quite rapidly, because when the muscles are broken down and used as energy instead of fat, the weight-loss is ten times as fast. One kilo of protein doesn't have half the amount of energy as one kilo of fat, and muscles are one part protein and four parts water. Each kilo of muscle tissue therefore has only a tenth of the energy that is in a kilo of fatty tissue.

Insulin works by tying itself to receptors on the cell membrane, and that is the start of a series of activities within the cell. The most important insulin-sensitive tissues in this context are the liver and the muscles. When the insulin is tied to the muscle cells, they increase their glucose reception. After a carbohydrate-rich meal, 70 % of the sugar is deposited in the muscles, and insulin must be present for that to happen. If the effect of insulin is reduced, the glucose reception is delayed, and the blood sugar values remain high for a considerable time after the meal. When everything is as it should be, the liver is very sensitive to insulin, and the insulin prevents the production of glucose through glocogenolyse and glycogenese. But when the insulin does not work properly, there is no such prevention of glucose production, and the liver is forced to receive large deposits of glucose.

The main physiological regulator of insulin production is the glucose level in the blood. When the beta cells in the pancreas, which produce the insulin, function normally, there is a coherent connection between the insulin level and the sugar level in the blood. The insulin level in the blood mirrors the insulin resistance, and as long as the beta cells are able to compensate, the insulin resistance will be accompanied by increased insulin level. When the beta cells can't cope any more, often after many years of excessive strain on them, we get diabetes type II, and the connection between insulin resistance and insulin level becomes distorted, complicated and dangerous.

Most people with insulin resistance have normal insulin receptors, and neither pushing molecules nor genes has given any traces of any good hypotheses about the reasons for this. But overweight and obesity is usually followed by insulin resistance, with far too high levels of free fatty acids in the blood circulation and far too much fat in muscle cells and liver cells. The genetic tendency for obesity and insulin resistance in the population has of course not changed or got worse the last few years and generations, but obesity and insulin resistance are increasing rapidly in Norway as in most other countries. So we can indeed not go past key words such as life-style, too little *heavy* muscular labour, and too much fat food in proportion

to the amount of physical activities throughout the day and year. Few or no campaigns from the authorities to get people to diet have been based on correct insight in the connection between muscle work, insulin, food and obesity, but that is probably not the cause of the failure of the campaigns. Even with the latest and best knowledge such campaigns will fail for those who already are worn out by insulin resistance and obesity, also called the metabolic syndrome. Insulin resistance and hyperinsulinism follow each other like shadows, with dangerous and exasperating ailments in their wake, like:

- Diabetes II
- Cardiovascular diseases and high blood pressure
- High cholesterol and triglycerides
- Fatigue, anxiety and depression
- Urine acid arthritis and fibromyalgia

It is of course better to treat the insulin resistance with correct food and exercise rather than trying to cure the ailments with medication!

The hormone *glucagon* is also produced in the pancreas and has the opposite effect of insulin. When we haven't eaten for a few hours, the blood sugar levels drop, but the brain requires a constant blood sugar level, or else we become irritable, drowsy and sleepy. Too low blood sugar level is a signal to the pancreas to produce more glucagon. Protein-rich food stimulates the production of glucagon, slows down the production of insulin, increases the fat-burning process and decreases the deployment of fat. Our own choice of food-stuffs can affect the balance between glucagon and insulin, and counteract obesity if we do the right choices. One of the glucagon's many tasks is to split fatty tissue that can become blood sugar in the liver, so that we once again achieve the right level of blood sugar. Glucagon is therefore the body's fat burning hormone.

*Leptin* is another interesting hormone that is produced in the fatty tissue. The more fatty tissue we carry about, the more leptin is produced. Leptin sends messages to a centre for appetite in the hypothalamus – deep down in the brain – so that the appetite diminishes. Oddly enough, fat people have more leptin in their blood than others, but that is not efficient when the amount of insulin in the blood is too large. Consequently, fat people have a large appetite, especially for sweets and other fast carbohydrates.

The last hormone we shall mention is *cholecystokinin,* which is produced when we eat protein-rich or fat food. This hormone sends signals to the brain that we are satisfied! It is *not* deployed when we eat carbohydrates – sugar, white bread, potatoes – but it can explain why we feel content for a long time after a good dinner of salmon, mackerel or herring, protein-bombs of healthy fat!

*Heavy* muscular labour is vital for a better effect of the insulin, so that we need less of it, with all the benefits that implies. But an overweight person with insulin resistance can't do such heavy muscular labour. This is where electro-exercise can be the rescue, an effective way of getting the muscles to work while the pat person lies down, a life-saving flying start to get going on your own. But even several months after the fat person has started muscle training on her own, the electro-exercise can be a valuable supplement and a helpful aid.

When electro-exercise is done in the right way, it is tremendously effective. The Danish physician and researcher Thomas Mohr has written a 6-page article on this at *dadlnet.dk* on April 10th 2000. He reports that electric stimulation of paralysed musculature gives well-being, increase of maximum oxygen intake fro 20-100%, increased muscle mass, enhanced

insulin stimulated glucose intake, and better mineral status in the lower extremities. He believes that electro-exercise will be used for even more purposes in the future, and there is an organisation with this intention, *The International Functional Electrical Stimulation Society*, which has annual conferences. He also reports that an increasing number of healthy people use electro-therapy as a substitute for normal muscular training.

Fat is a more precise – and more brutal – word than obese, and from day one it is connected with too much fat food for the person in question. The fat person has not eaten too much tuna, salmon, mackerel or steak, but too many sweets and other fast carbohydrates. In the ancient hunter and livestock cultures there was little carbohydrate in the diet, and people dreamed about sweet berries and honey. With agriculture, cereals were served at the table, but not finely ground and refined and certainly not in the form of sugar. Even 200 years ago, the sugar intake was almost zero. 100 years ago it was less than 10 kilo per person per year, whereas in Norway today, we gulp down 40 kilo per person per year, or more than 180 million kilos all together. USA is far ahead of us, with a sugar consumption of 65 kilo per person per year. The steep and ugly curves for increase in sugar consumption, fast carbohydrates and overweight follow each other like shadows, and the connection is obvious for anyone who wants to see.

Johan Throne Holst (1868-1946) founded and led the chocolate factory Freia Chocolade Fabrik in Oslo. In 1931 he founded a large fund for research in nutrition, and along with a large contribution from the sister-factory, the chocolate factory Marabou in Sweden, the chocolate producer paid for the establishment of "Johan Throne Holsts Institutt for Ernæringsforsking" *(Johan Throne Holst's Institute for Nutritional Research)*. Until recently, most people did not know that this is *not* a part of Oslo University. This is where the most prominent nutritional physiologists in Norway are educated, and the Scandinavian nutritional circles still produce articles for the Internet about the benefits of chocolate. Normal chocolate is pure poison for people who are suffering from the metabolic syndrome, and is of course also fattening and unhealthy for the rest of us.

Most nutritional physiologists are women, but the *gurus* are men, and they sneer and bite at if anyone dares to question their nutritional advice to the population. New research, with key words such as *glucemic index* is not tolerated, not even as advice for diabetics. Nor have Norwegian sports and work physiologists contributed to new and nuanced insight in what kind of exercise and work that is most effective for fighting obesity, with one honourable exception, Kjell Nedregård's masters dissertation "Styrketrening som virkemiddel i behandling av fedme" *(Strength Training As Treatment For Obesity)*. But that was done at the institute for *general* physiology at the University of Oslo.

The ruler-techniques that are used to hold back the public from knowing about the free research in this area are drastic. But in a few years time, we must assume that the public has gained enough information to see through the "fat lie" about obesity, like leading newspapers in Germany and USA already have reported. Obesity begets diabetes, one of the most expensive diseases to treat per person, and one that the medical industry has the greatest profit from. So from diabetologists we can't expect much help in revealing the "fat lies", apart from honourable exceptions like Richard K. Bernstein (1997): "The Solution to Diabetes".

But so what? Anyone with a professional background and the opportunity to go into relevant research, and who brings this knowledge on to the public, can only do so. So that the public can learn what kind of *food* is the correct medicine against obesity, and what kind of *training* that most efficiently diminishes the need of insulin.

*(For Bailine by Olav Nøkling M. Sc.)*