



# **Protein Metabolism and Storage with Special Consideration of the Liver and Kidney Function**

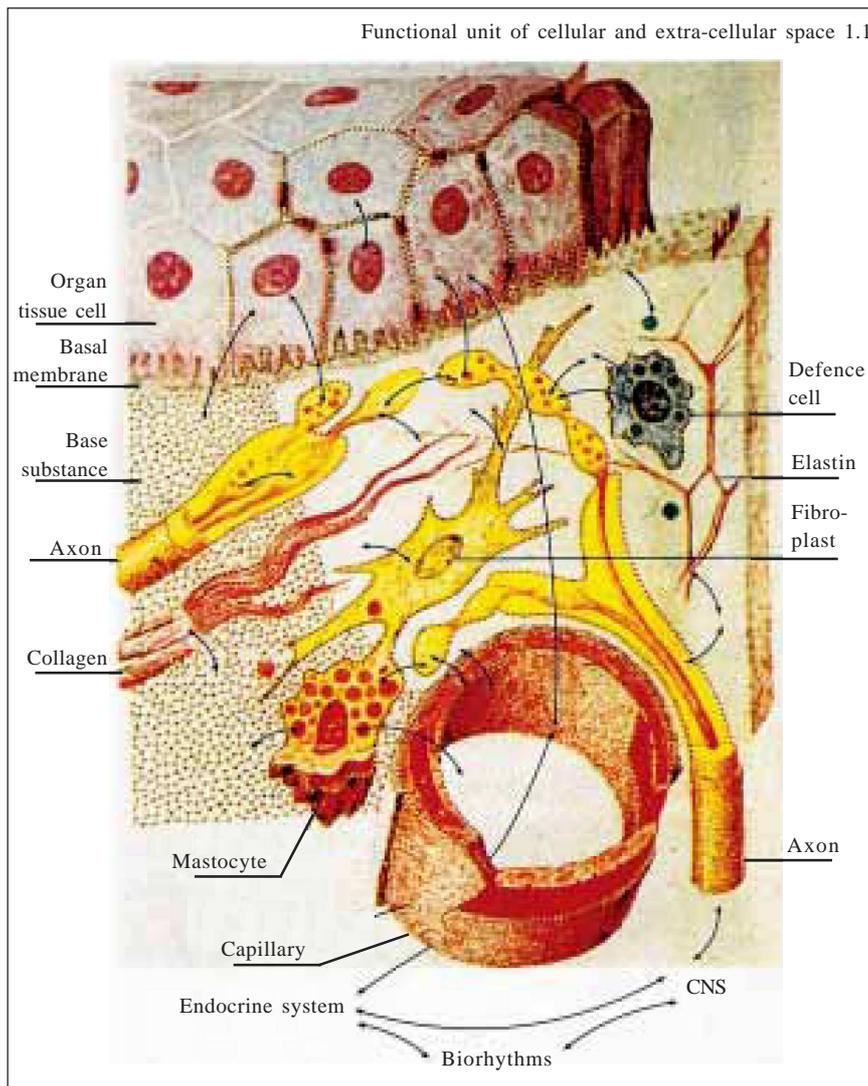
**by Dr. Anita Kracke, Naturopath**

The metabolism of living beings serves several purposes. On one hand, there is a specific achievement of a function or an organ, whilst on the other hand, the order and up-keep of the organism must be secured, and destroyed or worn parts have to be regenerated.

In order to achieve these tasks, nutrition and energy must be provided. We require a balanced diet containing carbohydrates, fats, proteins, vitamins, minerals, trace elements, vital elements, water, oxygen, sunlight and energetic power.

As long as a mono-cellular organism lives in a liquid environment, the surrounding medium (mostly water) provides all the vital elements, and waste can be disposed of into that medium. Higher developed poly-cellular organisms require a complicated system of nutrient provision and waste disposal to maintain their vital functions. The so-called base-tissue most successfully meets these requirements for the individual cells: nutrients, waste and information are transported via a large supply network.

The macerated food particles are absorbed from the intestines into the vascular pathways and channelled through the liver, finally arriving in the circulation and reaching the tissue by way of the capillary vessels. The individual cellular building blocks, energy carriers, minerals, vital elements and water arrive at the destined cells by the respective diffusion pressures and osmotic gradient.



*Fig. 1: Schematic of the Basic Regulation: Mutual relationships (directional arrows) between peripheral current (capillaries, lymphatic vessels), base-substance, terminal vegetative axons, connective tissue cells (mastocytes, defence cells, fibroblasts etc.) and organ tissue cells. Epithelial and endothelial cell conglomerates are supported by the basal membrane which conveys them to the base substance (from „Das System der Grundregulation“ by Alfred Pischinger, revised and published by Hartmut Heine, 9. edition, Haug, 1998).*

After the tissue fluid has delivered the nutrients to the cells, it returns emptied to the blood stream where it is reloaded. According to Prof. Wendt, („Die Eiweißspeicherkrankheiten“ (*Protein Storage Disorders*) by Prof. Dr. Lothar Wendt, 2<sup>nd</sup> edition, Haug, 1984), this exchange takes approximately 500 rotations or 3 hours after food intake, before the differences of the

filtration and diffusion pressures between blood and tissue level out.

Evolution has proven the need to store nutrients in order to survive famines. We can assume that the first storage possibility was limited to the fat in the respective cells. Later, it was also possible to store glucose and protein.



Differently expressed, we can say that only those mutants who learned to store nutrients were able to survive. Their descendants then inherited this capability. The storage possibilities enormously emancipated the individuals with this capability. Nutrition and storage occur at the same time. Storage does not „feed“ on nutrition.

Even today, the belief that fat is the only storage molecule for our nutrients is widely spread. The truth is that most nutrients can be stored, but there are different storage molecules with different storage capacities. The body can thus store protein in the form of collagen, while glucose, amino acids, fatty acids and water are stored in mucopolysaccharides. Fat and glucose are stored in fat cells in the form of triglycerides, and finally glucose can be stored in the form of glycogen. These storage molecules are not water-soluble, which gives them the storage capacity in the first place. Before the stored substances are to be re-entered into the metabolism they have to be made water-soluble.

Only blood permits water-soluble storage. Specifically in respect to protein storage, collagen and mucopolysaccharides have to be seen as depot molecules that are not water-soluble, while albumin and amino acids represent water-soluble protein transport and storage molecules. Fat is transported and stored water-solubly in the form of free fatty acids or lipoprotein with protein and cholesterol within one molecule.

The storage of triglycerides in the

fat cells is extremely efficient and sufficient for a month's energy generation in the healthy body. Weight would double if this amount of energy was to be stored as glycogen. The stored glycogen usually lasts from one meal to the next and depends on insulin.

Each cell of the body can store additional nutrients intracellularly. The extracellular storage of building blocks, sugars and water is largely reserved to the descendants of the 3<sup>rd</sup> mesodermal germ layer and relates to all desmoid structures such as blood, blood vessels, connective tissue, cartilaginous tissue and bones.

### **Various (Protein) Storage Depots in the Human**

*1. The Subcutaneous Tissue:* is the storage depot for times of starvation. It is best qualified for this task because none of the body functions are interrupted. The skin is a very thin organ with a relatively low metabolism. Even with intensive storage in the subcutis, the organelles are optimally supplied despite a low nutrient stream and slow waste disposal. The subcutaneous tissue cell begins storing only after a specific stimulus threshold has been reached. This threshold is lower than that of the endothelial cell of the lymph duct, and lower still than the hydrostatic pressure in the veinlet. This is the reason why accumulation in the subcutis does not drain away and subcutaneous cells begin to store.

The thick fat layer of the whale that covers it like a coat is typical of subcutaneous tissue storage, at the same time serving as thermo-

insulation. On land, it would suffocate in its „water swimming“ fatty coat, which means that weight is the physical limit for subcutis storage.

Depending on the storage, the human skin is paper-thin or several centimetres thick. The subcutis is bloated with the storage of many mucopolysaccharides and water; firm with protein storage, and tough to thick skinned whilst fat generates a consistency which lies in between.

It is, therefore, advisable to check the thickness of the skin fold, which cannot be lifted in cases of extremely obese individuals. Fat alone is never stored.

The preferred locations for storage in the subcutis are varied: Collagen is mainly stored in the neck and fat is stored beneath the abdominal skin. Subcutis storage depots are supposed to help the body to survive in times of famine. Histological incisions through the subcutaneous connective tissue of obese people for example, show only large fat cells in one area and heavily bloated and increased collagen fibres in others; this is pure protein.

During starvation periods, the fat cells are „emptied“ and the collagen fibres are completely broken down, resulting in gaping holes between the elastic fibres of the connective tissue.

*2. The interstitium:* is the service area of the parenchymal cells, as well as the source of the lymph and storage depot. The interstitium lies between the capillary and cell. It is like a well-drained marshy area, interspersed by elastic and col-



lagenous fibres and is directed by the peptide hormones of the cell. It equally serves three physiological main tasks: Nutrient supply and waste disposal as well as storage. The thickness of the interstitium is frequently less than the diameter of an erythrocyte: e.g. 5  $\mu\text{m}$  in cardiac muscle tissue. In times, in which we find ourselves at present - without famine - and the environment becoming more and more polluted, the interstitium easily reaches the limits of its storage function, since it is only rarely or never excreted, thus frequently turning the interstitial tissue into a waste dumping area.

In healthy people, the interstitium has an average thickness of 5-10  $\mu\text{m}$ , containing mainly collagen, mucopolysaccharides and approximately 16-17 litres of water. The physiological protein storage capacity is approximately 3 kilograms. In the normal interstitium, the normal transport is rather fast since the cells rapidly „serve themselves“ to whatever flows through by way of the capillaries' basal membrane. This is different in the case of over-proteinisation, as the cell requirements are low when the interstitium surpasses a thickness of 10  $\mu\text{m}$  and the storage process begins anew. The normal balanced time period between meals is now absent, in which the storage depot was emptied before hunger pangs were felt. An interstitial space thickness of over 20  $\mu\text{m}$  represents risk factors to health.

**3. The Capillaries:** This storage organ is even more minuscule. It stores with its basal membrane that has a thickness of approximately 0.06  $\mu\text{m}$ . Its protein storage capa-

city lies by approximately 1 kilogram and the storage molecules consist of 95% collagen and 5% mucopolysaccharides. The endothelial basal membrane can expand to a thickness of 0.12  $\mu\text{m}$ , which is still physiological immediately after a meal. However, the swelling should decrease again as soon as possible before the next intake of food.

**4. Blood Storage Depot:** 78 ml blood per kilogram of body weight is considered normal. The physiological hematocrit value in healthy people lies between 35 and 42 vol.%. The range between these two values is the physiological storage depot margin and is approximately 300 grams in the case of a healthy person with a body weight of 77 kilograms and 6 litres of blood. In the case of over-proteinisation, which may reach a hematocrit value of up to 65 vol.%, this corresponds to 900 grams of solid substance. With these values, the risk of an infarct is particularly high. It can be determined that the so-called „physiological values“ have been raised in the past due to the continually increasing over-proteinisation of „healthy“ people. In general, it can be said that the increase of the molecule concentration of blood components would result in a retardation of the micro-circulation due to an increase in the blood's viscosity; this means accumulation which stimulates storage.

Residues in the blood caused by an oversupply of nutrients are transferred to the subcutaneous connective tissue for storage. The human organism is healthy, even though

he may appear somewhat fat, as long as feeding and consumption only occur in the interstitial connective tissue and storage only takes place in the subcutis.

The highest threshold for accumulation-storage values still considered physiological, lies at 42 vol.% for hematocrit, 0.12  $\mu\text{m}$  for the basal membrane of the capillaries and a thickness of 10  $\mu\text{m}$  for the interstitium of the organs.

In the case of an excessive supply of protein in a meal, a part of the amino acids can be converted immediately after a meal in the liver into urea and excreted through the kidneys, thus avoiding an amino acid accumulation or an over-proteinisation in the tissue. The ornithine or urea cycle is, therefore, like an overflow valve for the supply of amino acids. As long as the urea cycle can break down an oversupply of amino acids, and thus avoid accumulations, the human organism remains healthy. Urea synthesis allows the organism to excrete the nitrogen compounds of two amino acids at a time. This reaction does not occur when hungry. When oversupplied, the entire nitrogen can be metabolised. However, the efficiency of the human organism or its enzymes can be rather varied in regard to urea synthesis; fluctuating between 100% and 42%. The urea synthesis capacity limitation is an important factor for pathological protein storage.

If the protein supply in humans exceeds its maximum enzyme activity of the urea cycle, more protein molecules than the cells can

consume will flood the interstitium. Protein waste remains there and develops into a protein-rich connective tissue oedema, resulting in the stimulation and storage of the connective tissue cells whereby the collagen net and the basal membrane (BM) begin to thicken.

In addition, the cell's energy is generated from the breakdown of fats and proteins. In all cases, acid metabolic products lead to a further hindrance in the transport of substances in the stroma, as the matrix's sol condition changes into a gel condition.

as well as the pinocytotic vesicle, and its content flows into the subendothelial space and onto the basal membrane. The contents of the vesicle then reach the basal membrane unaltered just as with the substances that come into direct contact between the endothelial cells and the basal membrane.

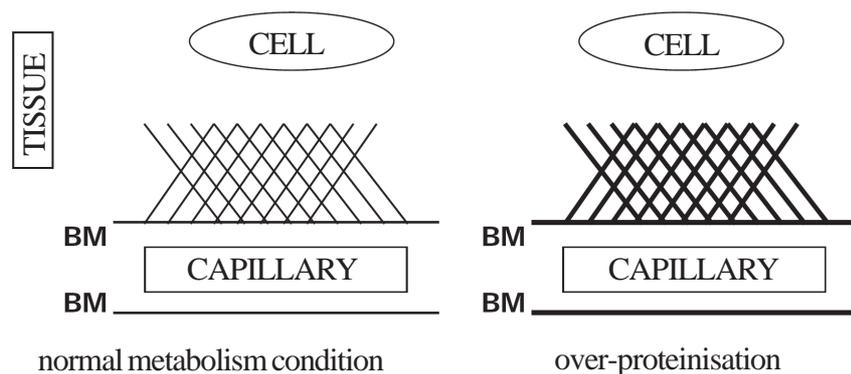


Fig. 2: The change of the capillary's basal membrane (BM) and of the collagen nets of the connective tissue as result of an excessive supply of protein

The thickened collagen net, however, obstructs diffusion in the interstitium. This means that the cells are undersupplied and cannot distinguish their functions. The undersupply includes all substances, which are needed for the regeneration of cell components and the fulfillment of specific cell functions: water including its information, oxygen and glucose to supply energy. An undersupply also means a blockage in waste products, as of course, in the opposite direction, transport obstacles occur away from the cells. At the same time, one can observe that cells with an insulin deficiency (the insulin molecule is comparatively large and becomes quickly affected by diffusion obstacles) switch to the generation of anaerobic energy, through which the fermentation processes produce lactic acid. In

### The Capillary Walls

As a rule, the capillary endothelium consists of a three-layered basal membrane (lamina rara externa, lamina densa, lamina rara interna) with a layer of endothelial cells on the inside of the capillary, and perithelial cells on the outer side towards the tissue. The transport of substances from the capillary over the endothelial cells can occur in two different ways:

1. The endothelial cells invaginate a vesicle on the lumen side; the pinocytotic vesicle, filling it with serum and the molecules dissolved therein. The protein substances involved may be endogenic or foreign (hetero-) protein particles. This vesicle can travel through the endothelial cell to the basal membrane. Once there, the cell membrane opens

2. A pinocytotic vesicle may just as well encounter and fuse with a lysosome in the cell. These cell organelles contain up to 40 different enzymes, through which e.g. nucleic acids, proteins, glycogen, mucopolysaccharides and lipids can be broken down. The body's own, as well as foreign materials can be broken down or rebuilt in the lysosomes in this way. Even damaged plasma particles of a cell can be excreted through a membrane, combined with a lysosome and broken down or rebuilt.

In cases, where protein is stored in the capillary walls, the biochemical processes can take place as follows: The endothelial cell takes glycoprotein from the blood by way of pinocytosis. The pinocytotic vesicles fuse with the lysosomes followed by the lysosomal splitting of glycoprotein into amino acids and sugar. The amino acids penetrate the mitochondria, where the amino group is split by oxidative deamination or transamination. The remaining C-skeleton is utilised in the citric acid cycle, whilst the nitrogen, in form of an amide or amino group, initially ends in the glutamine. The glutamine leaves the mitochondria and transaminates its amide group with the rebuilt sugar,

thus creating the amino sugar glucosamine. At a ratio of 1:1, regular sugar and amino sugar are then bound-up into MPS (mucopolysaccharides). The glutamine, however, having lost its amide group, and thus having been turned into glutamate, is transformed into proline, which is once again the main amino acid of the procollagen molecule. Procollagen and MPS leave the endothelial cells. The procollagen turns into collagen monomers, which are finally deposited on the basal membrane of the capillary or turn into collagenic fibres by helixisation.

With the release of the substances, the endothelial cells absorb again materials from the basal membrane, splitting them into amino acids, sugar and amino sugar. In reverse synthesis, glutamin and sugar are formed from the amino sugar. Amino sugar, sugar and glutamin infiltrate the blood with the help of GOT and GTP and are turned, amongst others, into protein by the liver.

The **Lysosomes** of all cells are the waste incineration and regeneration plants of the body. Indigestible waste products from this regeneration are permantly disposed of in the so called telo-lysosomes. All living cells with the exception of erythrocytes are capable of such heterophagy. Phagocytes cleanse the blood and in turn break down the absorbed components (heteroproteins) with their lysosomes. In any case, the capability of the lysosomes to break down and transform proteins is the key in cleansing the bodily fluids of the organism's endogenic and heteroproteins, whereas the phagocytes certainly have a slightly different composition level of enzymes than the endothelial cells.

This description plainly shows that an oversupply of proteins which must be broken down can overexert the lysosomal abilities of the endothelial cells. The problem can still intensify if a weakness in the break-down of lysosomal proteins already exists. It is also possible that

just one or several enzymes are missing, which in turn may lead to the mostly lethal thesaurismosis diseases. With the development of protein thesaurismosis diseases, one must consider the possibility of the storage of protein compounds that are generated because environmental pollutants, bacterial or viral particles, bond with proteins that are specific to the organism. Either through lysosomal weakness, or through already existing overproteinisation, or because the body cannot recognise and break-down these connections, it must store them as heteroproteins. These are the keys for autoimmune diseases.

When degradation forces are too strong, this may also lead to malformation. (refer to „Grundriss der Biochemie“ (*The Blueprint of Biochemistry*), Buddecke, 9<sup>th</sup> edition, 1994, published by de Gruyters).

The **basal membrane** of the capillary walls is the filter through which everything has to be filtered

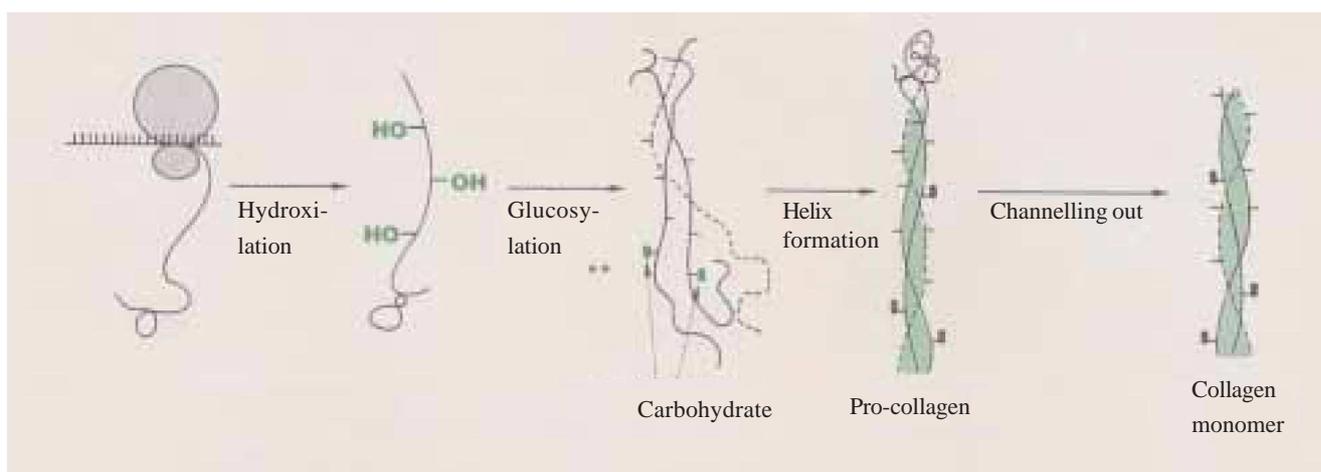


Fig. 3: Collagen Biosynthesis

The peptide chain is synthesised on the ribosomes. It is modified in the endoplasmatic reticulum by hydroxylation and glycosylation; a triple helix is formed and the generated pro-collagens are channelled out. The collagen monomers are developed extracellularly (refer to „Kurzes Lehrbuch der Biochemie für Mediziner und Naturwissenschaftler“ (*Brief Tutorial of Biochemistry for Physicians and Scientists*) by Peter Karlson, published by Georg Thieme publishers, Stuttgart).



from the blood which should reach the cells of the organs and tissues. The actual filter is the basal membrane's lamina densa and has a pore size of less than 0.01  $\mu\text{m}$ . Both of the attached laminae rarae mainly serve the storage (in the fetus, the lamina densa is a quarter of the basal membrane's thickness, whilst the laminae rarae are empty, since all the protein is used for the development of the body substance). Only the lamina densa is the actual filter. It is of no consequence as to whether or not the substances infiltrated the endothelial cell beforehand. The three layers of the basal membrane are the storage locations for the accumulation, interim storage and end storage. Those substances, which are stored and isolated in the basal membrane are absorbed by the pericytes or perithelial cells (so called, because of their foot-shaped appendices or podocytes, with which they lie on the basal membrane) and released again into the tissue fluid. A similar transformation also takes place in the pericytes, which means that the pericytes transform the basal membrane's accumulated collagens and mucopolysaccharides into soluble substances again. The basal membrane is a living filter that constantly renews itself, in which substances are spread on the capillary lumen and removed on the tissue side. As long as development and break-down balance out, diffusion and osmosis are possible through this filter, and circulation of blood and fluids in the tissues are also undisturbed. If, however, the tissues are especially saturated with protein substances, because consumption through the cells cannot keep tempo with the supply, then

this will lead to their storage in the interstitium and the basal membrane's capillary walls, causing a simultaneous back-up in the blood. A thickening of the basal membrane with a simultaneous increase of collagenous fibres in the interstitium and their swelling automatically leads to a transport obstruction of all supply molecules for the cells.

### **Accumulation Storage and its Consequences**

An oversupply of protein leads simultaneously to an undersupply of the interstitials and parenchymal cells with e.g. glucose, oxygen and water, resulting in the reflexive increase in blood pressure by an increased diffusion pressure, in order to supply the cells with vital substances.

Using the muscle cells as an example, the effects of this undersupply through over-proteinisation can be explained. Every cell must not only be supplied in order to remain viable, it also has a specific function to fulfil. The muscle cell must generate contractile energy from glycogen. Glycogen produced from glucose and oxygen in the presence of insulin is produced in the body. If now, the transport of stored energy to the cells, or as the case may be, of insulin glucose and oxygen becoming obstructed, the reserve energy metabolism is activated, so that the cells (e.g. heart muscle cells) can fulfil their task. This reserve energy metabolism is fed by glucose alone and does not require oxygen or insulin. The glucose (not previously processed into glycogen) is enzymatically split and turns into the end product of lactic acid. Energy production is

very low compared with the aerobic energy production in the mitochondria. Since, however, the glucose fermentation does not suffice for energy supply, fat is broken down, thereby additional acidity is created in the tissues through the formation of e.g.  $\beta$ -oxybutyric acid,  $\beta$ -hydroxybutyrate,  $\beta$ -ketobutyric acid and acetone. Even the activation of proteins for energy production causes additional acidification, since after deamination, another fatty acid from the amino acid remains. Simultaneously, removal of waste in the interstitium is blocked and the physiological prone waste products of the metabolism, such as uric acid and creatinin are joined by the degradation products of the reserve energy metabolism.

The increase of acidosis and the waste level causes an irritation of the sensory nerve endings in the networked system of the base substance. The acidotic tissue oedema, rich in waste products, that has formed, produces a muscular pain that we register as angina pectoris pain, in the cardiac region or as rheumatic pain or fibromyalgia in the skeletal muscles. Another situation can arise whereby the undersupply of cells leads to atrophy and necrosis. Since the cardiac muscle is not sensorily innervated, the cell dies painlessly, which is what we call a silent (or painless) myocardial infarct.

The described blockage in the interstitium or the undersupply of cells due to transport obstructions, leads to a congestion of substances in the direction of the capillaries. Because the individual substances



in the blood are not utilised, the molecules in the blood level increase significantly.

First of all, these are multiply stored in the basal membrane of the capillaries. The stimulus for the endothelial cell is now so strong that a larger quantity of insoluble collagen is precipitated on the basal membrane, which substantially reduces its permeability. The peptide hormones of the cells of the interstitium and the organs signalise their undersupply, which are responded in plasma with an increase in concentration of the „ordered“ substances such as insulin, glucose, cholesterol etc. The increased concentration of the excessively supplied and congested proteins as well as all other vital molecules for the cell rises, leading to a reduced ability in blood flow.

The number of erythrocytes also increases, so that the blood can ensure the supply of oxygen by supplying an increased load of haemoglobin. Finally, the blood pressure also rises, since the constriction of the blood vessels and the increasing pressure can improve the diffusion of substrate through the basal membrane.

By continued congestion, the stimulus threshold of the endothelial cells of the arteries' intima is soon reached, activating the storage process here as well. This is the beginning of a multifactorial arteriosclerosis, as all the congested molecules, in particular proteins, are now stored here. The other „storage“ organs such as the basal membrane, interstitium and subcutaneous connective tissue are

nevertheless continuously filled.

The break down of the bodily functions can be induced by the total failure of the transport functions or by necrosis. Such a person may die of a painless cellular infarct, an interstitiogenic cardiac infarct during an acute angina pectoris attack, an untreatable heart weakness, an arteriogenic or a capillarogenic cardiac infarct.

According to this understanding, it is the protein storage diseases, which lead to the risk factors micro- and macroangiopathies, heart infarcts, stroke, rheumatism, angina pectoris and not so much the disorders in sugar and fat metabolism which by many, is still propagated. The microangiopathies of diabetics or hypertensive people result from the cause of a blockage of the basal membrane and the death of the cells which lay behind in the stroma.

The partial pressures and blood levels of the individual molecules in the veins and lungs are not high enough in order to exceed the stimulus threshold in the endothelial cells vessels located there.

### **The Significance of Heteroproteins**

Our environment and nutrition force us to ingest substances that originally did not exist in nature, or that are generated and ingested in much higher concentration due to industrialisation. These substances (frequently metal ions such as platinum from catalysts from our cars) store themselves in the body, preferably on protein structures so that they become water soluble and

transportable. When the protein turns into a heteroprotein, the endothelial cell then breaks it down and detoxifies it via the cell lysosomes.

The end products are preferably stored on the basal membrane or in the interstitium. There are, however, many complex compounds for which the body has no „recipe“ at all to break-down. Such substances must be stored completely or slightly modified and through this, can significantly disturb diffusions.

Apart from that, it is possible that through the compound of foreign substances with the body's own protein substances, the body is no longer capable to recognise this protein as „its own“ and answers with an immune reaction. These compounds of such destructive substances with endogenic protein can lead to lethal autoimmune diseases. Furthermore, pathogenic agents or their toxins (streptococci) or the compound of antigen-antibody-complexes, which are irregularly broken-down and turned into energy can be stored in the basal membrane. This always happens, when the lysosomal strength of the cells, in particular those of the endothelial cells become overexerted.

From an evolutionary angle, this type of storage in one single reservoir made good sense, however, due to the increase in environmental toxins and lack of famine the stored „storage substances“ obstruct each other. Both together lead to angiopathies which are the cause of 50% of fatalities.



The processes on the basal membrane with the obstruction of the pores and thickening were tested on rats with ferritin. Ferritin is a protein substance that bonds with the iron that is to be transported. Its molecular size is larger than  $0.1 \mu\text{m}$  so that the pores of the basal membrane become obstructed after an injection.

Water can no longer leave the capillaries in order to enter the tissue; the hydrostatic pressure rises in the capillaries and sinks in the tissue. For a substance exchange, the hydrostatic pressure in the capillaries must always be stronger than the colloid-osmotic pressure in the tissue. In order to maintain water regulation, the muscle cell combined with the endothelium of the capillaries produces renin, which is transported via the venous blood path. Sympatricotonic impulses then cause a rise in blood pressure over an increase in cardiac output, until the normal water filtration rate is restored. At the same time, the arterioles of the capillaries with reduced permeability of the basal membrane are particularly widened, so that the increased performance of the heart is especially effective in this area. At other positions, the arterioles are narrowed so that hyperhydration cannot occur.

This arterial tension is maintained until the water content in the undersupplied area has been balanced. The cardiac output can return earlier to the norm, as the arterial tension of the normally supplied areas maintains the blood pressure for the under supplied areas.

### Summary of the Storage

#### Process and its Consequences

Hyperalimentation with a mixed diet leads to the storage of fat, protein, carbohydrates and water, which generally results in the following changes in the body:

- weight gain
- thickening of the blood
- thickening and solidification of the connective tissue
- thickening of the basal membrane and provocation of risk factors
- thickening of arteries intima
- arteriosclerosis, cardiac infarct, stroke

### The Kidney's Principle Function

*Filtration:* A large volume of fluid from the blood is filtered off (glomerulo filtrate) in the glomerulus, which besides water, contains small molecular substances of the plasma.

The glomerular filtration rate (GFR) lies at 120 ml/min, which equates to approximately 180 litres per day. This means that the exchangeable extracellular fluid of approximately 17 litres passes the renal tubules more than 10 times a day. Of this extracellular fluid, 99% return to the extracellular space after repeated tubular resorption. The functional excretion of water lies at 1% of the GFR, equating to approximately 1-2 litres of urine per day.

In order to carry out such measurements via the GFR, one must use filterable substances, but not varying the amount of urine by resorption or excretion, which cannot be metabolised in the kidney. Furthermore, they must not

alter the renal function. Inulin fulfils these requirements, and to a certain extent, creatine which is also found physiologically in the body and urine.

*Resorption:* In the tubules and collecting tubes, the components of the primary urine are re-absorbed through the tubular wall transported back into the blood, either according to the type of substance (e.g. glucose and urea) in varying proportions or depending on the demand of the substance in varying quantities (e.g.  $\text{Na}^+$  or  $\text{H}_2\text{O}$ ).

*Excretion:* The remainder of the filtrate is excreted together with the urine.

*Secretion:* A few substances that should especially swiftly leave the body (e.g. toxins) are not only filtrated, but additionally transported into the tubular lumen by the tubular cells.

*Regulation:* Salt and water excretion is controlled through „supply and demand“ resorption  $\rightarrow$  this influences the volume and osmolality of the extracellular space and, as a rule, keeps it constant.

Furthermore, regulation of the acid-base-balance together with the lungs, liver and metabolism occurs by the excretion of  $\text{H}^+$  ions and  $\text{HCO}_3^-$  ions.

*Detoxification:* Metabolic end products and foreign substances are eliminated (urea, uric acid, toxins, medicaments), however, precious constituents of the blood are preserved (glucose, amino acids).

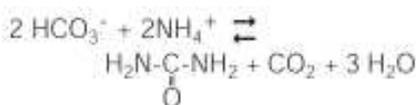


*Hormones:* The following hormones, amongst others, are produced: angiotensin II, erythropoetin, thrombopoetin, calcitriol, prostaglandin.

*Service functions in the metabolism of the organism:* i.e. the breaking down of protein and peptide, gluconeogenesis, generation of arginine.

### **The Significance of the Liver in Connection with the Protein Metabolism**

The liver is the organ that is very closely linked with the protein balance, break down and production of protein corpuscles. Surplus amino acids are channelled out of the body over the urea synthesis. At the same time, the liver intervenes the acid-base-balance with a strong regulating effect. In this context, the urea synthesis plays a central role. One can regard urea as a diamide of carbonic acid  $\text{CO}(\text{NH}_2)_2$ .



Bicarbonate is needed for the regulation of the acid-base-balance in order to excrete protons in the form of ammonium ion. With urea synthesis, the body loses large quantities of basic bicarbonate.

However, in order to save bicarbonate in the case of a hyperacidity that can have several different causes (among others, heavy over-proteinisation), the body takes a different route. Highly toxic ammonia can arise through an excessive protein supply in the nutrition or, for example, by putre-

fective processes in the bowels, but can nevertheless still be eliminated. Urea synthesis is reduced and the ammonia bonds instead with the amino acid and glutamine acid, producing glutamine, which is then transported to the kidneys.

### **The Significance of the Kidneys in Connection with the Protein Metabolism**

The kidneys, as opposed to the liver, have little to do with the protein balance. It is, however, the kidneys' function to excrete the urea that is produced in the liver. Glutamin, which is created by the aminogenesis of the amino acid and glutamine acid is also conveyed to the kidneys in order to save bicarbonate and to still detoxify ammonia. The kidneys can transform the glutamin so that bicarbonate, ammonia and glucose are formed. Two molecules of bicarbonate are formed and protons in the form of  $\text{NH}_4^+$  can in this way be excreted. In this case, one shouldn't be surprised with a constant neutral or basic urine, even though the patient suffers from hyperacidity. With the saved and with the additionally produced bicarbonate, protons can be intercepted and excreted as  $\text{CO}_2$  and water through the lungs by exhalation.

This is so far, the physiological sequence of events of the protein metabolism.

The tasks and anatomical design of the kidneys harmonise wonderfully with each other. The organ is very heavily supplied with blood and the filtration of primary urine takes place in the glomerula. The glomerular

capillaries have an endothelium with pores on a relatively thick basal membrane. On the other side of the basal membrane is an epithelium where the inner membrane of the Bowmann's Capsule is formed and is occupied with so called podocytes, that have pedicles and whose nucleus as a protrusion projects into the lumen.

It is thus easy to estimate what happens, if euproteins or heteroproteins and their storage in the basal membrane of all vascular endothelial overload the body. The basal membrane of the renal epithelia increasingly thickens and healthy filtration is no longer possible. At the same time, all the kidney's cells are undersupplied so that the tubular cells together with poor filtration, are no longer able to fulfil their other tasks. In order to increase the filtration rate and to ensure the cell supply, the blood pressure must be reflexively increased in the kidneys. Clinically, this high blood pressure manifests itself as renal hypertension.

Selye already determined and confirmed in the 1930's with experiments carried out on rats, that these animals developed manifest kidney problems when they were fed with a diet rich in protein **and** common salt. The situation in nutrition is exactly the same with our population. Instant meals as well as baked goods are well known for their high salt content. The excessive supply of NaCl results in a dysbalance in the Na/K-relationship. The potassium/sodium pump cannot function properly. Through an oversupply with sodium, a large quantity of water is retained purely



physically in the body and the connective tissue is „swamped“. There is now a potassium deficiency in all the cells of the body; which is particularly obvious on the heart, which through the extra work, is in any case already severely stretched. An arrhythmia is the result of a potassium deficiency in the heart muscle.

At the same time, it can be observed that many patients, especially postmenopausal women, increasingly lose albumin through the urine. In healthy people, the albumin that is naturally contained in the primary urine is reabsorbed by the endothelial cells and lysosomally broken down. Increased amounts of albumin possibly reach the primary urine due to a raised amount of plasma concentration in the blood and strong filtration pressure.

With a physiological concentration in the primary urine, the epithelial cell works to capacity with the resorption and processing of the albumins. If an oversupply of proteins or the filter coefficient for albumin e.g. become increased with nephrotic syndrome, the lysosomal strength of the epithelial cells fail, resulting in an albuminuria.

The same is valid for the excretion of glucose in the urine. Due to the deficiency in the Pischinger space, the cell sends out its impulses and the insulin and sugar concentrations in the blood plasma are increased. The insulin molecules are too large to diffuse through the thickened basal membrane, whereas the rise of the blood pressure enables the glucose molecules to pass the basal

membrane in sufficient quantities. This of course results in a higher renal filtration with decreased resorption due to overexertion of the tubular cells. A part of the sugar is excreted, therefore, impressing itself as diabetes.

### **The SANUM Therapy for Over-Proteinisation**

In cases of increased storage of euproteins due to nutritional over-proteinisation, the thickened basal membranes and overflowing reservoir can be easily emptied through a strict protein free diet, whereby it must be stressed that animal protein is to be avoided. Acutely endangered patients with high blood pressure and other risk factors for cardiac infarct, apoplectic stroke etc. may find quick relief through light bloodlettings. The blood store is the only „storage“ that allows the therapist relatively easy and immediate access. If at the same time the patient is offered plenty of fluid, either as water or weak herbal tea, a bloodletting of 150 to 200 ml is well tolerated. As with communicating tubes, protein quickly flows from the other storage depots into the plasma when animal protein is completely avoided and with vegetable protein supplied in moderation.

Such a bloodletting can be applied once or twice a week. Relief for the patient is often noticeable after a very short time and the blood parameters gradually return to normal. If the patient also takes part in „movement training“ such as walking and/or physical exercise, the chances are good that the heteroproteins can also be broken-down during this time because they

are burned to produce energy. Perseverance, tenacity and discipline lead safely towards a normal, happy and healthy future. The Dr. Werthmann diet, omitting cow's milk and its derivatives, chicken eggs and pork (refer to „Ratgeber für chronisch Kranke und Allergiker“ (*Successful Treatments of Allergies and Chronic Disorders*) by Dr. Konrad Werthmann MD, published and available through Semmelweis, Hoya, Germany) at the same time enables the patient to avoid primary allergens such as cow's milk, chicken egg and pork products, thus improving the state of his immune system.

With a disorder of the intestinal flora a basic therapy with FORTAKEHL and/or PEFRAKEHL is advisable, whilst MUCOKEHL (or combined with NIGERSAN as SANKOMBI) should in every case be considered for the improvement of blood flow. Acidity in the patient should be neutralised with the help of ALKALAT or N together with mixed potencies of the dextrorotatory lactic acid in SANUVIS and with citric acid in CITROKEHL. FORMASAN and LATENSIN support the cleansing of the connective tissue. It is especially important that older patients consume very small amounts of animal protein. Age based, so-called „transmission mistakes“ between the DNA and the mRNS may occur more frequently which leads to the production of proteins which the body recognises as wrong and must, therefore, be broken down. Since an age-related atrophy of the intestinal mucosa occurs simultaneously, causing increased amounts of heteroproteins to pass



the intestinal barrier, the lysosomal abilities of the somatic cells and endothelium are easily strained. Older people should, therefore; increasingly keep to a light, variable vegetal diet and to drink plenty of fluids, in order to avoid the cleansing of the connective tissues so that the detoxification organs don't become overexerted. The following table

according to Dr. Mielke (from „Droge Wohlstandskost: Chronisch krank durch Fehlernahrung“ (*Rich Foods as a Drug: chronically ill due to wrong eating habits*) by Dr. Klaus Jürgen Mielke, Mielke Verlag, Hannover) once again points out the valence of the main components of our nutrition for the maintenance our body.

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**The Four Pillars of Nutrition** (according to Dr. Klaus Jürgen Mielke)

	1	2	3	4
Nutritional components	Carbohydrates	Fats	Proteins	Vital elements
Substance group	Energy	Energy	building-up and function substances	metabolic tools
Physiological requirements of nutritional components	80%	11%	7%	2%
Supply with vegetal foods	generous	sufficient	sufficient	mainly sufficient
Supply with animal foods	insufficient	excessive	excessive	insufficient