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“A groundbreaking treatment program combining Western and Eastern medicine for maximum wellness and healing”

Excerpt from Chapter # 3 -

How the Liver Works

You go along for years without the slightest awareness of what is inside you, and then you're told you have hepatitis, and all of a sudden you swear you can feel your liver. Take it from me, it's one busy place. Sometimes I feel like I'm hosting a Grand Prix road race, there is so much activity going on around my poor overburdened liver.

MARY S., 52, who contracted hepatitis C from a blood transfusion after the birth of her fourth child fourteen years ago

The liver, the second largest organ (only the skin is larger), is like a sharp-eyed bouncer guarding the red velvet rope in front of an exclusive nightclub called Your Body: It makes sure the right elements get in and the wrong eliminated.

The liver enforces its stringent standards for good health using an intricate of highly sophisticated cells designed to synthesize, transform or detoxify nutrients and other chemicals in the blood.

Linked to the digestive tract through a complex system of blood vessels, the liver takes nutrition from food in the intestines and changes it into essential nutrients such as proteins, fats and vitamins.

The liver also stores vitamins and sugars (carbohydrates) so the body can have a ready supply in times of need; and it contains and converts iron and iron-related molecules into heme, the main oxygen-transporting molecule in red blood cells. No wonder the immune system, digestive tract, kidney, brain, cardiovascular system and the regulation of sex hormones are all dependent on a healthy liver.

Understanding how the healthy liver works is essential to understanding what happens to the body when hepatitis C prevents the liver from doing its job.

Blood Circulation and Filtration

The liver has the most complicated network of arteries, veins and capillaries of any organ. In fact, a gallon of

blood passes through it every 2.6 minutes.

There are two main vessels that transport the blood:

The *portal vein* carries all the blood in the large and small intestines to the liver—and that brings 90 percent of all the nutrition extracted from food in the intestines through the liver's processing plant.

The *hepatic artery*, a branch of a main heart artery called the aorta, brings oxygenated blood from the heart to the liver. Sometimes up to a quarter of all the blood in the body is circulating through the liver.

The portal vein and the hepatic artery are fed by a system of smaller blood conduits that run throughout the liver. These smaller blood conduits in the liver are called sinusoids.

The liver cells, called hepatocytes, are assembled into cordlike structures that are separated by the sinusoids.

These hepatocytes and the sinusoids are contained inside lobules, tiny six-sided structures about one-fifth of an inch wide. Each lobule is dense with blood vessels; a vein runs through its center and is connected to the sinusoids, and six or seven additional blood vessels cluster around each lobule. These vessels include branches of the portal vein (that connects the liver to the digestive tract) and the hepatic artery (that connects it to the heart).

The role of all these blood vessels is to bathe the liver cells with toxins, nutrients and other chemicals; the liver cells respond appropriately, excreting bile, synthesizing, breaking down, storing or transporting each element as needed to keep the body healthy and the blood circulating.

In liver disease, scarring of the liver tissue can interfere with the circulation of the blood; this in turn can produce high blood pressure in the portal vein and interfere with the cleansing and nutrition-building functions of the liver.

Bile Production and Fat Metabolism

One to two quarts of bile—the most important digestive chemical in the body—are synthesized in the liver every day. After you eat a meal, bile made in the liver travels to the major bile ducts and is temporarily stored in the gallbladder until it is needed. When summoned to help with digestion, it travels on through the pancreas and into the intestines, where it breaks down fat molecules so the body can digest them more effectively or excrete them if they are in oversupply.

This process allows the body to absorb the oil-soluble vitamins A, D, K and E.

Bile helps the body balance cholesterol—90 percent of which is synthesized in the liver, not derived through the food you eat. Blood levels of this fatty substance, essential for healthy cell membranes and production of sex hormones, can surge in hepatitis C. This happens when bile production is impeded by cirrhosis or when scarring of the liver reduces the number of active cells available to process cholesterol or makes it difficult for the cells and the blood in the sinusoids to come into contact.

Bile also helps transport the toxins that the liver neutralizes to the kidneys and intestines for excretion.

When bile flow is impaired because of a blocked bile duct (a possible result of gallstones or scar tissue), the whole body is thrown out of kilter: Vitamin synthesis may be reduced, and toxins cleared though the bile may not be excreted from the body. As a result, a person becomes lethargic or depressed, or experiences fuzzy thinking. Jaundice may set in.

The connection between the liver, bile and feeling down in the dumps has been known for thousands of years. Ancient Greeks coined the word melancholy—it literally means black bile—to describe a state of overall sadness and world weariness. Chinese medicine doctors have long diagnosed Liver Qi Stagnation when a person has similar symptoms: depression and apathy.

Blood Sugar Regulation

The liver changes glucose (sugar) into glycogen, which it stores until the body needs to regulate blood sugar levels and provide energy to the muscles and the brain. In addition, it helps balance amino acids, the building blocks of proteins that are converted into fatty acids and glucose. In Chinese medicine this is associated with the functions of the Spleen Organ System, which encompasses all pancreatic functions.

Changes in blood glucose levels can indicate liver function problems. In fulminant liver failure (that is, sudden liver shutdown) blood sugar levels drop; with cirrhosis, blood sugar levels may skyrocket as a result of increasing insulin resistance and the development of diabetes.

Toxin Removal

Many toxins such as DDT are lipid soluble; that is, they dissolve in fatty substances, not in water. The liver, using enzymes produced in the liver cells, transforms these fatty toxins circulating in the blood into water-soluble toxins so that they can enter the gastrointestinal and kidney systems and be excreted through the bladder and intestines.

The liver also breaks down natural waste by-products of cell metabolism and other naturally occurring bodily toxins such as ammonia—the by-product of muscle and amino acid metabolism—into less toxic substances (in this case, urea) that can pass through the kidney and become waste.

Bilirubin, a waste product that comes from a breakdown of heme, the central oxygen-carrying molecule in red blood cells, can also act as a toxin. If not cleared out by the liver, this yellowish liquid can produce jaundice, the most vivid symptom of hepatitis and often the first one that alerts a person to the presence of the disease, especially in acute hepatitis or late-stage chronic hepatitis.

The liver also detoxifies drugs, such as clearing aspirin from the blood, breaking down alcohol so it can pass from the system and keeping acetaminophen from being converted to toxic molecules. Excess alcohol harms the liver because it overwhelms the detoxification process, allowing poisons to remain in the liver and damage the tissue.

The liver regulates hormones; hepatitis C disrupts the liver's ability to keep estrogen levels in check. As levels rise in both women and men, complications occur. In men they may include testicular atrophy and breast development.

Liver Enzyme Synthesis

The liver is awash in enzymes, molecular agitators that are essential for the organ's important work of transforming chemicals and synthesizing nutrients. AST (aspartate aminotransferase) and ALT (alanine aminotransferase) are liver enzymes used for amino acid metabolism, a process that balances the types of amino acids available for building proteins and then transforms them into proteins. (Tests for AST and ALT enzyme levels are frequently used in diagnosing hepatitis C, despite the fact that they are only crudely indicative of what is going on in the liver: The best use of these tests is to keep tabs on changes in liver inflammation. When ALT or AST levels increase by a factor of ten or more, it can indicate a worsening of the disease.) Note: AST used to be called SGOT, and ALT used to be called SGPT; some labs still use that terminology.

Other enzymes made in the liver that are vital to maintaining overall health include alkaline phosphatase and GGT (gamma-glutamyltransferase). Alkaline phosphatase is involved in phosphorus metabolism, which also delivers energy to the body's cells. GGT is used in metabolizing another amino acid, glutamate, which affects tissue oxidation. When fatty deposits cause damage to bile ducts or blockages, these enzyme levels increase. Although the elevated levels aren't necessarily associated with symptoms, blood tests that track these levels can be used to determine the presence and degree of liver inflammation.

Chinese Medicine Notes

In Western medicine the functions of the liver are to transport and transform nutrients, to help maintain a healthy immune system and digestive tract, to help in the smooth functioning of the kidney, brain and cardiovascular system and to regulate sex hormones. In Chinese medicine these functions are understood as being the result of the harmonious collaboration of several different Organ Systems.

For example, while the Liver Organ System regulates the Qi and Xue (the life force and blood) and harmonizes the emotions, the Spleen Organ System affects fluid metabolism, energy levels and transportation and transformation of Nutritive Qi—the life energy that comes from food.

The Kidney Organ System is responsible for the underlying body energy, sexual function, elimination of bodily fluids, clear thinking and the will. When there is fluid retention, as often happens in advanced liver disease, or fuzzy thinking—another side effect—the Kidney Organ System is involved. People who fight off hepatitis generally have strong constitutions, and that's often associated with a strong Kidney system. The amount of Kidney energy you have is associated with how much Qi (life force) as well as Jing (essence) you have in your body when you come into this world.

The Heart Organ System may reflect Shen disturbances that are strongly associated with liver disease. It may also reflect Xue (blood) Deficiency, insomnia or nervousness, which often accompany a chronic illness.

Balancing the Medical Insights

In both Western and Chinese medicine the liver is a central repository and regulator of the blood. It is instrumental in digestion and nutrition, and when it is not functioning optimally, every other system in the body—from the thyroid to the kidney—can be affected.

Chinese medicine, as distinct from Western medicine, also focuses on the liver's relationship to emotional health. (Remember, the Liver Organ System houses the ethereal soul, one part of the Shen or mind-spirit.)

Many symptoms associated with hepatitis are not treated as separate disorders in Western medicine. In Chinese medicine, however, every syndrome that appears can be treated by working to restore harmony to affected Organ Systems and Essential Substances.

Western medicine provides analysis of the liver's biochemical functions in ways that Chinese traditional medicine cannot.