ADVANCED TRICHOLOGY COURSE PART I
• Most Trichologists are not physicians and so do not “diagnose” hair or scalp conditions.

• Certified Trichologists should be trained to “recognize” certain conditions and work with physicians for the betterment of the patient/client.

• This Advanced Trichology Course is designed to help the Certified Trichologist achieve this goal and is NOT intended to encourage him/her to make medical diagnoses or provide medical treatments for his/her patients/clients. THE COURSE IS DESIGNED TO HELP THE TRICHOLOGIST LOOK AT THE BLOOD TEST RESULTS TRICHOLOGICALLY, TO HELP GUIDE HIS/HER TREATMENT PROTOCOL.

• ANY MEDICAL DIAGNOSIS OR MEDICAL TREATMENT MUST BE HANDLED BY THE PATIENT/CLIENT’S PHYSICIAN.

• FOR MORE INFORMATION ON EACH TOPIC IN THIS COURSE, PLEASE DO YOUR OWN ADDITIONAL RESEARCH AND READING.

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ADVANCED TRICHOLOGY COURSE SYLLABUS

PART I & II: BLOOD (LABORATORY) TESTS FOR THE TRICHOLOGIST
- WHY A TRICHOLOGIST RECOMMENDS THESE TESTS
- WHAT BLOOD TESTS ARE IMPORTANT & WHAT THE RESULTS MEAN
- WHAT TREATMENTS ARE AVAILABLE FOR THE TRICHOLOGIST
- CONTACTING A PHYSICIAN (EXAMPLE LETTER)
  - EXAMPLE BLOOD TEST SHEET

PART III & IV: EXAMINATION, RECOGNITION AND TREATMENT OF TRICHOLOGICAL HAIR LOSS CONDITIONS
- REVIEW OF HAIR LOSS PATTERNS AND HAIR & SKIN SCALES
- DISCUSSION OF TRICHOLOGICAL CASES AND CASE HISTORIES (REFERENCING BLOOD TEST RESULTS)
  - MULTIMODAL TREATMENTS
  - MORE DIFFICULT HAIR LOSS ASSESSMENTS THAT CONSIDER OTHER HEALTH ISSUES

IMPORTANT FOR THE TRICHOLOGIST

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PARTS I & II: BLOOD TESTS FOR THE TRICHOLOGIST

LEARNING OBJECTIVES

- TO LEARN WHICH ARE THE MOST COMMON BLOOD TESTS IMPORTANT FOR THE TRICHOLOGIST
  - TO LEARN WHAT THE BLOOD TEST RESULTS MEAN
- TO LEARN WHAT TREATMENTS ARE AVAILABLE FOR THE TRICHOLOGIST
  - TO LEARN HOW TO CONTACT A PHYSICIAN

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WHY A TRICHOLOGIST RECOMMENDS THESE TESTS

• Trichologists not only recognize hair and scalp problems, but also need to help find the cause(s).
• As hair cycle disturbances can be the result of many issues, blood tests are sometimes necessary to help in determining some of the reasons for the hair loss.
• These tests are performed by the client/patient’s physician.
• The medical doctor will analyze the results medically, however, the trichologist can analyze the results trichologically to see if there is a vitamin and/or mineral deficiency that could be causing the client/patient’s hair problem.
• The trichologist will look at the ranges of the results and assess potential trichological deficiencies.
• Any deficiencies can result in hair cycle disturbances and may be treated with supplementation.
• Deficiencies in vitamins/minerals, in particular, can lead to:
  1) reduced cellular energy (ATP) production, and/or
  2) reduced enzymatic/co-enzymatic activity (important for protein synthesis).

Fill in: Underline and bold
WHY A TRICHOLOGIST RECOMMENDS THESE TESTS

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• Deficiencies in vitamins/minerals, in particular, can lead to:
  1) reduced **cellular energy (________) production**, and/or
  2) reduced enzymatic/co-enzymatic activity (**important for ________________**).
ATP PRODUCTION OVERVIEW

• ATP = ____________________________.

• Cellular respiration (the production of ATP from food in the mitochondria of hair cells) occurs in three metabolic stages:
  - Stage 1-__________________,
  - Stage 2-the ________________, and
  - Stage 3-the ________________.

• Efficient respiration in humans needs ________________.

• Carbohydrates and ___________ are very important in this process.

• Millions of these processes are carried out in ____________________________.
ATP PRODUCTION I

• Stage 1: Glycolysis: the splitting of glucose

• Important raw materials:
  Biotin (vitamin B7), Zinc

  -glucose is split into 2 pyruvates,
  -the pyruvates are then changed to acetyl-CoA

• 2 ATP molecules (net) are produced
ATP PRODUCTION II

• Stage 2: The Krebs cycle: produce high energy molecules that will be used in Stage 3

• Important raw materials:

  Glucose (in form of acetyl-CoA), Thiamin (vitamin B1), Riboflavin (vitamin B2), Niacin (vitamin B3), Pantothenic Acid (vitamin B5), Biotin (vitamin B7)

• -the acetyl-CoA goes through the cycle producing **NADH** and **FADH** energy containing molecules

• 2 more ATP molecules produced
ATP PRODUCTION III

• Stage 3: Electron transport chain (inside mitochondria): converts high energy molecules (NADH and FADH from Stage 2) into ATP

• Important raw materials:
  **Oxygen, _____, ________________, Sulfur, Copper**

• -cytochromes (iron containing proteins) are essential in this process

• 34 more ATP molecules produced

• TOTAL ATP over all 3 Stages per glucose molecule = approx. 38 ATP

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ATP PRODUCTION SUMMARY

• Food (carbohydrates) >> energy (ATP).

• The carbs are broken down in 3 stages.

• Some of the important raw materials for this process are:

<table>
<thead>
<tr>
<th>Biotin (B7)</th>
<th>Pantothenic Acid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Riboflavin (B2)</td>
</tr>
<tr>
<td></td>
<td>Sulfur</td>
</tr>
<tr>
<td></td>
<td>Thiamin (B1)</td>
</tr>
<tr>
<td>Niacin (B3)</td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td></td>
</tr>
</tbody>
</table>
PROTEIN SYNTHESIS and COENZYMES I
A review from your WTS certification course.

• To review this subject (including transcription and translation) see Chapter 6 in your WTS certification course.

• Protein production is determined by the _______________ in DNA.

• Protein synthesis requires ______________ obtained from food.

• Enzymes (themselves proteins) are essential to ______________ the process of protein synthesis.

• Enzymes need ‘help’ to perform correctly. Help comes from ________________.

• These coenzymes are extremely useful because they can often be _______________ and reused multiple times.

4 levels of protein structure

- Primary – sequence of amino acids
- Secondary – interactions between adjacent amino acids
- Tertiary – 3D folding of the polypeptide
- Quaternary – arrangements of multiple polypeptides

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Hair is a ________________ tissue and so any deficiencies may be received by the hair follicle last – or the hair is the first thing that the body cuts back on if there is a deficiency.

Hair protein _______ contains approximately ________________ in its structure. In order of quantity: Cysteine, Serine, Glutamic Acid, Threonine, Glycine, Leucine, Valine, Arginine, Aspartic Acid, Alanine, Proline, Isoleucine, Tyrosine, Phenylalanine, Histidine, Methionine.

Hair is made from approximately ___________% keratin protein.
PROTEIN SYNTHESIS and COENZYMES III

• ___________ and ____________ are essential for co-enzymatic activity during protein synthesis (some of many): Iron, Folic Acid, Vitamin D, Vitamin B12

• Coenzymes bind with the inactive enzyme (called an ________________) to form the active enzyme (called a ______________).

• Coenzymes help enzymes in many different ways. In this example the coenzyme adds a ________________, allowing the substrate (______________) and enzyme to join together so that the chemical process can take place.
PROTEIN SYNTHESIS and COENZYMES III

SUMMARY

• Hair Protein Synthesis means the building of the hair protein, ____________.
• Proteins are built from amino acids using ________________.
• ________________ are needed to help the enzymes in this building process.
• Some of the important raw materials for this process are:

Iron, Folic Acid, Vitamin D, Vitamin B12
WHAT BLOOD TESTS ARE IMPORTANT & WHAT THE RESULTS MEAN

• Over the years, many minerals and vitamins have been discovered as being important for ________________________________.

• Published research has shown that deficiencies in certain minerals and vitamins have been recognized to be ________________________________ of hair loss.

• Some of the most important minerals and vitamins for the trichologist to investigate are:
  
  • Ferritin plus Iron Profile and CBC
    • Vitamin B12
    • Vitamin D
    • Folic acid/Folate
      • Copper
      • Zinc

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Overview

• Vitamins are ______________ compounds required by the human body for ________________________________.

• Vitamins cannot be synthesized in sufficient amounts by the human body, and therefore must be ________________________________. There are 13 essential vitamins needed for the body to function.

• Minerals are ______________ elements essential for normal body functioning and development.

• There are 16 essential minerals important for the health of the body.
MINERAL/VITAMIN DEFICIENCY

Overview

• Hair is one of the ______________ tissues in the body, therefore, cells in the hair follicle are very active metabolically.

• This means that the hair papilla cells are ______________ and producing many proteins such as keratin.

• This exceptional rate of activity means hair follicles need a plentiful supply of ______________(ATP) as well as important raw materials such as protein, vitamins and minerals.

• A ______________ in any of these raw materials can lead to a drastic reduction in hair follicle metabolism causing the hair cycle to be disturbed causing hair loss (particularly telogen effluvium).

• The specific action of individual vitamins and minerals is not fully known, however, many can act in ______________ or ______________ activities which help in the process of tissue synthesis and ATP production.
IRON DEFINITIONS

• Iron is the most __________ trace metal in the human body.

• Iron is a critical micronutrient with a major role in the transport of __________.

• Iron is the functional center of __________, meaning it coordinates the oxygen molecule into the hemoglobin so that it can be transported from the lungs to the tissues.

• Transferrin helps __________ iron.

• Ferritin is the __________ protein of iron.

• **Iron sources**: red meat, poultry, seafood, beans, dark green leafy vegetables (natural); cereal, bread, pasta (fortified).
SUMMARY

• Ferritin is a protein in the blood that ____________.
• Transferrin helps _________________ iron.
• Each ferritin molecule can ‘hold’ up to ________________ iron atoms
• The iron is released from the ferritin as the body requires.
• Most ferritin is found in the spleen, liver, muscles, and bone marrow.
• Red blood cells (__________________) need iron to form normally and carry oxygen around the body.
• Low levels of ferritin may lead to iron-deficiency anemia.
• Ferritin/iron ________________ may be caused by heavy menstruation, poor diet, vegetarianism, high caffeine intake and high alcohol intake.
FERRITIN (IRON STORES) II

ACTION OF FERRITIN IN TISSUE

• Iron is the central atom of the _________________ group in hemoglobin that binds oxygen (O_2) in the lungs and carries it to all of the other cells in the body (e.g., the hair) that need oxygen to perform their activities.

• Iron plays a role in electron transfer (____________________) during the third step of ATP production.

• Iron deficiency can result in a reduction of _________________ leading to reduced ATP (energy) production and cell division.

• Iron is stored in ferritin as a ferric (Fe III) ion (non-soluble) and released as a ferrous (Fe II) ion (____________________).

• Hemoglobin contains the ferrous ion which binds to oxygen.

• L-Lysine and _________________ increase the absorption of iron.
IRON

DEFICIENCY STAGES

Stage 1 iron deficiency
- Decreased iron stores
- Reduced ferritin level
- No physical symptoms

Stage 2 iron deficiency
- Decreased iron transport
- Reduced transferrin
- Reduced production of heme
- Physical symptoms include reduced work capacity

Stage 3 iron deficiency
- Iron deficiency anemia
- Production of normal red blood cells decreases
- Reduced production of heme
- Inadequate hemoglobin to transport oxygen
- Symptoms include pale skin, fatigue, reduced work performance, impaired immune and cognitive functions

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IRON BLOOD TEST RESULTS

Normal Range
60 – 170 mcg/dL

Iron Deficiency
________________mcg/dL

Iron Excess
Greater than 170 mcg/dL

• Refer to Ferritin for treatment options.

• mcg = micrograms (one millionth of a gram) per dl = deciliter (one tenth of a liter)

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FERRITIN BLOOD TEST RESULTS

• Normal range: 18-270 ng/ml

• Ferritin HAIR SUFFICIENCY (STABLE): _____________ ng/ml

• Ferritin HAIR SUFFICIENCY (IMPROVE): _____________ ng/ml

• Ferritin HAIR SUFFICIENCY PLUS THYROID: _____________ ng/ml

• ng = nanograms (one billionth of a gram) per ml = milliliter (one thousandth of a liter)

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FERRITIN (iron)
Treatments Options Available for the Trichologist

- Normal Daily Dosage:
  Iron: 15 mg (daily)
  Vitamin C: 75-90 mg (daily)
  L-Lysine: 750-900 mg (daily)

- Trichological Supplementation:
  Iron: ___________ (25 mg x 3 daily)
  Vitamin C: ___________ (x1 daily)
  L-Lysine ___________ (x1 daily)

- Medical Prescription:
  Iron: (intravenous/blood transfusion)
  Vitamin C: 1,000 mg (daily)
  L-Lysine 2,000-3,000 mg (daily) for cold sores

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TOTAL IRON BINDING CAPACITY, TRANSFERRIN & PERCENT TRANSFERRIN SATURATION

SUMMARY

• Just measuring Ferritin and Iron are sometimes not enough. For a more complete assessment of iron deficiency, the blood levels of **total iron-binding capacity (TIBC)**, _____________ and/or **percent transferrin saturation (\%TS)** may also be important.

• **Transferrin** binds and transports iron in the blood between body tissues. If transferrin is ______ it means that it is NOT binding much iron and could indicate an _______________. If it is ______, then the transferrin is carrying a high amount of iron, which could indicate ________________.

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• The % **Transferrin saturation (\%TS)** blood test shows the percentage of iron bound by transferrin. This result is often assessed __________ to the transferrin result, meaning that a high %TS would indicate too much iron and a low %TS, too little iron.

• **Total iron-binding capacity** (TIBC) measures how much iron is carried in the bloodstream. (Transferrin does the actual iron carrying).

• **TIBC is similar to the transferrin level** and these two laboratory tests can be used _____________________ (usually the lab will only report one or the other).
TOTAL IRON BINDING CAPACITY, TRANSFERRIN & PERCENT TRANSFERRIN SATURATION

ACTION IN BLOOD

• Total iron-binding capacity (TIBC) is most frequently used along with a test to evaluate people suspected of having either iron deficiency or iron overload.

• These two tests (TIBC and iron) are used to calculate the transferrin saturation (%TS).

• In iron deficiency:
  - the iron level is ________,
  - the TIBC (Transferrin) is ________,
  - the transferrin saturation is ________.

• In iron overload states (________________________):
  - the iron level is ________,
  - the TIBC (Transferrin) will be ________ (or low normal),
  - the transferrin saturation is ________.

• TIBC (Transferrin) levels also drop when there is not enough protein in the diet, so this test can also be used to ________________.
# Table Comparing Different Iron Levels

<table>
<thead>
<tr>
<th>Disease</th>
<th>Iron</th>
<th>TIBC/Transferrin</th>
<th>%Transferrin Saturation</th>
<th>Ferritin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron Deficiency</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Hemochromatosis (Iron overload)</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>

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TOTAL IRON BINDING CAPACITY
BLOOD TEST RESULTS

• Normal range TIBC: 240-450 mcg/dl

• Iron deficiency: __________ mcg/dl

• Iron excess: less than 240 mcg/dl

• The TIBC result is inverse to the amount of iron available.
• A high TIBC level often indicates a low amount of iron is present in the blood.
• A low TIBC level often indicates normal/high levels of iron.
  • Refer to Ferritin for treatment options.

  • mcg = micrograms (one millionth of a gram) per dl = deciliter (one tenth of a liter)

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PERCENT TRANSFERRIN SATURATION
BLOOD TEST RESULTS

• Normal range % Transferrin Saturation:
  20-50 %

  • Iron deficiency:
    _________________ %

  • Iron excess:
    greater than 50 %

• Do not suggest iron supplements to a client with high % transferrin saturation, even if the ferritin level is low.
  • Refer to Ferritin for treatment options.

• % = percent

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COMPLETE BLOOD COUNT (CBC) BLOOD TEST I

• To fully assess iron deficiency ____________, a CBC blood test should also be performed. There are ___________________________ taken with a CBC screen.

• The most important results for a trichologist include:
  • The number of ____________(RBC Count). RBCs play a vital role in transporting oxygen from the lungs to the rest of the body. These oval-shaped cells contain ____________, the protein that binds oxygen while it is being carried to the body cells (_________________________ cells).
  • Remember:
    - the chemical process that converts food into energy (ATP) requires ________________;
    - the papilla cells require ________________ to function;
    - therefore, the hair cells need oxygen, and are dependent on the ________________ to transport it.
COMPLETE BLOOD COUNT (CBC)
BLOOD TEST II

• ____________ is a blood test that measures how much of a person's blood is made up of red blood cells. This measurement depends on the ________________ of the red blood cells.

• ________________ are parts of the blood that help the blood clot.

• The number of ______________________ (WBC Count). A WBC count is a blood test to measure the number of white blood cells (WBCs) in the blood. This can indicate the presence of infection.

• Sometimes CBC’s are done with ________________. Here the blood is examined microscopically. A differential provides more information about the blood sample, such as platelets and the percentages of each type of WBC.
COMPLETE BLOOD COUNT (CBC)

BLOOD TEST RESULTS

**RBC Count**

---

\[ \text{4.32-5.72 trillion cells/L} \]

---

\[ \text{3.90-5.03 trillion cells/L} \]

**Hemoglobin**

Male: 13.5-17.5 grams/dL

Female: 12.0-15.5 grams/dL

**Hematocrit**

Male: 38.8-50.0 percent

Female: 34.9-44.5 percent

**Platelet Count**

\[ 150-450 \text{ billion/L} \]

**WBC Count**

\[ 3.5-10.5 \text{ billion cells/L} \]

A differential will give more information about the platelets and the % of each type of WBC

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L = liter
dL = deciliter (one tenth of a liter)
REFERENCES FOR PARTS I & II

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- Haugen BR. Drugs that suppress TSH or cause central hypothyroidism. Best Practice & Res. Clinical Endo. & Metabolism. 2009; 23(6):793 – 800.
ADVANCED TRICHOLOGY COURSE
END OF PART I