

## **ORGANIC ACIDS & AMINO ACIDS COURSE OVERVIEW**

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These course(s) teach advanced biochemical assessment using critical analysis of client history with clinical testing from a functional medicine perspective. Functional lab testing will be evaluated in detail with case studies. Topics will be relevant to preventative as well as therapeutic nutrition care.

### **Course(s) Outcomes**

- Evaluate specific nutrient deficiency states through organic acids
- Plan and monitor nutrient interventions to correct abnormalities found by the tests

### **ORGANIC ACIDS COURSE SYLLABUS:**

#### **VIDEO 1: INTRODUCTION TO ORGANIC ACIDS – 39 minutes (0.75 CE credits)**

After completing the review of course materials, students will be able to:

- Determine populations that would benefit from organic acid testing
- Determine conditions that may benefit from organic acid testing
- Overview of main points of what organic acids test for
- Clarify to individuals on how to prepare for the test and procedure for specimen collection
- Determine particular confounders that may impact test results

#### **VIDEO 2: VITAMIN MARKERS – 36 minutes (0.5 CE credits)**

After completing the review of course materials, students will be able to:

- Recognize B complex vitamin deficiencies and enzyme polymorphism from the alpha-keto acids
- Recognize hypometabolic states from alpha-keto acid patterns
- Recognize confounders that may affect vitamin marker test results
- Recognize vitamin patterns that indicate possible cell membrane fluidity impairment
- Identify folate and B12 metabolism markers
- Develop treatment regimens for vitamin deficiencies
- Identify patterns of the specific nutrient deficiency impairing methylation

#### **VIDEO 3: BETA-OXIDATION OF FATTY ACIDS – 38 minutes (0.75 CE credits)**

After completing the review of course materials, students will be able to:

- Summarize the biochemical steps of beta oxidation of fatty acids
- Identify nutrient deficiencies indicated with elevations of adipate, suberate, and ethylmalonate
- Identify nutrients needed for carnitine synthesis
- Identify confounders of elevated adipate, suberate, and ethylmalonate
- Identify origins of very low adipate and suberate
- Recognize patterns indicating polymorphisms in the beta-oxidation of fatty acid metabolism
- Recognize patterns that indicate hypometabolic states

#### **VIDEO 4: NEUROTRANSMITTERS (HVA & VMA) PATTERNS ACIDS – 26 minutes (0.5 CE credits)**

After completing the review of course materials, students will be able to:

- Summarize the catecholamine biochemical pathway
- Identify and evaluate neurotransmitter organic acid patterns
- Evaluate neurotransmitter ratios
- Identify symptoms of low catecholamines
- Develop a treatment plan for neurotransmitter imbalances based on organic acid evaluation
- Evaluate and identify common polymorphisms involved in the catecholamine biochemical pathway

#### **VIDEO 5: KYNURENINE PATHWAY PATTERNS ACIDS – 33 minutes (0.5 CE credits)**

After completing the review of course materials, students will be able to:

- Recognize organic acid patterns in the Kynurenine pathway
- Identify and evaluate confounders of elevated 5-HIAA marker
- Summarize the Kynurenine biochemical pathway
- Evaluate the impact of diet to Kynurenine pathway patterns
- Summarize the biochemical pathways of tryptophan metabolism
- Connect tryptophan metabolism to brain immune health
- Recognize patterns that may indicate dysbiosis
- Recognize patterns that may indicate hypometabolic states
- Evaluate ratios of Kynurenine markers
- Quantify B6 deficiency
- Recognize patterns that indicate neuroinflammation

#### **VIDEO 6: LACTATE/PYRUVATE/OXALATE PATTERNS ACIDS – 28 minutes (0,5 CE credits)**

After completing the review of course materials, students will be able to:

- Evaluate lactate and pyruvate patterns
- Summarize the main energetic flux of glycolysis
- Summarize the Pyruvate Dehydrogenase Complex
- Develop treatment options for pyruvate and lactate imbalances
- Identify and evaluate conditions involved in lactate elevations
- Identify and evaluate conditions involved in Beta-Hydroxybuterate elevations
- Evaluate and connect diet impact on lactate/pyruvate and oxalate patterns
- Recognize and evaluate endogenous oxalate production
- Develop a plan for oxalate reduction

#### **VIDEO 7: CITRIC ACID CYCLE – ENERGY REGULATION – 25 min (0.5 CE credits)**

After completing the review of course materials, students will be able to:

- Identify hypometabolic states in the organic acids
- Recognize and evaluate cell regulator markers
- Determine the energetic flux of the TCA
- Recognize mitochondria oxidative stress patterns
- Summarize the Cell Danger Response Cycle
- Connect energy production to immune activation
- Recognize anaplerosis patterns
- Recognize and evaluate patterns that indicate hypoxia
- Evaluate and develop a treatment plan for 3-Hydroxy-3-Methylglutarate (HMG) patterns
- Summarize conditions that restrict the electron transport chain flux

#### **VIDEO 8: MITOCHONDRIA – TRICARBOXYLIC ACIDS PATTERNS ACIDS – 25 min (0.5 CE credits)**

After completing the review of course materials, students will be able to:

- Recognize markers for chronic pH renal balancing
- Identify and evaluate patterns of the Tricarboxylic acids
- Connect citric acid markers to immune function
- Explain the negative feedback pathways of elevated citric acid
- Recognize problems with Complex II as related to TCA
- Explain how to use alpha-ketoglutarate as a surrogate marker for systemic pH
- Recognize anaplerotic filling of the Citric Acid Cycle
- Recognize a pattern of functional CoQ10 deficiency

#### **VIDEO 9: OXIDATIVE STRESS & DETOXIFICATION – 33 min (0.5 CE credits)**

After completing the review of course materials, students will be able to:

- Be able to define free radicals
- Identify and evaluate oxidative damage and detoxification markers
- Recognize mitochondria antioxidants
- Understand the antioxidant recycling pathway
- Predict glutathione status
- Develop an appropriate antioxidant treatment plan

## **VIDEO 10: DYSBIOSIS PATTERNS – 24 MINUTES (0.5 CE credits)**

After completing the review of course materials, students will be able to:

- Identify organic acid dysbiosis markers
- Recognize excessive bacteria action on tryptophan
- Evaluate functional B5 sufficiency through benzoate and Hippurate patterns
- Recognize patterns of phase 2 detoxification overload
- Differentiate elevated yeast and specific Candida markers
- Evaluate Clostridium markers for sufficient hydrogengenotropic action
- Relate Tricarballic acid to bile

## **BONUS LECTURES:**

- Using organic acids in histamine intolerance
- Deep dive into glutathione and free radicals using organic acids
- Using organic acids in detox & dysbiosis with a focus on phenyl acids

## **Amino Acid Course Syllabus:**

### **MODULE 1: Introduction to Amino Acids**

- **Amino Acid introduction**
  - **Learning objectives:** Upon completion of this module, students should be able to:
  - Explain how to properly collect a specimen to send in for amino acids to the lab
  - Explain to their patients the confounders that may skew test results
  - Understand the structure & function relationship of amino acids
  - Understand how proteins & peptide bonds are formed
  - Understand the concept of enzyme affinity and how enzymes get amino acids to their final destination
  - Understand the factors that regulate enzyme activity
  - Understand factors that inhibit enzyme activity
- **Basic Principles of Amino Acids**

- **Learning Objectives:** After completing the review of this module, students will be able to:
  - Determine a patient's protein requirements
  - Recite protein functions in the body
  - Describe the basic structure of amino acids
  - Differentiate the essential vs. non-essential protein amino acids
  - Classify amino acids
  - Describe amino acid isomers and zwitter ions
  - Understand the metabolism process of amino acids
  - Understand the process of urea process
  - Describe amino acids role in nitrogen balance
- **Protein Structure**
  - **Learning Objectives:** Upon completion of this lecture, students should be able to:
    - Understand protein functions in the body
    - Understand how the hierarchy of protein structures are determined
    - Describe the process of the formation of peptide bonds
    - Understand the characteristics of the peptide bond
- **Enzymes**
  - **Learning Objectives:** After completing the review of this module, students will be able to:
    - Understand the power of enzymes as catalysts
    - Describe how the enzyme complex is formed
    - Understand the concept of co-factors needed for reactions to happen
    - Describe the two models of forming enzyme complexes
    - Understand the concept of the enzyme constant
    - Understand things that inhibit enzyme activity
    - Know the difference between reversible and irreversible enzyme inhibitors
    - Differentiate between co-enzymes and co-factors

## MODULE 2: Conditionally Essential Amino Acids

- **Introduction to Conditionally Essential Amino Acids**
  - **Learning Objectives:** After completing the review of this module, students will be able to:
    - Identify conditions where Glutamine, Taurine, Glycine and Arginine may become depleted and require supplementation
    - Connect symptoms to amino acid deficiencies
    - Investigate patterns of the conditionally essential amino acids
    - Develop a plan of amino acid and nutrient repletion, and/or diet changes based on test findings.

- **Glutamine**
  - **Learning Objectives:** After completing the review of this module, students will be able to:
    - Recognize conditions in which glutamine becomes essential
    - Understand the buffering system of Glutamine/Glutamate
    - Understand clinical indications of the GLN/GLU ratio
    - Understand clinical indications of high/low Glutamine/Glutamate patterns in amino acid testing
    - Understand the neurotoxicity implications of glutamate
    - Develop an appropriate dosing plan for glutamine supplementation
- **Taurine**
  - **Learning Objectives:** After completing the review of this module, students will be able to:
    - Assess the teeter-totter of methylation and transulfuration and functional patterns of taurine and sulfur amino acids and binding affinities to SAMe
    - Recognize conditions associated with Taurine deficiency:
      - Retinal degeneration
      - Coronary heart disease
      - Hypertension & congestive heart failure/cardiomyopathy
      - Diabetes
      - Diabetic neuropathy
      - Renal dysfunction
      - Impaired skeletal muscle function
      - Oxidative stress
- **Glycine**
  - **Learning Objectives:** After completing the review of this module, students will be able to:
    - Identify competing pathways for Glycine.
    - Understand the regulation of glycine
    - Evaluate high/low patterns of glycine
    - Identify metabolic blocks in the glycine/serine pathway that affect Phospholipid production
    - Identify nutrients needed for Carnitine synthesis
    - Assessment of glutathione
    - Identify essential nutrients in Collagen production
- **Arginine**
  - **Learning Objectives:** After completing the review of this module, students will be able to:
    - Identify conditions where arginine becomes essential
    - Describe the functions of arginine in the body
    - Identify the urea cycle intermediates and co-factors

- Describe the pathway to nitric oxide formation
- Identify nutrients that enhance and inhibit nitric oxide formation
- Modulate nitric oxide formation through diet and targeted nutrients
- Recognize urea cycle patterns indicating a polymorphism

## MODULE 3: SPECIAL PATTERNS

### • Limiting Amino Acids

- **Learning Objectives:** Upon completion of this lecture, students should be able to:
  - Identify which amino acids are limited in the diet
  - Detail the lysine metabolic pathways
  - Describe the benefits and cautions with Lysine supplementation
  - List the pathways involving carnitine
  - Detail methionine and competing pathways
  - Explain the sulfur amino acids role and interpret patterns in methylation and detoxification
  - Understand the consequences of low limiting amino acids
  - Understand the benefits and contraindications and cautions in supplementing the limiting amino acids
  - List the foods higher in limiting amino acids

### • BCAAs

- **Learning Objectives:** Upon completion of this lecture, students should be able to:
  - Understand BCAAs role in energy metabolism
  - Understand the transamination & metabolism pathways of BCAAs
  - Determine the causes and develop a treatment plan for high or low BCAA levels on testing
  - Identify metabolic pathways affected by BCAA supplementation
  - List foods high in BCAAs
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### • Special Patterns

- **Learning Objectives:** After completing the review of this lecture materials, students will be able to:
  - Understand the causes of low or high amino acid patterns and be able to develop a personalized treatment plan for corrective action
  - Relate amino acid levels to energy production and the ability to conduct protein synthesis and repair in the body
  - Identify amino acids that are related to cholesterol production
  - Relate amino acid patterns to hypometabolic states

- Recognize abnormal amino acid ratios and pinpoint a focal point of how to correct them
- Beta Amino acids Plus Histamine
  - **Learning Objectives:** After completing the review of this lecture materials, students will be able to:
  - Interpret abnormal Beta-amino acids and identify the possible causes
  - Determine dietary influences on Anserine and Carnosine markers
  - Detail the histamine degradation pathways
  - Understand the co-factors involved in histadine/histamine metabolism and develop a treatment plan for excess histamine in the body