

THE FUNCTIONAL MEDICINE APPROACH TO LONG COVID



OUTLINE

- Introduction
- Long COVID current landscape
- Risk factors, mechanisms, pathophysiology
- Post Viral Recovery Program implementation
- Nutritional supplement selections
- Patient registry outcomes: early data
- Case studies
- Q&A

LONG COVID PREVALENCE ¹

- ❖ Most Long COVID cases are cases with mild acute illness
- ❖ 1/3 of people with Long COVID have **no identified pre-existing conditions**

- ❖ 104,538,730 - reported
>200,000,000 - reported + unreported estimate
- ❖ 15-30% people have persistent symptoms @1 month
- ❖ 6-10% people have persistent symptoms @3 months
- ❖ 1-2% people have persistent symptoms @12 months

Long COVID Incidence Estimate

- ❖ ~ 30 million people with Post-COVID @1 month
- ❖ ~ 10 million people with Post-COVID @3 months
- ❖ ~ 2 million people with Post-COVID @12 months

Current Landscape: 3 Years Into PASC

- ❖ Confusing terminology: Chronic COVID, Post Viral Syndrome, Long -Haul COVID, Long COVID...and more.
- ❖ 200+ symptoms
- ❖ No agreed upon definitions: CDC 30 -days; WHO 90-days post-acute infection
- ❖ No proven treatments, no standards of care = no guidelines and no trained workforce
- ❖ Providers and patients frustrated - where to turn for guidance and help?
- ❖ NIH RECOVER: research and clinical trials- \$1.2 billion
 - Largely observational studies: no findings published
 - 5 clinical trials planned (2600 total patients, 25-100 sites/study)
 - Drugs (Paxlovid), CBT, exercise, rehab
 - Not a single patient enrolled to-date

MORE IS NEEDED

A FUNCTIONAL MEDICINE APPROACH



Project Timeline

November 2021
Expert working group assembled

February 2022
Social listening study completed mining > 1 million conversations

July 2022
Selected outcomes measures and developed Timeline & Progression of symptoms

September 2022
Finalized specialty supplement recommendations to address 5 drivers of Long COVID.

December 2022
First patients enrolled in virtual group visit program at Hennepin

February 2023
Enrolled first AndHealth “VIP” patients.

May 2023
2500 practitioners registered for the PVRP education & training series.

January 2022
Prototype root-cause framework & standards for evaluating and treating long COVID

April 2022
Presented research to support 5 primary drivers of long COVID

August 2022
Presented 90-day program and protocol (beta)

October 2022
Contracted with NUNM to develop REDCap patient registry

January 2023
First patients enrolled from Mayo Clinic

April 2023

- 100+ patients enrolled in registry with first patients completing 90-day protocol.
- Outcomes data analyzed.
- Completed development of 3-part provider education series

Expert Clinical Working Group



Kristine Burke, MD



Patrick Hanaway, MD



Laurie Hofmann, MPH



Kara Parker, MD



Michael Stone, MD, MS



Kristi Hughes, ND



Monique Class, ARNP



Tom Guilliams, PhD



Bob Sheeler, MD



Heather Tick, MD

POST VIRAL RECOVERY IN THE COVID ERA

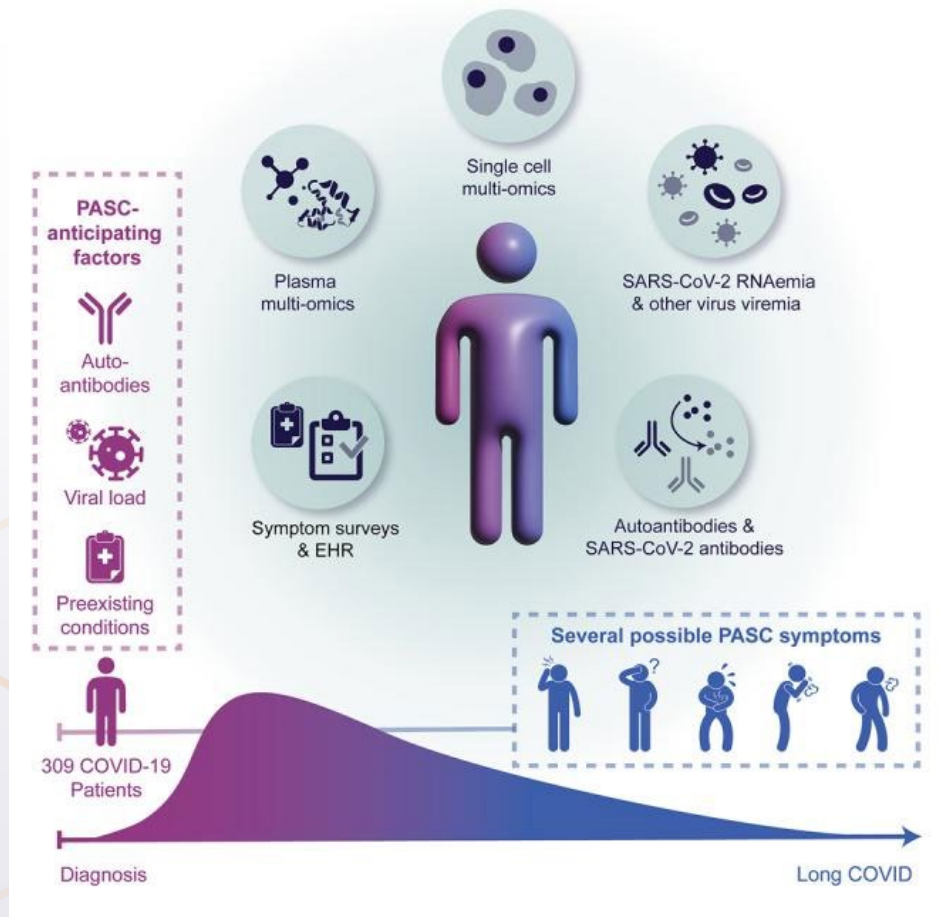
ASSESSING PROGRESSION **AND**
PERSONALIZING TREATMENT USING A ROOT-
CAUSE APPROACH

Multiple early factors anticipate post-acute COVID-19 sequelae

Su, Y, Yuan, D, et. al. (2022). Multiple early factors anticipate post-acute COVID-19 sequelae. *Cell*, 185(5).

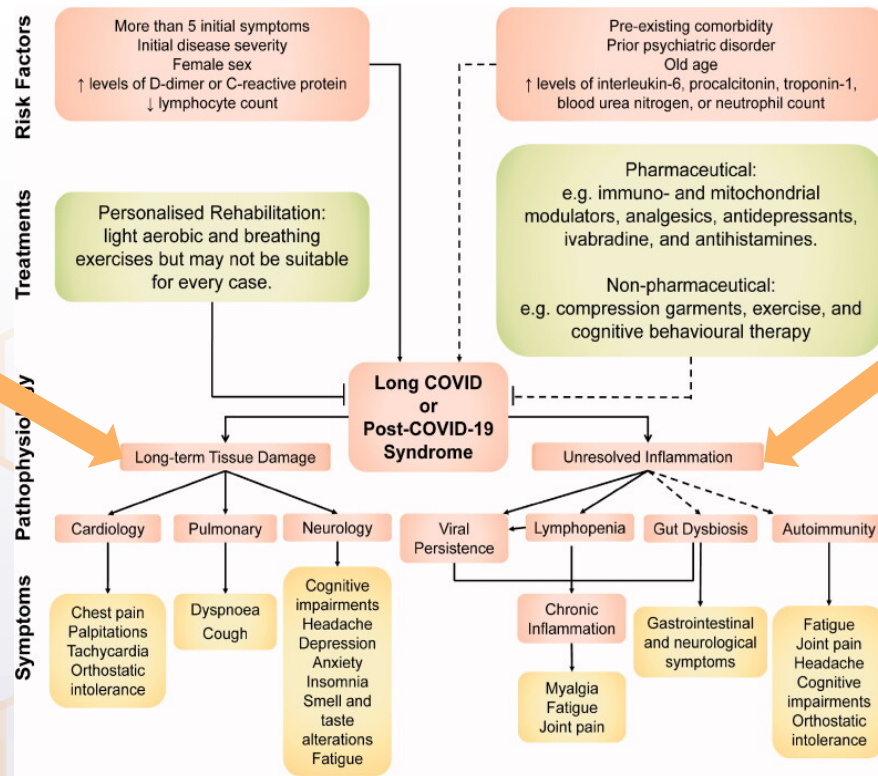
<https://doi.org/10.1016/j.cell.2022.01.014>

4



Long COVID or post-COVID-19 syndrome: putative pathophysiology, risk factors, and treatments

Yong, SS (2021). Long COVID or post-COVID-19 syndrome: putative pathophysiology, risk factors, and treatments. *Infectious Diseases*, 53(10), 737–754. <https://doi.org/10.1080/23744235.2021.1924397>

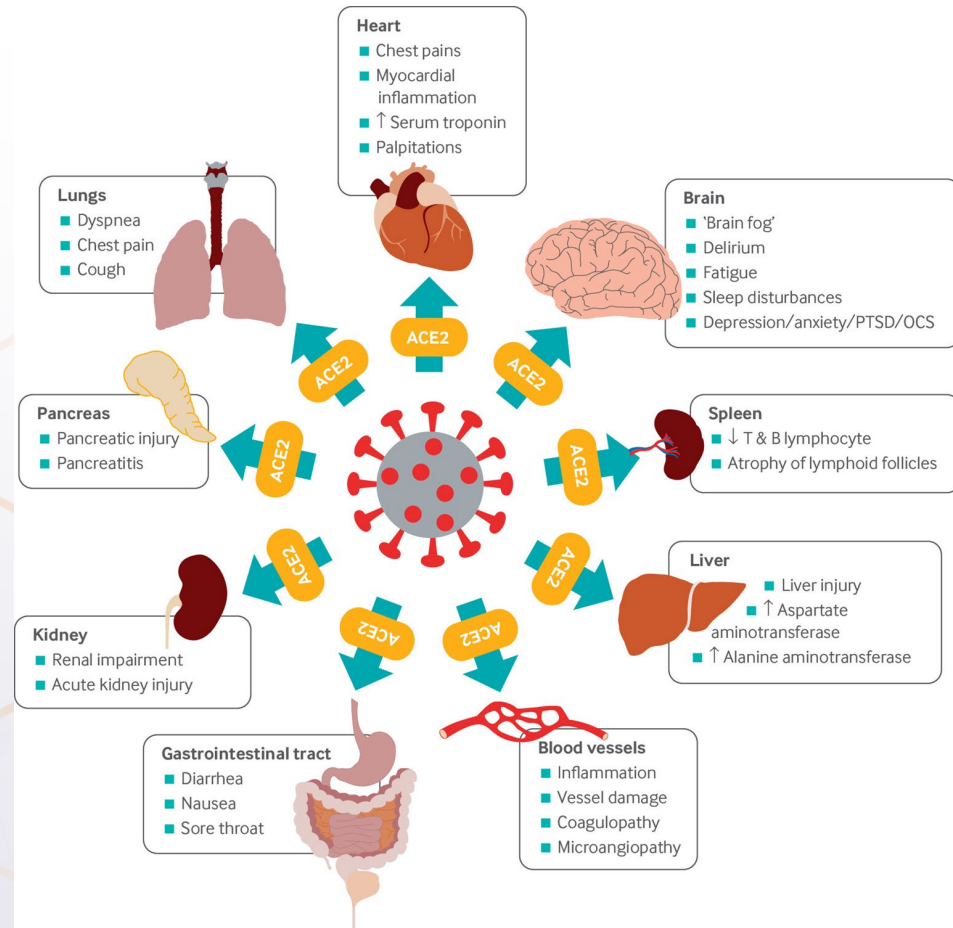


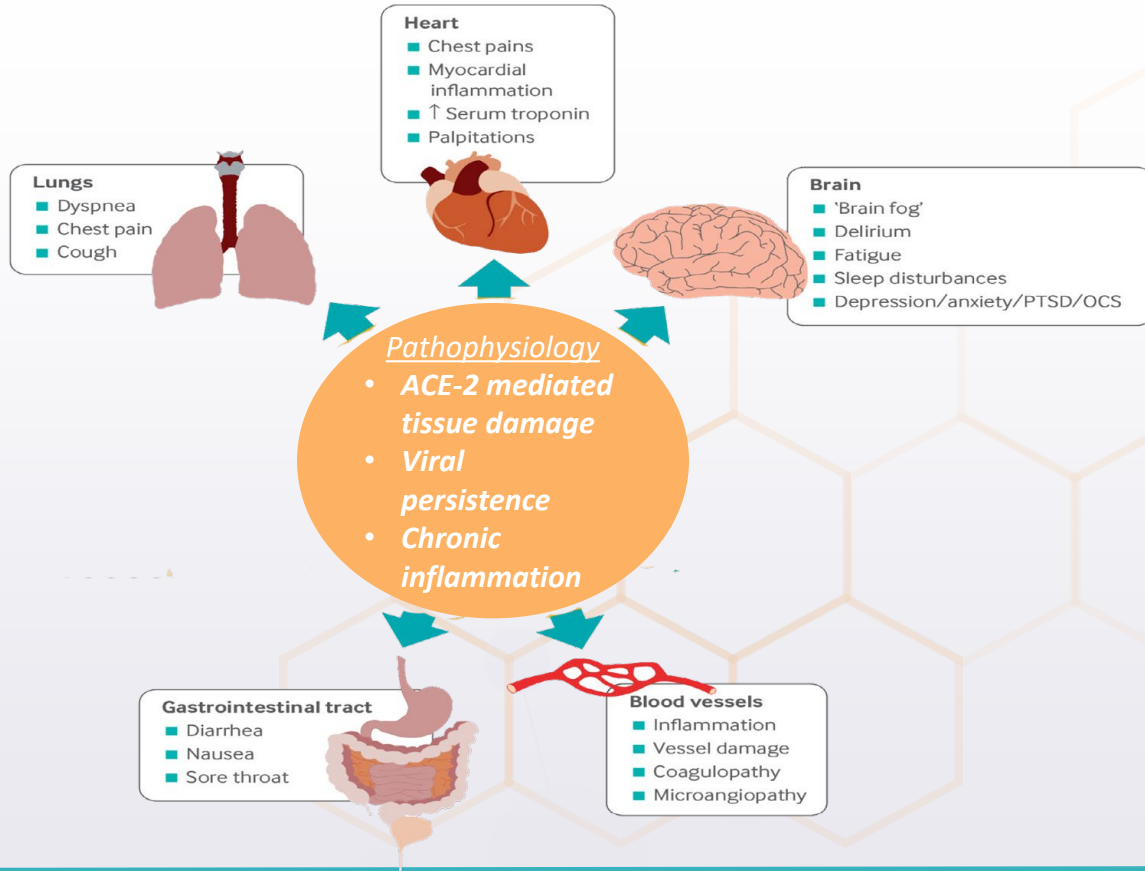
An overview of the symptoms, putative pathophysiology, associated risk factors, and potential treatments involved in long COVID. Note: Dashed lines represent areas where evidence is relatively lacking compared to non-dashed lines. (Color online only).

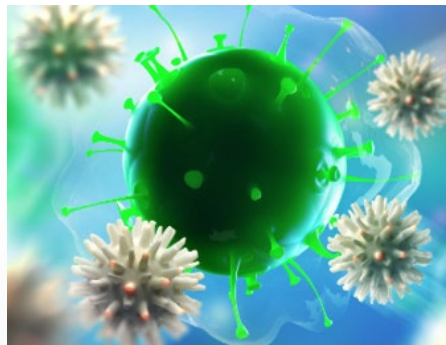
Long covid—mechanisms, risk factors, and management

Crook, H, Raza, S, Nowell, J, Young, MK, Edison, P (2021). Long covid—mechanisms, risk factors, and management. *BMJ*, n1648. <https://doi.org/10.1136/bmj.n1648>

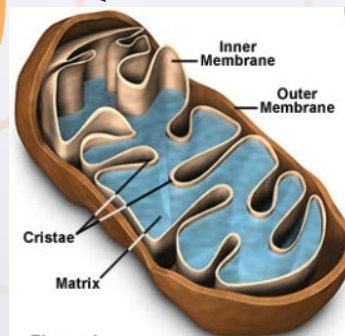
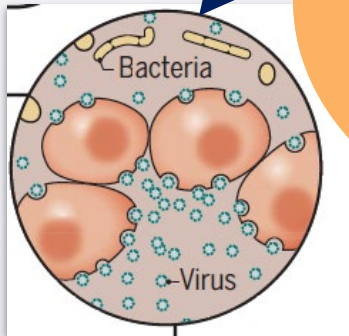
Multi-organ complications of covid-19 and long covid. The SARS-CoV-2 virus gains entry into the cells of multiple organs via the ACE2 receptor. Once these cells have been invaded, the virus can cause a multitude of damage ultimately leading to numerous persistent symptoms.







ACE-2 mediated damage
Viral persistence
Chronic inflammation
Gut/Microbiome dysbiosis
Mitochondrial dysfunction



Distinguishing features of Long COVID identified through immune profiling

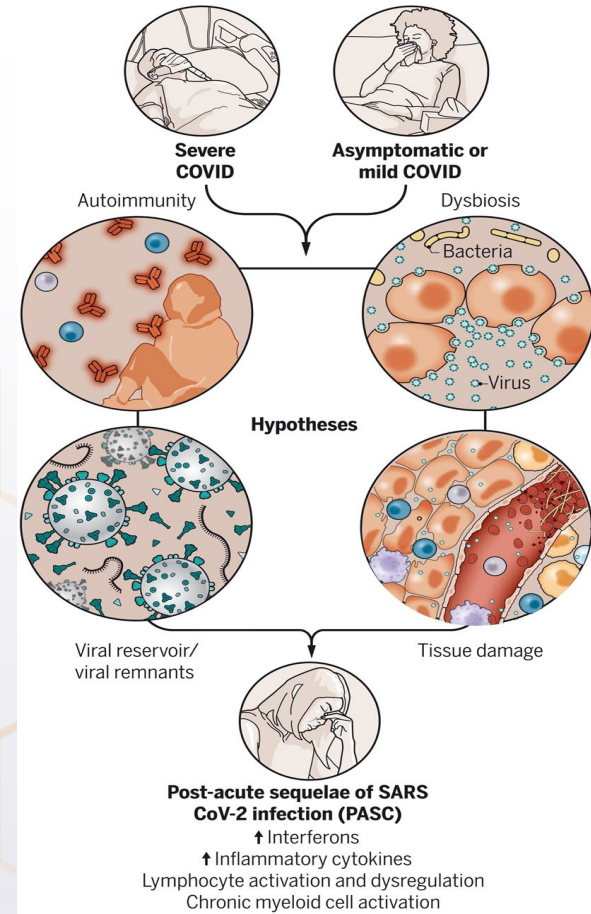
Klein, JB, Wood, JR, Iwasaki, A, et al. (2022).

Distinguishing features of Long COVID identified through immune profiling. medRxiv (Cold Spring Harbor Laboratory).

<https://doi.org/10.1101/2022.08.09.22278592>

A fraction of COVID-19 patients with either severe or mild COVID-19 develop a variety of new, recurring, or ongoing symptoms and clinical findings 4 or more weeks after infection. Analyses of immune responses in people with PASC reveal key inflammatory cytokines and cellular activation phenotypes that are significantly elevated over nonPASC convalescent controls. Further studies are needed to identify the drivers of PASC pathophysiology.

Illustration: V. Altounian/Science



Long COVID or Post-acute Sequelae of COVID-19 (PASC): An Overview of Biological Factors That May Contribute to Persistent Symptoms

Proal, AD, VanElzakker, MB. (2021b). Long COVID or Post-acute Sequelae of COVID-19 (PASC): An Overview of Biological Factors That May Contribute to Persistent Symptoms. *Frontiers in Microbiology*, 12. <https://doi.org/10.3389/fmicb.2021.698169>

Long COVID EndoTypes*

1. Multi-Organ Tissue Damage, 2^o to acute infection
2. Persistent SARS-CoV-2 Infection
3. Reactivation of Neurotrophic Pathogens (e.g. HSV, HHV-6, EBV, etc.)
4. Microbiome/ Virome Dysregulation
5. Autoantibody Production with Molecular Mimicry
6. Dysregulated Brainstem & Vagal Nerve Signaling
7. Activation of Primed Immune Cells [Hyperinflammation]
8. Clotting/ Coagulation Vascular Issues [ACE2]

Long COVID or Post-acute Sequelae of COVID-19 (PASC): An Overview of Biological Factors That May Contribute to Persistent Symptoms

Proal, AD, VanElzakker, MB. (2021b). Long COVID or Post-acute Sequelae of COVID-19 (PASC): An Overview of Biological Factors That May Contribute to Persistent Symptoms. *Frontiers in Microbiology*, 12. <https://doi.org/10.3389/fmicb.2021.698169>

Long COVID EndoTypes*

1. **Multi -Organ Tissue Damage, 2^o to acute infection**
2. Persistent SARS-CoV-2 Infection
3. Reactivation of Neurotrophic Pathogens (e.g. HSV, HHV-6, EBV, etc.)
4. Microbiome/ Virome Dysregulation
5. Autoantibody Production with Molecular Mimicry
6. **Dysregulated Brainstem & Vagal Nerve Signaling**
7. Activation of Primed Immune Cells [Hyperinflammation]
8. **Clotting/ Coagulation Vascular Issues [ACE2]**

**ACE-2 mediated
tissue damage**

Viral Persistence

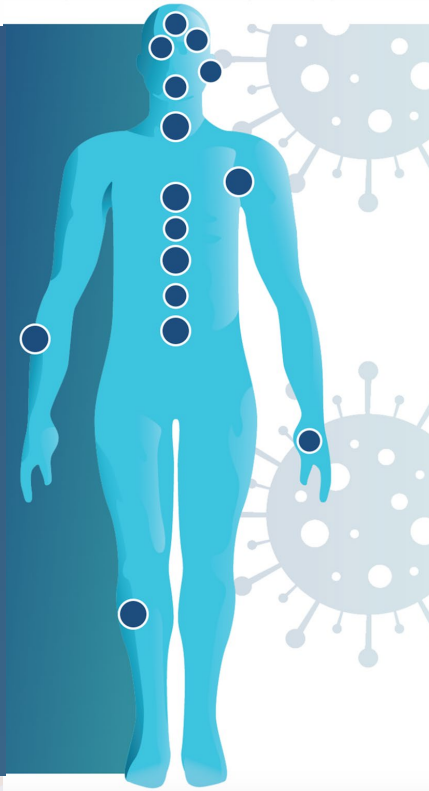
**Chronic
Inflammation**

**Gut/Microbiome
dysbiosis**

**Mitochondrial
dysfunction**

Long COVID: Symptoms

- Whole Body
- Brain and Nerves
- Eyes
- Ears
- Smell and Taste
- Neck
- Lungs
- Heart and Blood
- Kidneys
- Hands
- Legs and Feet
- Reproductive Systems
- Digestive Systems
- Skin and Hair
- Muscles and Bones



Long COVID | NIH COVID-19 Research. (n.d.). NIH COVID-19 Research. <https://covid19.nih.gov/covid-19-topics/long-covid>

ACE2-Driven Tissue Damage AND/OR Inflammation/ Immune Dysregulation

ACE2 TISSUE DAMAGE

❖ Tissue Damage

- ❖ Cardiac
- ❖ Pulmonary
- ❖ Endothelitis
- ❖ Brain/Neural tissue
- ❖ GI Tract

❖ Secondary dysfunction

- ❖ Clotting/ Coagulation
- ❖ Vagus nerve/ Brainstem
- ❖ Cognitive & Mood Disorders

IMMUNE DYSREGULATION

❖ Infection

- ❖ Persistent SARS-CoV-2 virus/ fragments
- ❖ EBV Reactivation
- ❖ Reactivation of Neurotrophic Pathogens

❖ Chronic Inflammation

- ❖ T-cell Dysregulation
- ❖ MicroGlial Activation
- ❖ Mast Cell Activation
- ❖ Gut/ Microbiome Dysbiosis
- ❖ Mitochondrial Dysfunction

Progression to Long COVID

Acute COVID



(ACE2) TISSUE DAMAGE/
INFLAMMATION

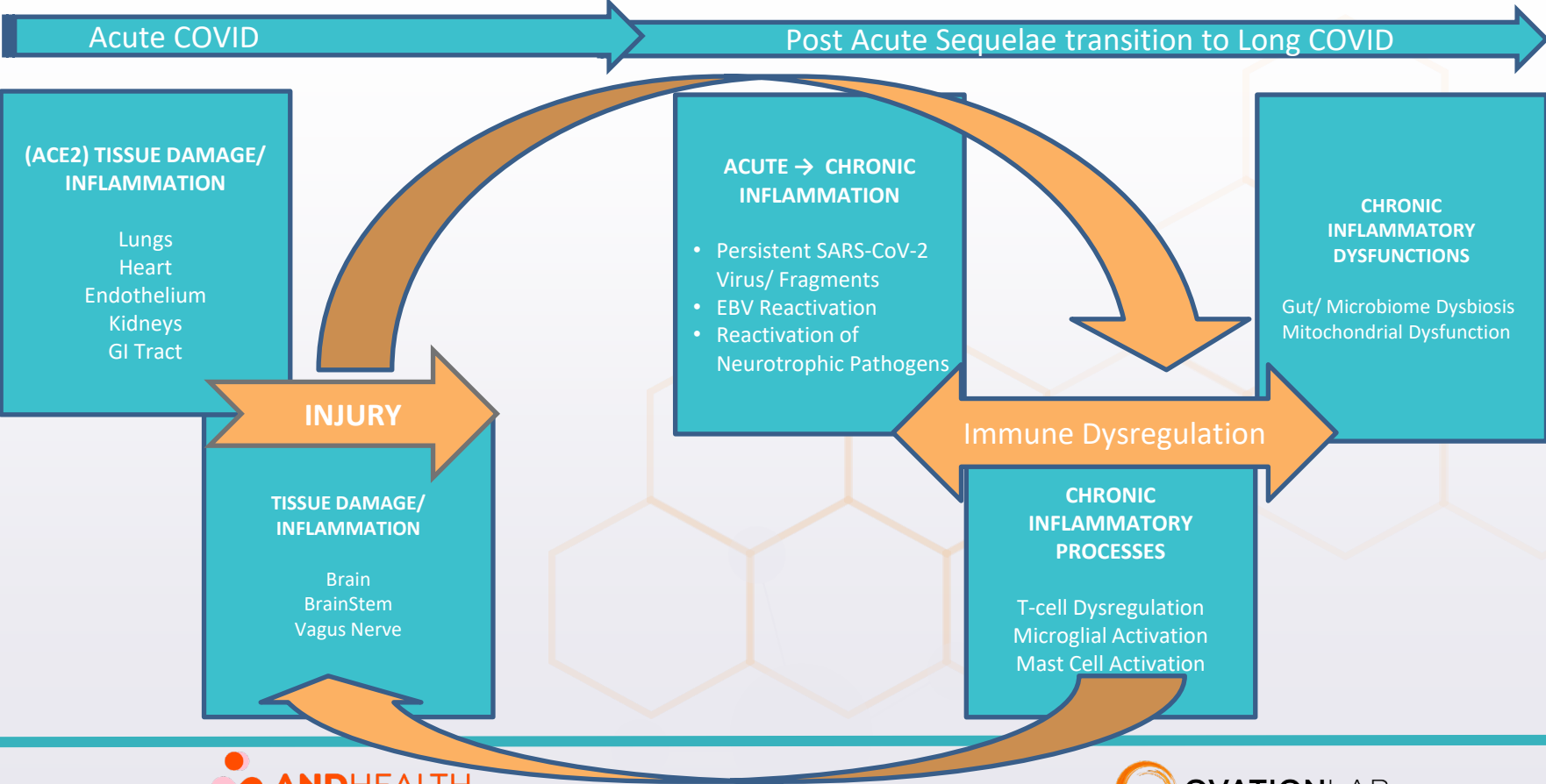
Lungs
Heart
Endothelium
Kidneys
GI Tract



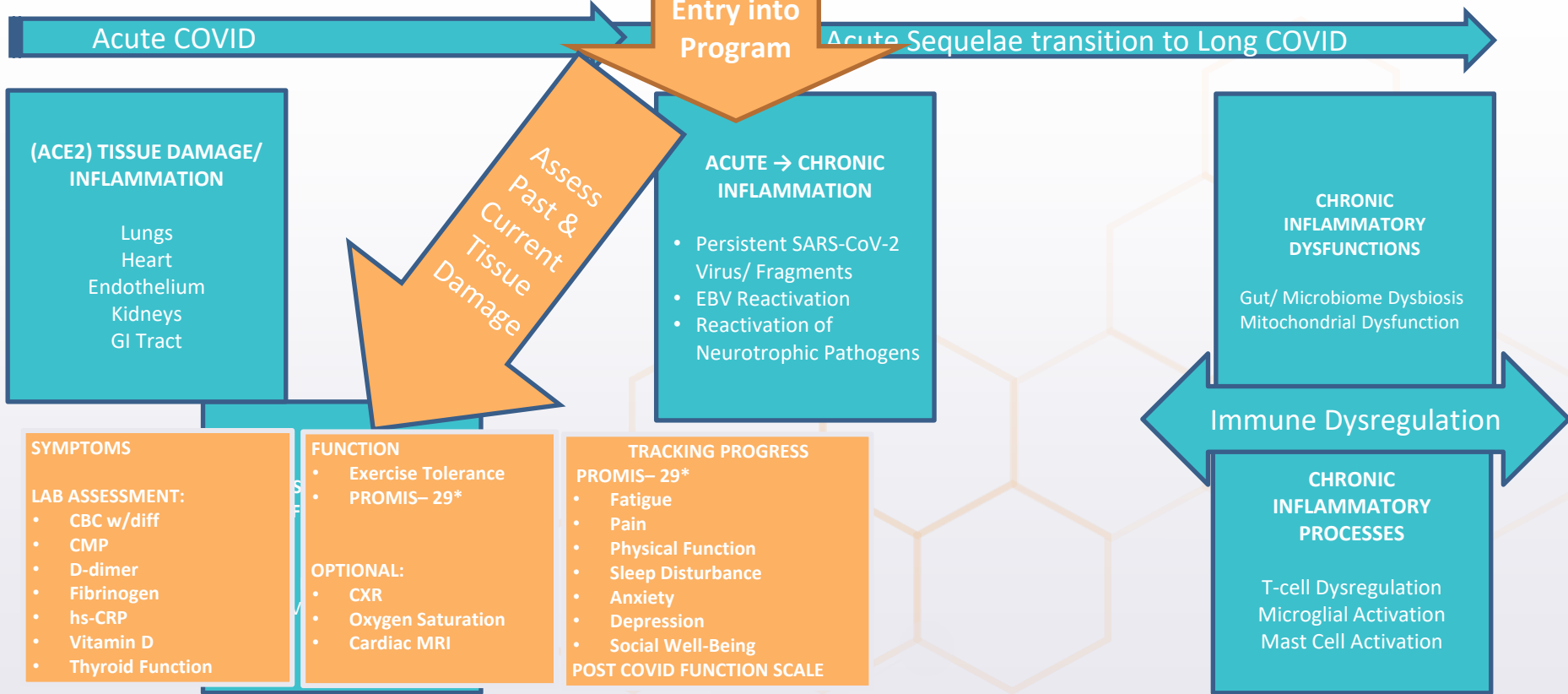
TISSUE DAMAGE/
INFLAMMATION

Brain
BrainStem
Vagus Nerve

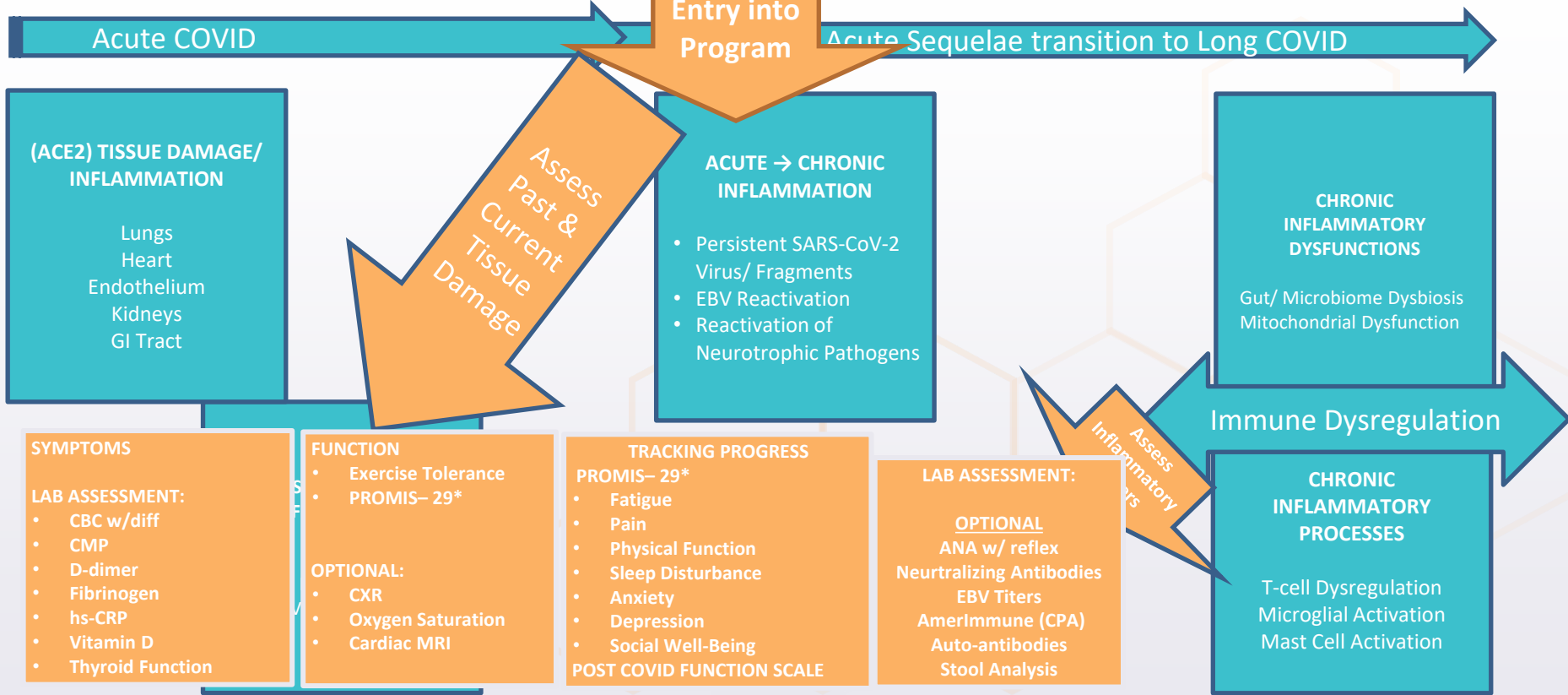
Progression to Long COVID



Entry into the Program



Entry into the Program



Long COVID Protocol

ENROLLMENT

- Health History
- Timeline & Progression of Symptoms
- Previous Testing (if available)
- Evaluation of Function (PROMIS-29*)
- Recovery Goals

PHASE 1: 90-Day Program

- Lifestyle Support
- Baseline Supplements

LIFESTYLE:

- ❖ Food & Nutrition
- ❖ Movement & Exercise
- ❖ Stress Modification
- ❖ Social Connection
- ❖ Sleep
- ❖ Nutritional
Supplementation

Long COVID Protocol

PHASE 1

Specialty Nutritional Supplements

Selected to address the primary
drivers of long COVID

Foundational Supplements

Selected to support optimal health
and wellbeing

Long COVID Patient Journey

Follow -Up: 30, 60, 90-day patient registry surveys

- ❖ Updated timeline and progression of symptoms at 30 -day intervals
- ❖ Adherence to food plan, nutritional supplements, and lifestyle recommendations
- ❖ PROMIS-29*
- ❖ Post COVID Function Scale (PCFS)

A Rising Tide Lifts all Boats



KEY LIFESTYLE INTERVENTIONS OVERVIEW



LIFESTYLE LEARNING OBJECTIVES



Understand the benefits of specific lifestyle factors for recovery from post-viral conditions



Review resources for plant forward anti-inflammatory diet and how to advise using them with participants



Become familiar with the lifestyle handouts provided for sleep, stress, movement, and community



Understand how to implement lifestyle tools clinically as part of the Post - Viral Recovery Program

KEY LIFESTYLE INTERVENTIONS OVERVIEW

- Food & Nutrition
- Sleep
- Movement & Exercise
- Stress Modification
- Social Connection
- Nutritional Supplementation



WHY LIFESTYLE?

- In a prospective cohort study of 2000 women. Adherence to a healthy lifestyle prior to COVID- 19 infection was inversely associated with risk of Post- COVID Conditions (PCC) in a dose-dependent manner.
- Compared with those who did not have any healthy lifestyle factors, those with 5 or 6 had half the risk of PCC.



Wang S, Li Y, Wang S, Li Y, Yue Y, et al. Adherence to Healthy Lifestyle Prior to Infection and S, Li Y, Yue Y, et al. Adherence to Healthy Lifestyle Prior to Infection and Risk of Post-COVID-19 Condition. JAMA Intern Med. 2023;183(3):232–241.

FOOD & NUTRITION

- Including plant-based foods, colorful and nutrient dense, with high quality protein and fats.
- Eliminating processed foods and drinks.



FOOD & NUTRITION

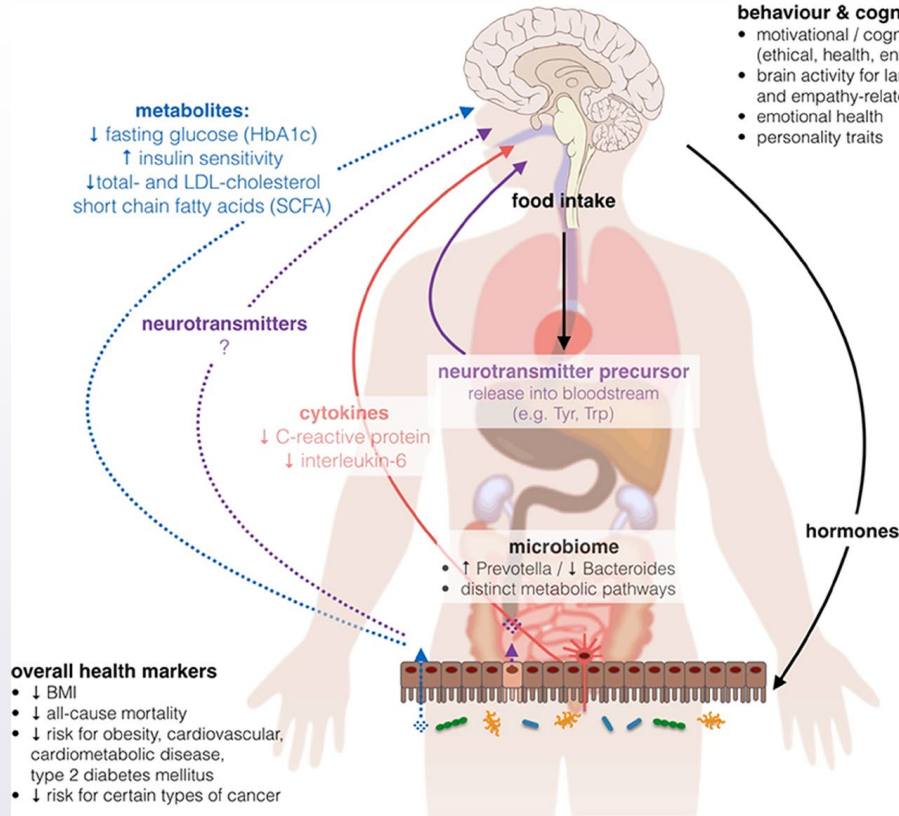


- Plant-based nutrition is associated with less hospitalization and death from acute covid.
- And greater recovery from acute and post covid.

Kim H, Rebolz CM, Hegde S, LaFiura C, Raghavan M, Lloyd JF, et al. Plant-based diets, pescatarian diets and COVID-19 severity: a population-based case-control study in six countries. *BMJ Nutrition, Prevention & Health*. 2021 May 18;

Storz MA. Lifestyle Adjustments in Long-COVID Management: Potential Benefits of Plant-Based Diets. *Curr Nutr Rep*. 2021 Dec;10(4):352-363. doi: 10.1007/s13668-021-00369-x. Epub 2021 Sep 10

FOOD & NUTRITION



Medawar E, Huhn S, Villringer A, Veronica Witte A. The effects of plant-based diets on the body and the brain: a systematic review. *Transl Psychiatry*. 2019 Sep 12;9(1):226. doi: 10.1038/s41398-019-0552-0. PMID: 31515473; PMCID: PMC6742661.

FOOD & NUTRITION



REVIEW THE PLANT-BASED WHOLE30 RULES

The Plant-Based Whole30 Program

Empowering you to change your health, habits, and relationship with food—on your terms. Let's do this.

TAKE THE FIRST STEPS



Improve your energy, sleep, cravings, mood, and self-confidence with the Whole30's new whole food plant-based approach.

Melissa Urban, Whole30 Co-Founder



PLAN

Use our signature resources to plan your successful Plant-Based Whole30

[START PLANNING](#)



COOK

Discover delicious flavors and ingredients in our collection of compatible recipes

[START COOKING](#)



LEARN

Find answers to your questions and troubleshoot your Plant-Based Whole30

[GET SUPPORT](#)



FOOD & NUTRITION

Resources in the package include, among others

- [Program Rules >](#)
- [Plant-Based Whole30 Prep Pack >](#)
- [Grocery Guide >](#)
- [Shopping List >](#)
- [Meal Planning >](#)
- [Plant-Based Recipes >](#)



FOOD & NUTRITION

TIPS for Coaching on Eating for Post Viral Recovery

- Personalize to individual GI symptoms, intolerances and budget
- Use a health coach or nutritionist
- Advise on time restricted eating
- Rx low glycemic diet
- Optimize fermented foods and prebiotics
- Reduce histamines if symptoms correlate
- Suggest spices for added benefit & taste



FOOD & NUTRITION: Additional Resources

IFM Lifestyle Course Tools

- Eating a Balanced Diet
- Micronutrients: Phytonutrients
- Mindful and Intuitive Eating
- The Core Food Plan Comprehensive Guide
- Phytonutrient Food Plan Comprehensive Guide



SLEEP

“COVID-19 and sleep disorders can induce BBB leakage via neuroinflammation, which might contribute to the ‘coronasomnia’ phenomenon. The new studies suggest that the control of sleep hygiene and quality should be incorporated into the rehabilitation of COVID-19 patients.”

Coiro MJ, Asraf K, Tzischinsky O, Hadar-Shoval D, Tannous-Haddad L, Wolfson AR. Sleep quality and COVID-19-related stress in relation to mental health symptoms among Israeli and US adults. *Sleep Health*. 2021;7(2):127–33

Gupta R, Grover S, Basu A, Krishnan V, Tripathi A, Subramanyam A, et al. Changes in sleep pattern and sleep quality during COVID-19 lockdown. *Indian J Psychiatr*. 2020;62(4):370–378

Jahrami HA, Alhaj OA, Humood AM, et al. Sleep disturbances during the COVID-19 pandemic: A systematic review, meta-analysis, and meta-regression. *Sleep Med Rev*. 2022;62:101591. doi:10.1016/j.smrv.2022.101591

Alzueta E, , et al An international study of post-COVID sleep health. *Sleep Health*. 2022 Dec;8(6):684-690. doi: 10.1016/j.sleh.2022.06.011. Epub 2022 Sep 23. PMID: 36163137; PMCID: PMC9501615.



SLEEP

- Both quality and quantity matter
- Improving sleep hygiene >
- Supplements that support sleep
- Practicing ultradian rhythm break or URB >



SLEEP: Improving Sleep Hygiene



One way to improve sleep quality and quantity is to have daily routines and a bedroom environment that promotes consistent uninterrupted sleep.

Find personalized experiments to achieve sleep goals

Alzueta E, et al. An international study of post-COVID sleep health. *Sleep Health*. 2022 Dec;8(6):684-690. doi: 10.1016/j.sleh.2022.06.011. Epub 2022 Sep 23

Semyachkina-Glushkovskaya O, Mamedova A, Vinnik V, Klimova M, Saranceva E, Ageev V, Yu T, Zhu D, Penzel T, Kurths J. Brain Mechanisms of COVID-19-Sleep Disorders. *Int J Mol Sci*. 2021 Jun 28;22(13):6917. doi: 10.3390/ijms22136917. PMID: 34203143;

SLEEP:

Additional Resources

IFM Lifestyle Course resources:

- Effects of Poor Sleep
- The Sleep Questionnaire
- Mindfulness for Insomnia and Sleep Disorders
- Suggestions for Better Sleep



MOVEMENT & EXERCISE >>

- Moderate, regular activity is essential to functioning of immune system, circulation, and tissue oxygenation
- Pacing of movement is essential.

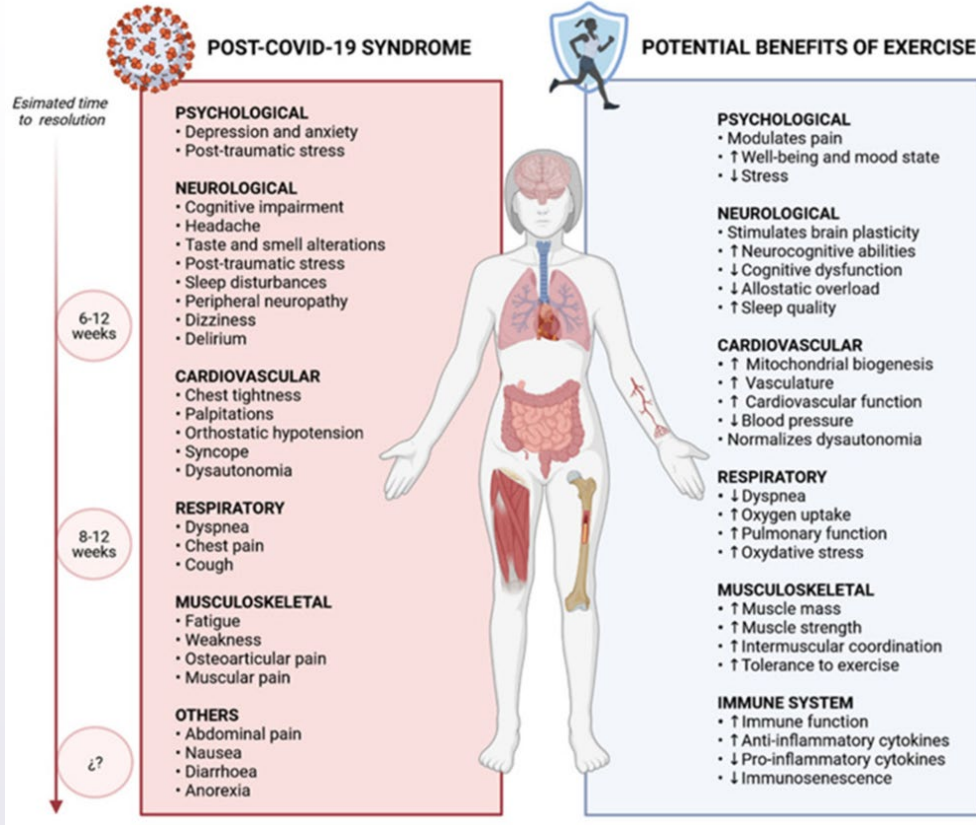


MOVEMENT & EXERCISE >>

- Moderate, regular activity is essential to functioning of immune system, circulation, and tissue oxygenation
- Pacing of movement is essential.



MOVEMENT as Post COVID Treatment



Jimeno-Almazán A, Pallarés JG, Buendía-Romero Á, Martínez-Cava A, Franco-López F, Sánchez-Alcaraz Martínez BJ, Bernal-Morel E, Courel-Ibáñez J. Post-COVID-19 Syndrome and the Potential Benefits of Exercise. *Int J Environ Res Public Health*. 2021 May 17;18(10):5329. doi: 10.3390/ijerph18105329. PMID: 34067776; PMCID: PMC8156194.

TIPS TO GET MOVING

These experiments may help keep your body's stress response in check and help bring more physical activity into your day:

- Personalize it.
- Start small
- Plan it out.
- Step outside.
- Utilize daily activities.
- Take it slow.
- HIIT It.
- Find support.



MOVEMENT:

Additional Resources

IFM Lifestyle Course resources:

- The Exercise History Questionnaire
- Effects of Physical Inactivity
- Tips to Incorporate Mindful Movement Every Day
- SMART Goals for Exercise
- And more



STRESS MODIFICATION >>

Techniques to modify the impact of stress on augmenting inflammation and decreasing immune function



STRESS MODIFICATION



- Acute COVID is associated with elevated evening cortisol levels.
- Long COVID is associated with low cortisol levels and low activation of the HPA axis.
- Stress modification and adrenal restoration are treatment for post -viral conditions

Lamontagne S.J., Pizzagalli D.A., Olmstead M.C. Does inflammation link stress to poor COVID-19 outcome? *Stress Health*. 2021;37(3):401–414.

Sandrini L., Ieraci A., Amadio P., Zara M., Barbieri S.S. Impact of acute and chronic stress on thrombosis in healthy individuals and cardiovascular disease patients. *Int. J. Mol. Sci.* 2020;2

Yavropoulou MP, Tsokos GC, Chrousos GP, Sfikakis PP. Protracted stress-induced hypocortisolemia may account for the clinical and immune manifestations of Long COVID. *Clin Immunol*. 2022 Dec;245:109133.

STRESS MODIFICATION

Stress triggers are highly individual.

Chronic stress can lead to physical symptoms such as headaches, high blood pressure, sleep issues, and digestive problems. It can also impact emotional and mental health and manifest as depression, anxiety, and panic attacks.



STRESS: MIND and MENTAL HEALTH



Worsened by stress, mental health and performance impacts post-viral recovery:

- Brain fog is a common symptom this program addresses .
- Mental health conditions are often new or worse post COVID and appropriate referrals and support are imperative to recovery.
- Mindset matters in recovery

Taquet M, et al. Neurological and psychiatric risk trajectories after SARS-CoV-2 infection: an analysis of 2-year retrospective cohort studies including 1 284 437 patients. *Lancet Psychiatry*. 2022;9:815–827. doi: 10.1016/S2215-0366(22)00260-7.

Schou TM, Joca S, Wegener G, Bay-Richter C. Psychiatric and neuropsychiatric sequelae of COVID-19 - A systematic review. *Brain Behav Immun*. 2021 Oct;97:328-348. doi: 10.1016/j.bbi.2021.07.018. Epub 2021 Jul 30.

R. Zion a, Kengthsagn Louis a, Rina Horii a b, Kari Leibowitz a, Lauren C. Heathcote c d, Alia J. Crum. Making sense of a pandemic: Mindsets influence emotions, behaviors, health, and wellbeing during the COVID-19 pandemic. *Social Science & Medicine*. Volume 301, May 2022, 114889

STRESS MASTERY TECHNIQUES >>

Like stress triggers, what helps someone navigate stressful situations varies. Some common experiments include:



- Relaxation techniques
- Meditation
- Finding support from others
- Being physically active (note that this can add stress to the body but may help address mental and emotional stress).
- Spending time in nature
- Diversion tactics
- Gratitude practices
- Laughter, joy, and play
- Engaging in arts, music, and crafts

STRESS MODIFICATION: Additional Resources



IFM Lifestyle Course resources:

- Self-Care questionnaire
- Strategies for Transforming Stress
- Cultivating Mindfulness and Self Awareness
- Mindful Breathing

STRESS: MIND and MENTAL HEALTH TIPS



- Refer people to mental health providers as appropriate
- Listen deeply, and offer support
- Acknowledge grief over losses
- Set expectations for a variable course of improvement
- Ask specifically what is working/ improving
- Support strengths
- Work with mindset to envision health
- Assist people to find community and reduce isolation

<https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects/care-post-covid.html>

Burton A, Aughterson H, Fancourt D, Philip KEJ. Factors shaping the mental health and well-being of people experiencing persistent COVID-19 symptoms or 'long COVID': qualitative study. BJPsych Open. 2022 Mar 21;8(2):e72.

SOCIAL CONNECTION >>

People impacted by long COVID reflect how isolated they continue to feel as others move on with lifting of the pandemic restrictions.

Connecting participants to community, and especially to support of people experiencing similar losses is essential to recovery.



COMMUNITY RESOURCES

- <https://www.weforum.org/agenda/2021/08/long-covid-symptoms-illness-pandemic>
- <https://www.survivorcorps.com>
- <https://www.longcovid.org>
- <https://longcovidalliance.org>



SOCIAL CONNECTION:

Additional Resources

IFM Lifestyle Course resources:

- Importance of Social Support and Relationships
- The Self- Care Questionnaire
- Practicing Gratitude with the IFM Gratitude Journal



POST VIRAL RECOVERY: NUTRITIONAL SUPPLEMENTS

SUPPLEMENT TARGETING

- ❖ ACE-2 mediated damage (tissue damage)
- ❖ Viral persistence
- ❖ Chronic inflammation
- ❖ Mitochondrial dysfunction
- ❖ Gut / Microbiome dysbiosis

After simplifying the Post COVID Recovery Framework, we found ourselves needing a curated suite of nutritional product solutions to target the five main drivers of Long COVID.

LONG COVID FRAMEWORK

Program
Entry

Assess Past & Current
Tissue Damage

Symptoms

- ❖ Master Intake
- ❖ Global Symptoms Assessment

Lab Assessment

- ❖ CMP
- ❖ CBC
- ❖ D-dimer
- ❖ Fibrinogen
- ❖ hs-CRP
- ❖ Vitamin D
- ❖ Thyroid Function

Function

- ❖ Exercise Tolerance
- ❖ PROMIS-29*
- ❖ Long COVID Function

Optional

- ❖ CXR
- ❖ Oxygen Diffusion
- ❖ Cardiac MRI

Lifestyle

- ❖ Food & Nutrition
- ❖ Movement & Exercise
- ❖ Stress Modification
- ❖ Social Connection
- ❖ Sleep
- ❖ Nutritional Supplementation

Specialty Nutritional Supplements

- ❖ Arterosil (4caps 30 days, 2caps 60days)
- ❖ ITIS Formula (2 caps 3x/day 90 day)
- ❖ Tollovid (30d+7d+30d)
- ❖ MegaSporeBiotic Probiotic (1 cap/7d+2caps)
- ❖ MegaPrebiotic (3caps/day 60 days)

Foundational Supplements

- ❖ MitoCore [MVit + AntiOx] (2x/day 90 days)
- ❖ Vitamin K2 with D3 (up to 10,000IU)
- ❖ Ω-3 Oil (1000mg 2x/day 90 days)
- ❖ Magnesium Glycinate (200mg 2x/day 90 days)
- ❖ Quercetin (500mg 2x/day 90 days)
- ❖ Coenzyme Q10 (100mg/day 90 days)

Foundational Supplements

- ❖ MitoCore [MVit + AntiOx]
(2x/day 90 days)
- ❖ Vitamin K2 with D3
(up to 10,000IU)
- ❖ Ω-3 Oil (1000mg 2x/day 90 days)
- ❖ Magnesium Glycinate (200mg
2x/day 90 days)
- ❖ Quercetin (500mg 2x/day 90 days)
- ❖ Coenzyme Q10 (100mg/day 90
days)

MitoCore key features:

Comprehensive MVI with Antioxidant and Mitochondrial Support

- ❖ NAC 500 mg
- ❖ Glucoraphanin 40 mg
- ❖ Alpha Lipoic Acid, Resveratrol and EGCG
- ❖ Acetyl L-carnitine 500 mg, Magnesium
- ❖ Manganese, Zinc

Vitamin K2 with D3 dosing based on levels:

- ❖ serum level < 40 ng/mL, use 10000 IU;
- ❖ if 40-60 ng/mL, use 5000 IU daily
- ❖ if > 60 ng/mL no additional needed

Quercetin:

- ❖ Immunomodulatory and may improve T-Reg function
- ❖ Demonstrated anti-viral activity against both RNA and DNA viruses

SPECIALTY NUTRITIONALS SUPPLEMENTS



Arterosil:
Endothelial, Blood
Vessel, Cardiovascular
Tissue Damage



MegaSporeBiotic:
Maintain healthy gut
barrier function



ITIS:
Natural
Anti-inflammatory,
Scutulleria



MegaPrebiotic:
Gut Health Support,
Microbial Diversity

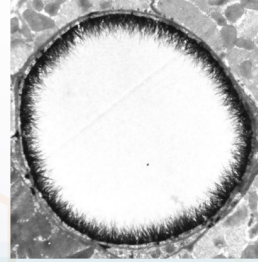


Tollovid:
3CL Protease
Inhibitor for Persistent
Viral Infection

SPECIALTY NUTRITIONALS SUPPLEMENTS



Arterosil:
Endothelial, Blood Vessel,
Cardiovascular Tissue Damage



Arterosil: Protects and repairs the Endothelial Glycocalyx (EGx)

- ❖ Selectively permeable barrier that prevents blood components from sticking to the vessel wall
- ❖ Harbors Super Oxide Dismutase (extracellular SOD)
- ❖ Regulates vascular permeability, inflammation, coagulation, and fluid balance

Active Ingredient: Rhamnan Sulfate

SPECIALTY NUTRITIONALS SUPPLEMENTS



ITIS:
Natural Anti-inflammatory,
Scutellaria

ITIS Formula:

- ❖ Reduces pain & inflammation
- ❖ Maintains comfortable joint & muscle function

Soothes an irritated immune system

Key Ingredients:

- ❖ Scutellaria (Chinese skullcap)
- ❖ Curcumin
- ❖ Boswellia serrata (frankincense)
- ❖ Copaiba
- ❖ Roman Chamomile

Supplement Facts

Serving Size: 4 Vegetarian Capsules
Servings Per Container: 30

Amount Per Serving	% DV†
Skullcap Extract (Scutellaria baicalensis, root, wildcrafted).....	1000 mg.....*
Celery Seed Powder (Apium graveolens).....	350 mg.....*
Tart Cherry Extract 4:1 (Prunus cerasus, fruit).....	250 mg.....*
Cat's Claw Powder (Uncaria tomentosa, wildcrafted bark).....	202.5 mg.....*
Boswellia serrata Extract (Standardized to 65% Boswellic Acid, Non-GMO)	193.8 mg.....*
Devil's Claw Root Powder (Harpagophytum procumbens, Non-GMO, Organic).....	180 mg.....*
Bromelain (600 GDU/g).....	225 mg.....*
Feverfew Powder (Tanacetum parthenium, herb, Organic).....	90 mg.....*
Quercetin Dihydrate.....	90 mg.....*
BioPerine Black Pepper Extract (Piper nigrum, fruit).....	2.25 mg.....*
Ginger Essential Oil (Zingiber officinale, root).....	20 mg.....*
Curcumin Extract 95% (Curcuma longa root extract).....	202.5 mg.....*
Copaiba Essential Oil.....	20 mg.....*
Roman Chamomile Essential Oil.....	20 mg.....*

† - % Daily Value * - Daily Value Not Established

Other Ingredients: Cellulose (capsule).

SP2721-120

SPECIALTY NUTRITIONALS SUPPLEMENTS



Tollovid:
3CL Protease
Inhibitor for Persistent
Viral Infection

Tollovid: Blocks viral replication capacity

Coronaviruses use their signature “spikes” to fuse themselves to a cell’s outer membrane via the ACE2-receptor to gain entry inside.

- ❖ The spike protein is primed for access using a 3CL protease
- ❖ By tightly binding to this protease enzyme, its ability to cleave is blocked.
- ❖ This shuts down the entire virus-making apparatus, leaving it unable to enter the cell and replicate.



Active Ingredient: Gromwell Root

SPECIALTY NUTRITIONALS SUPPLEMENTS



MegaSporeBiotic:
Maintain healthy gut
barrier function

MegaSporeBiotic

- ❖ Probiotic blend of 5 *Bacillus* spores that have been shown to maintain healthy gut barrier and immune function
- ❖ Aims to RECONDITION the gut instead of reseeded with probiotic strains that cannot survive digestion or colonize the gut.

Active Ingredient: *Bacillus* spores

SPECIALTY NUTRITIONAL SUPPLEMENTS



MegaPrebiotic:
Gut Health Support,
Microbial Diversity

MegaPreBiotic

- ❖ Contains non-digestible oligosaccharides that can increase microbial diversity and selectively feed beneficial bacteria like Akkermansia muciniphila, Faecalibacterium prausnitzii, and Bifidobacteria
- ❖ REINFORCES the beneficial microbial changes created by MegaSporeBiotic⁺ to promote a strong and diverse microbiome..

Active Ingredient: non-GMO green and gold kiwi fruit, non-GMO corn cob, and rBST-free cow's milk

FIRST 30-DAYS SUPPLEMENT PROTOCOL

Specialty Nutritional Supplements

- ❖ Arterosil
2 caps 2x/day
- ❖ ITIS Formula
2 caps 3x/day
- ❖ Tollovid
3 caps 4x/day
- ❖ MegaSporeBiotic
1 cap/day for 7 days, then 2caps/day to complete one bottle
- ❖ MegaPrebiotic
N/A

Foundational Supplements

- ❖ MitoCore [MVit + AntiOx]
2 caps 2x/day
- ❖ Vitamin K2 with D3
1 cap 2x/day with food
- ❖ OmegaGenics® EPA-DHA 1000
1000 mg 2x/day
- ❖ Designs for Health® Magnesium Chelate
200 mg 2x/day
- ❖ Vital Nutrients Quercetin 250 mg
2 caps 2x/day
- ❖ Vital Nutrients Coenzyme Q10 100 mg
1 cap once/day

31-TO-60 DAYS SUPPLEMENT PROTOCOL

Specialty Nutritional Supplements

- ❖ Arterosil*
1 cap 2x/day
- ❖ ITIS Formula
2 caps 3x/day
- ❖ Tollovid*
2 caps 4x/day for 7 days then 1 cap 2x/day for 30 days
- ❖ MegaSporeBiotic*
2caps/day to complete one bottle
- ❖ MegaPrebiotic*
3 caps/day

Foundational Supplements

- ❖ MitoCore [MVit + AntiOx]
2 caps 2x/day
- ❖ Vitamin K2 with D3
1 cap 2x/day with food
- ❖ OmegaGenics® EPA-DHA 1000
1000 mg 2x/day
- ❖ Designs for Health® Magnesium Chelate
200 mg 2x/day
- ❖ Vital Nutrients Quercetin 250 mg
2 caps 2x/day
- ❖ Vital Nutrients Coenzyme Q10 100 mg
1 cap once/day

61-TO-90 DAYS SUPPLEMENT PROTOCOL

Specialty Nutritional Supplements

- ❖ Arterosil
1 cap 2x/day
- ❖ ITIS Formula
2 caps 3x/day
- ❖ Tollovid*
1 cap 2x/day for 7 days
- ❖ MegaSporeBiotic*
N/A
- ❖ MegaPrebiotic
3 caps/day

Foundational Supplements

- ❖ MitoCore [MVit + AntiOx]
2 caps 2x/day
- ❖ Vitamin K2 with D3
1 cap 2x/day with food
- ❖ OmegaGenics® EPA-DHA 1000
1000 mg 2x/day
- ❖ Designs for Health® Magnesium Chelate
200 mg 2x/day
- ❖ Vital Nutrients Quercetin 250 mg
2 caps 2x/day
- ❖ Vital Nutrients Coenzyme Q10 100 mg
1 cap once/day

Patient Registry Early Outcomes



Benchmarking Our Success

Post COVID Function Scale
(3-point scale adopted by the NIH RECOVER Initiative and translated into 25 languages)

- ❖ <0.5 point decline = insignificant
- ❖ 0.5 - 1.0 point decline = clinically significant
- ❖ >1.0 point decline = excellent

Patient Outcomes

4.5 months after first patient enrollment

Post COVID Function Scale

- ❖ Patients (n= 8) achieved an average decline of 1.5 points.
- ❖ 5 of 8 patients reported total resolution over the 90-day program.
- ❖ No significant adverse events to date. 2 reports Tollovid GI intolerance (upset stomach).

PROMIS-29: 7 domains of function plus a global pain measure

- ❖ **Physical Function:** increased from 15th to 42nd percentile
- ❖ **Social Participation:** increased from 17th percentile to 63rd percentile
- ❖ **Anxiety:** decreased from 80th to 34th percentile
- ❖ **Depression:** decreased from 73rd to 46th percentile
- ❖ **Fatigue:** decreased from 82nd to 58th percentile
- ❖ **Sleep Interference:** decreased from 58th to 52nd percentile
- ❖ **Pain Interference:** decreased from 63rd to 41st percentile

“My blood oxygen used to go down to 82% while doing PT at the hospital little effort.

Now I stay over 90% O2 sat with a lot more movement in 2 weeks on the supplements.”

“The group visits tools give me power – I have agency when I have scary and dangerous symptoms, they no longer overwhelm me.”

“My body shape is changing, and I’m convinced it (the protocol) is helping everything.”

Early Patient Quotes

- ❖ “My migraines are gone now, just small daily headaches remain, they are less.”
- ❖ “My chest pain was really bothering me, I almost went to the ER again but they never find anything. I took an Arterosil and my pain reduced enough to stay home. Now that I’m on it 2 weeks I don’t have those pains anymore.” (Patient cried with gratitude when sharing this).
- ❖ “My pain with exertion is less, and I can move more without being set back.”
- ❖ “I have much more mental clarity.”
- ❖ “I have much better energy and much better mood.”
- ❖ “My muscle fatigue is much less since starting the program.”
- ❖ “I am done with the Tollovid. It helped my energy. On the Arterosil now for a month I continue to have a lot less pooling and swelling in my legs, and my POTS symptoms are less.”
- ❖ “I know more than my regular doctors about my condition. I wish more knew about mitochondria, vagal tone, cortisol and adrenal health, Ace-2 receptors and how it all affects long COVID symptoms.”
- ❖ “I no longer feel alone in what I am dealing with. Hearing everyone else’s stories heals me. Hearing everyone’s tools and ways of coping gives me hope and options.” (6 people emphasize this).



CASE STUDY: CS

Dr. Patrick Hanaway, MD

CS Demographics

- ❖ 51yo male, business executive
- ❖ Height = 6' 3½"
- ❖ Weight = 297#
- ❖ BMI = 36.6

❖ PMHx: Non-Hodgkin's Lymphoma (2004) @32yo
ChemoTx → Remission

- ❖ Vaccine x1 (Pfizer) April, 2021
- ❖ COVID Jan, 2022



CS History / Timeline

COVID #1 = Jan, 2022

- ❖ Very Sick, Hospitalized x 8d, O2 support (no ventilator)
- ❖ Fluid on Lungs, recurrence of Lymphoma
- ❖ ChemoTx May, 2022 → August, 2022
- ❖ Vaccine (Pfizer) #2 Sept, 2022

COVID #2 = Jan, 2023

- ❖ Milder, received Paxlovid
- ❖ Hospitalized x4d for ↓ WBC, received Neupogen
- ❖ Development of ‘Brain Fog’ and ↓ Memory (without fatigue)
- ❖ Primary Concern is “loss of words . . . mid-sentence”



CS Diagnoses

Long COVID x 4 months

- ❖ Cognitive Impairment
- ❖ Non-Hodgkin's Lymphoma
- ❖ 'Morbid' Obesity (BMI 35-40)
- ❖ Hypertension
- ❖ Metabolic Syndrome

Meds:

- ❖ Valacyclovir (s/p Shingles)

Supplements:

- ❖ MultiVitamin (generic)



CS Treatments

Week 1 – Fasting Mimicking Diet

Week 2 – Begin Lifestyle Modification & CGM

Week 3 – Begin Protocol

- ❖ Tollovid x 30 days (3 caps QID) with one month taper
- ❖ 'ITIS' 2 caps TID x 90d
- ❖ Arterosil 2 caps BID x 30d, then 1 cap BID x 60d
- ❖ VascaNOX 1 cap BID x 90d
- ❖ Mitocore (B-Vitamin + AntiOx) 2 caps BID x 90d
- ❖ Vitamin D 5000IU qD x 90d
- ❖ EPA/ DHA 1000mg 2 caps qD x 90d
- ❖ Vitamin C 500mg TID x 90d

Whole30 Food Plan
Gradual Exercise Plan



CS Follow-up/Outcomes



Long COVID x 4 months

4/12

❖ Dietary modification x 2 weeks → Weight ↓ 10#

5/2

“The results of my scans indicate that I am still in remission and that previously impacted lymph nodes are all within normal size. The even more impressive news is that my blood counts are better than they have been for 17 years.”

5/15

❖ Weight Loss = ↓ 35#

“I feel better than I’ve felt in years. I don’t experience ‘word loss’ like I did. The changes have been profound.”



Group Medical Visits

Dr. Kara Parker, MD

Faculty, Department of Family
Medicine

Director of Group Medical Visits

Hennepin Healthcare Whittier Clinic

PVRRP Group Medical Visit Components



Scaled education on the benefits of and resources for specific Lifestyle factors for recovery after COVID



Group instruction and exploration on Whole 30, plant based anti-inflammatory diet tailored to each person's needs



Group teaching on the specialty and foundational supplements for post Viral recovery



Time for support, connection, questions, and group practices for each part of the program

PVRP Group Visit **Our Topics**

- ❖ Overview of program, Intros, Patient Post COVID story
- ❖ Food & Nutrition
- ❖ Sleep & Mood
- ❖ Movement & Exercise
- ❖ Stress Modification
- ❖ Brain and Microbiome
- ❖ Mitochondria



PVRP Group Medical Visits Our Structure:

- ❖ 7 week series, 2 hour virtual visits
- ❖ Start with a Mind Body exercise to center
- ❖ Ask a question relevant to each weekly topic
- ❖ Teach on physiology, science, and tips and encourage discussion and sharing
- ❖ End with a long form mind-body exercise and closing take-aways or actions
- ❖ Empower participants to practice self-care during the visits



PVRP Group Medical Visits Stats/ Insights:

7/2020 to current, 10 groups, average 12 pts
2 recent groups using the protocol

- ❖ Patients who feel alone, isolated, and misunderstood benefit from connection
- ❖ The Lifestyle and supplements (protocol) fit well in a GV format
- ❖ I have learned on care of pts w LC by listening to pts w LC share needs & wins
- ❖ Benefits multiply for pts and practitioners in the care and presence of others



PVRP Group Visit Patient Case TD



- ❖ 59 yo female with PMH depression and chronic constipation and 3 Pfizer n Biotech vaccines including a booster 11/21.
- ❖ COVID + Dec '21 by pos home PCR test.
- ❖ Had flu like symptoms cared for at home without complication
- ❖ Began to develop new symptoms by 3 weeks

PVRP Group Visit Patient TD

By one month reported:

- ❖ Severe fatigue
- ❖ Cognitive changes
- ❖ Vision changes
- ❖ New daily headache
- ❖ Joint pain
- ❖ Muscle pain
- ❖ Disturbance of sleep
- ❖ Mood change
- ❖ Loose stools



PVRP Group Visit Patient TD



- ❖ Worked with her primary care to address symptoms with no change by 6 months, sought referral
- ❖ Was sent to our PM&R Post COVID clinic, and while on a waitlist was also referred to our Long COVID Group Visits Program and started 9/22

PVRP Group Visit Patient TD



Attended all 7 GV sessions:

- ❖ Visit 1 - Intro and Covid Story. TD shared her grief at fxn loss
- ❖ Visit 2 - Stress: Learned extended exhale breathing & shaking
- ❖ Visit 3 - Nutrition: Learned whole 30 recipes and reduced grains
- ❖ Visit 4 - Mitochondria: Started coenzyme Q 10, healthy fats
- ❖ Visit 5 - Sleep: Practiced Body Scan to fall asleep
- ❖ Visit 6 - Brain and Biome: Tried humming & prebiotic foods
- ❖ Visit 7 - Movement: Learned tips on pacing & theraband exercises

PVRP Group Visit Patient TD



- ❖ At completion of the GV Series she went from “40%” to “60%”
- ❖ She then started TOLLOVID and Arterosil
 - by day 5 she walked to and around the lake!
- ❖ Finished a 10 day regimen TOLLOVID
 - reported HA gone, brain clear, concentration back, reading
 - constipation returned (a sign she was back to herself)!
- ❖ ITIS was given and she did not tolerate it, stopped it
- ❖ Added MegaSpore prebiotics and aloe and stools normalized, making her feel better than pre-covid condition.

PVRP Group Visit Patient TD



- ❖ 4 months later had a return of fatigue when she:
 - had added back grains
 - had a mild URI
 - smelled mold in her apartment after heavy rain
- ❖ Symptoms resolved after she:
 - reduced grains
 - filtered air, got tested and remediated and
 - restarted TOLLOVID for 10 days



RESOURCES

www.ovationlab.com/PVRPresources



What's Next?

Patient Registry Goal:
100 new patients who
complete the 90 -day
program based using
updated protocol by
9/30/2023.

- ❖ Interested in joining our learning community?
- ❖ Complete and submit interest form [here](#)

Next Steps

- ❖ Special Topics Workshops
- ❖ Master Classes
- ❖ Learning Community Case Studies
 - Learn from our working group and your colleagues
 - Present your own patient cases

Question and Answer Session



Recommended Education Programs and Online Courses

The American Academy of Anti-Aging Medicine (A4M)



Use the code VIRAL200 for \$200 off your registration fee

Longevity Fest 2023 – December 14-16, 2023

The Academy of Integrative Health & Medicine (AIHM)



Use the code OVATION100 for \$100 off your registration fee to the October Conference

Annual Conference - October 5-8, 2023

The Institute for Functional Medicine (IFM)



Use the code OVATIONLAB10 for 10% off your registration fee

Applying Functional Medicine in Clinical Practice † May 2023 (AFMCP) - online
Lifestyle: The Foundations of Functional Medicine – on-demand, online

POST VIRAL RECOVERY PROGRAM

Resources for Providers and Patients



Presented by



Research and Program Development Sponsor



WORKSHOP REPLAYS

POST VIRAL RECOVERY
IN THE COVID ERA
WORKSHOP NO. 1



POST VIRAL RECOVERY
A 90-DAY PROGRAM
AND PROTOCOL
WORKSHOP NO. 2



POST VIRAL RECOVERY
LIFESTYLE INTERVENTIONS,
CASE STUDIES & LEARNINGS
WORKSHOP NO. 3



DOWNLOADS

• [Workshop 1 Presentation](#)

DOWNLOADS

• [Workshop 2 Presentation](#)

DOWNLOADS

• [Workshop 3 Presentation](#)



POST VIRAL RECOVERY PROGRAM

Resources for Providers and Patients

Presented by  OVATIONLAB | Research and Program Development Sponsor  ANDHEALTH

WORKSHOP REPLAY

POST VIRAL RECOVERY
IN THE COVID ERA
WORKSHOP NO. 1

POST VIRAL RECOVERY
A 90-DAY PROGRAM
AND PROTOCOL
WORKSHOP NO. 2

DOWNLOADS
• [Workshop 1 Presentation](#)
• [Workshop 2 Presentation](#)



RECOMMENDED EDUCATION PROGRAMS AND ONLINE COURSES

Check-out the links to upcoming conferences and online programs offered by the following education organizations.

The American Academy of Anti-Aging Medicine (A4M)

Use the code **VIRAL200** for \$200 off your registration fee.

- [Longevity Fest 2023](#)

The Academy of Integrative Health & Medicine (AIHM)

Use the code **OVATION100** for \$100 off your registration fee to the October Conference

- [Annual Conference, October 5-8, 2023](#)

The Institute for Functional Medicine (IFM)

Use the code **OVATIONLAB10** for 10% off your registration fee

- [Applying Functional Medicine in Clinical Practice™ May 2023 \(AFMCP\)](#)
- [AIC 2023: Advancements in Clinical Research and Innovative Practices in Functional Medicine](#)
- [Lifestyle: The Foundations of Functional Medicine](#)

Personalized Lifestyle Medicine Institute (PLMI)

- [Is COVID Long-Haul a disease of the gut](#)

NIH Researching COVID to Enhance Recovery (RECOVER)

REFERENCE PAPERS

- Alzueta, E, Perrin, PB, Yuksel, D, Ramos-Usuga, D, Kiss, O, Iacovides, S, de Zambotti, M, Cortes, M, Olabarrieta-Landa, L, Arango-Lasprilla, JC, & Baker, FC (2022). **An international study of post-COVID sleep health.** Sleep health, 8(6), 684–690. <https://doi.org/10.1016/j.sleh.2022.06.011>

Vogel, JM et al. **Long COVID: major findings, recommendations.** Nat Rev Microbiol 21, 133–146 (2023). <https://doi.org/10.1038/s41579-022-00848-2>

Reyes, JG, Buendia-Romero, Á, Martínez-Cava, A, & Alcaraz Martínez, BJ. Bernal-Morel, E, & Courel-**COVID-19 Syndrome and the Potential Benefits of** Journal of environmental research and public health, [18\(10\):5329](https://doi.org/10.3390/jerph18105329)

Ki, A, et al. (2022). **Distinguishing features of Long COVID immune profiling.** medRxiv (Cold Spring Harbor <https://doi.org/10.1101/2022.06.09.22278592>

Chen, B (2021b). **Long COVID or Post-acute Sequelae of COVID-19: A Review of Biological Factors That May Contribute to the Syndrome.** Frontiers in Microbiology, 12. <https://doi.org/10.3389/fmicb.2021.681111>

COVID-19 Adjustments in Long-COVID Management: A Systematic Review of Diet-Based Diets. Current nutrition reports, 10(4), [10.1007/s13668-021-00369-x](https://doi.org/10.1007/s13668-021-00369-x)


Chrousos, GP, & Sfikakis, PP (2022). **Protracted COVID-19 sequelae may account for the clinical and immune features of Long COVID.** Clinical immunology (Orlando, Fla.), 245, [10.1016/j.clim.2022.109133](https://doi.org/10.1016/j.clim.2022.109133)

TOOLS

FOR PRACTITIONERS

- [Application to Participate in Post Viral/Long COVID learning community and patient registry.](#)

FULLSCRIPT RESOURCES

-  [Protocol Application with Fullscript](#)
- If you do not have an active Fullscript account, please use [this link](#) to create your no-cost account.
- If you would like to prescribe the specialty products only, please use [this link](#).
- If you would like to prescribe the full protocol or make modifications to it, please use [this link](#).
- [Dispensary & individual patient discounts](#)

SAMPLE SURVEY INSTRUMENTS

- [LongCOVID Patient Intake Form](#)
 - [WHO Post COVID-19 CRF](#)
- [Timeline and Progression of Symptoms Table](#)
- [PROMIS29](#)
- [Post COVID Function Scale](#)

◦ [The Post-COVID-19 Functional Status scale](#)

PATIENT CASES - Coming

FOR PATIENTS

- [Fullscript Patient Protocol](#)

WHOLE30 PROGRAM RESOURCES

- [Program Rules](#)
- [Plant-Based Whole30 Prep Pack](#)
- [Grocery Guide](#)
- [Shopping List](#)
- [Meal Planning](#)
- [Plant-Based Recipes](#)

LIFESTYLE INTERVENTION RESOURCES

- [How to Improve Sleep Hygiene](#)
- [Circadian Rhythms](#)
- [Stress Management](#)
- [Physical Activity and Stress](#)
- [Exercise Tolerance Assessment for Exercise Fitness & HR Recovery Instructions \(from Share Care\)](#)
- [WHO Support for Rehabilitation](#)
- [The Levine Protocol For Exercising With POTS - Better By The Beat](#)
- [Instructions for POTS Exercise Program—Children's Hospital of Philadelphia: The Structure of the Training Calendars](#)
- [Coronavirus Recovery Breathing Exercises | Johns Hopkins Medicine](#)
- [Bouncing Back From COVID-19](#)

THANK

YOU



References

1. Su et al. [ISB]. Multiple early factors anticipate post-acute COVID-19 sequelae. *Cell*. 2022. Mar 3;185(5):881-895.e20. doi: 10.1016/j.cell.2022.01.014.
2. Yong, SJ [Malaysia]. Long COVID or post-COVID-19 syndrome: putative pathophysiology, risk factors, and mechanisms. *Infectious Diseases*. 2021. Oct;53(10):737-754. doi: 10.1080/23744235.2021.1924397.
3. Crook et al [UK]. LongCOVID – Mechanisms, risk factors, and management. *BMJ*. 2021 Jul 26;374:n1648. doi: 10.1136/bmj.n1648.
4. Peluso MJ, Deeks SP [UCSF]. Early clues regarding the pathogenesis of long-COVID. *Trends in Immunology*. 2022. Apr;43(4):268-270. doi: 10.1016/j.it.2022.02.008.
5. Proal AD, VanElzakker MB [PolyBio]. Long COVID or Post-acute Sequelae of COVID-19 (PASC): An Overview of Biological Factors That May Contribute to Persistent Symptoms. *Frontiers in Microbiology*. 2021. 12:698169. doi: 10.3389/fmicb.2021.698169
6. Merad M, Blish CA, Sallusto F, Iwasaki A. [Yale]. The Immunology and ImmunoPathology of COVID-19. *Science*. 2022. 375:1122-1127. doi: 10.1126/science.abm8108

References

7. Alzueta E, et al An international study of post-COVID sleep health. *Sleep Health*. 2022 Dec;8(6):684-690. doi: 10.1016/j.sleh.2022.06.011. Epub 2022 Sep 23. PMID: 36163137; PMCID: PMC9501615.
8. Burton A, Aughterson H, Fancourt D, Philip KEJ. Factors shaping the mental health and well-being of people experiencing persistent COVID-19 symptoms or 'long COVID': qualitative study. *BJPsych Open*. 2022 Mar 21;8(2):e72.
9. Coiro MJ, Asraf K, Tzischinsky O, Hadar-Shoval D, Tannous-Haddad L, Wolfson AR. Sleep quality and COVID-19-related stress in relation to mental health symptoms among Israeli and US adults. *Sleep Health*. 2021;7(2):127–33
10. Gupta R, Grover S, Basu A, Krishnan V, Tripathi A, Subramanyam A, et al. Changes in sleep pattern and sleep quality during COVID-19 lockdown. *Indian J Psychiatr*. 2020;62(4):370–378
11. <https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects/care-post-covid.html>

References

12. Jahrami HA, Alhaj OA, Humood AM, et al. Sleep disturbances during the COVID-19 pandemic: A systematic review, meta-analysis, and meta-regression. *Sleep Med Rev.* 2022;62:101591. doi:10.1016/j.smrv.2022.101591
13. Jimeno-Almazán A, Pallarés JG, Buendía-Romero Á, Martínez-Cava A, Franco-López F, Sánchez-Alcaraz Martínez BJ, Bernal-Morel E, Courel-Ibáñez J. Post-COVID-19 Syndrome and the Potential Benefits of Exercise. *Int J Environ Res Public Health.* 2021 May 17;18(10):5329. doi: 10.3390/ijerph18105329. PMID: 34067776; PMCID: PMC8156194.
14. Kim H, Rebholz CM, Hegde S, LaFiura C, Raghavan M, Lloyd JF, et al. Plant-based diets, pescatarian diets and COVID-19 severity: a population-based case–control study in six countries. *BMJ Nutrition, Prevention & Health.* 2021 May 18;
15. Lamontagne S.J., Pizzagalli D.A., Olmstead M.C. Does inflammation link stress to poor COVID-19 outcome? *Stress Health.* 2021;37(3):401–414.
16. Medawar E, Huhn S, Villringer A, Veronica Witte A. The effects of plant-based diets on the body and the brain: a systematic review. *Transl Psychiatry.* 2019 Sep 12;9(1):226. doi: 10.1038/s41398-019-0552-0. PMID: 31515473; PMCID: PMC6742661.

References

17. R. Zion a, Kengthsagn Louis a, Rina Horii a b, Kari Leibowitz a, Lauren C. Heathcote c d, Alia J. Crum. Making sense of a pandemic: Mindsets influence emotions, behaviors, health, and wellbeing during the COVID-19 pandemic. *Social Science & Medicine*. Volume 301, May 2022, 114889
18. Sandrini L., Ieraci A., Amadio P., Zara M., Barbieri S.S. Impact of acute and chronic stress on thrombosis in healthy individuals and cardiovascular disease patients. *Int. J. Mol. Sci.* 2020;2
19. Schou TM, Joca S, Wegener G, Bay-Richter C. Psychiatric and neuropsychiatric sequelae of COVID-19 - A systematic review. *Brain Behav Immun.* 2021 Oct;97:328-348. doi: 10.1016/j.bbi.2021.07.018. Epub 2021 Jul 30.
20. Semyachkina-Glushkovskaya O, Mamedova A, Vinnik V, Klimova M, Saranceva E, Ageev V, Yu T, Zhu D, Penzel T, Kurths J. Brain Mechanisms of COVID-19-Sleep Disorders. *Int J Mol Sci.* 2021 Jun 28;22(13):6917. doi: 10.3390/ijms22136917. PMID: 34203143;

References

21. Storz MA. Lifestyle Adjustments in Long-COVID Management: Potential Benefits of Plant-Based Diets. *Curr Nutr Rep.* 2021 Dec;10(4):352-363. doi: 10.1007/s13668-021-00369-x. Epub 2021 Sep 10
22. Taquet M, et al. Neurological and psychiatric risk trajectories after SARS-CoV-2 infection: an analysis of 2-year retrospective cohort studies including 1 284 437 patients. *Lancet Psychiatry.* 2022;9:815–827. doi: 10.1016/S2215-0366(22)00260-7.
23. Wang S, Li Y, Wang S, Li Y, Yue Y, et al. Adherence to Healthy Lifestyle Prior to Infection and S, Li Y, Yue Y, et al. Adherence to Healthy Lifestyle Prior to Infection and Risk of Post-COVID-19 Condition. *JAMA Intern Med.* 2023;183(3):232–241.
24. Yavropoulou MP, Tsokos GC, Chrousos GP, Sfikakis PP. Protracted stress-induced hypocortisolemia may account for the clinical and immune manifestations of Long COVID. *Clin Immunol.* 2022 Dec;245:109133.