Thank you for choosing OXYMED LABS.

Additional information, clinical references and podcasts are available at www.oxymedlabs.com

**Cytokine Tier 1**
Typically requested by Allied Health Care Practitioners - Chiropractors, Osteopaths, Physiotherapists, Naturopaths.

- Pro-inflammatory: IL-1, IL-6, IL-8, TNF-α, S100B,
- Anti-inflammatory: GM-CSF, IL-4, IL-10, IL-13, BDNF

**Cytokine Tier 2**
Medical and Integrative Practitioners

- Pro-inflammatory: IL-1, IL-2, IL-6, IL-7, IL-8, IL-12, IL-15, IL-17, IL-18, IL-22, IL-23, TNF-α, S100B, IFN-γ, MMP-9, NFkB, GlycA, Nagalase, Hsf1, Hsp70, Hsp90
- Anti-inflammatory: GM-CSF, IL-3, IL-4, IL-5, IL-10, IL-13, IL-21, TGF-β1, IGF1, VEGF, BDNF, P53, Nrf2.

Cytokines are an integral part of individual Gene Expressions, Growth Factors and Immune Modulation. Cytokine testing is at the forefront of immunotherapy interventions.

Type into Google your “health condition” and “cytokines” and you will be overwhelmed with the response on the topic. So, this begs the question, why aren't governments paying for Cytokine testing enabling the public to access these specific advances with view of how your body is actually functioning at a "cellular level".

The answer is simple. Cytokines testing places focus on “individual” gene expressions with the view that your health is simply not another "generic drug" for another "symptom".

The human frame is dependent on Cytokine expressions. The rate of autoimmune cell destruction leading to cell death is Cytokine dependent. Equally the ability to self-regenerate and self-regulate is also Cytokine dependent.

Cytokine are gene signal proteins and glycoproteins that ‘orchestrate’ proper immune responses including inflammation and anti-inflammatory pathways. They are known as either proinflammatory or anti-inflammatory.

Cytokines are bioactive proteins produced by many different cells of the immune system. Due to their role in different inflammatory disease states and maintaining homeostasis, there is enormous clinical interest in the quantitation of cytokines.

Cytokines act as mediators and modulators within highly localized environments and regulate immunological responses, hematopoietic development, and cell-to-cell communication as well as host responses to infectious agents and inflammatory stimuli [6]. They interact with each other in complex ways that may be additive, synergistic or antagonistic, or may involve the
induction of one cytokine by another. Cytokines are pleiotropic which refers to their ability to address multiple targets and physiological effects.

Cytokine production is often transient and tightly regulated. Due to the high biological activity of most cytokines, their homeostatic concentration in body fluids is low, e.g. picomolar concentrations (PubMed). However, if required, the concentration of cytokines can increase up to 1,000-fold. In healthy individuals, cytokines are either not detectable or present at pg/mL concentrations in body fluid or tissues.

Markers such as the many inflammatory cytokines are elevated after exercise in healthy individuals and return to baseline values within minutes to hours after exercise (PubMed).

Elevated concentrations of cytokines indicate activation of cytokine pathways associated with inflammation or disease progression (PubMed). For this reason, cytokine measurements are important as these proteins are widely used as biomarkers to understand and predict disease progression and monitor the effects of treatment (PubMed). Since cytokines are biomarkers of inflammatory-based diseases, nearly every type of disease has involvement of cytokines as potential biomarkers.

Some recent representative reviews for these different diseases and the roles for cytokines are provided here: Alloreactivity (rejection to clinical transplantation) (PubMed 1, 2), Alzheimer’s (PubMed), asthma (PubMed), atherosclerosis (PubMed), colon cancer (PubMed), cancer (PubMed1, 2), depression (PubMed), heart disease (PubMed 1, 2), HIV (PubMed), kidney injury (PubMed), Parkinson's disease (PubMed), sepsis (PubMed), and rheumatoid arthritis (PubMed).

As a result, understanding of the cytokine orchestra and its regulation abnormalities in these diseases could ultimately lead to promising and specific treatments for patients [30, 31].

Pro-inflammatory:
- IL-1, IL-2, IL-6, IL-7, IL-8, IL-12, IL-15, IL-17, IL-18, IL-22, IL-23, TNF-α, S100B, ILF1, NFkB, GlycA, Nagalase, Hsf1, Hsp70, Hsp90

Anti-inflammatory:
- GM-CSF, IL-3, IL-4, IL-5, IL-10, IL-13, IL-21, TGF-β1, IGF1, VEGF, BDNF, P53, Nrf2.

Cytokine blood tests are indicators of what is happening in your ‘circulating blood’ however, does not necessarily reflect what is actually happening in the deeper tissues where cells are in a “hypoxic” – low oxygen respiration and a lowered metabolic state.

Cells that are in a hypoxic state over secrete “pro-inflammatory cytokines and inflammatory gene expressions”. Inflammatory responses are required in the ‘acute phase’ of an injury or illness but become detrimental with ‘chronic long-term expression’ leading to autoimmune related disorders including cancers. Many individuals also have an over expression of the anti-inflammatory cytokines (“good guys”) - this is part of the ‘cytokine storm’ response where your body is attempting to combat chronic immune challenges.
Pro-inflammatory Cytokine Expressions
References are available at www.oxymed.com.au

Interleukin 1 (IL1)
- IL1 is linked with systemic inflammation including the ‘gut and brain connection’.
- Patients with chronic irritable bowel and chronic disease are often elevated with IL1 and IL8.
- In stroke patients, IL1 caused a severe reduction in cerebral blood flow and an increase in infarct volume. Blockade of endothelin-1 receptors reversed this hypoperfusion, reduced tissue damage, and improved functional outcome.
- Post stroke, IL1 mediates inflammatory effects (negative cascade) - including increased adhesion molecules, neutrophil infiltration, reduced BBB integrity, decreased blood flow.
- Elevated IL1 on astrocytes reveal increased IL6, TNFa and other chemokines.
- Elevated IL1 inhibits stroke repair – reduced neurogenesis.
- Elevations in serum levels and joint fluids (synovial fluids) are detected in rheumatoid arthritis.

Interleukin 6 (IL6)
- IL6 is a cytokine with a wide variety of biological functions. It is a potent lymphoid cell growth factor that stimulates the growth and survivability of certain B cells and T cells. It plays an essential role in the final differentiation of b-cells into Ig-secreting cells, it induces myeloma and plasmacytoma growth, it induces nerve cells differentiation and in hepatocytes it induces acute phase reactants.
- IL6 is an important biomarker in monitoring inflammatory responses.
- IL-6 is involved in the induction of acute phase responses and induction of fever.
- Elevated serum levels of IL6 are also found in patients with chronic inflammatory arthritis and traumatic arthritis.
- IL6 can increase up to a 1,000-fold during trauma and infection.
- Chronic elevation of serum IL-6 is associated with the progression of atherosclerosis in patients with vascular risk factors.
- Elevated IL6 but not C-reactive protein in midlife, predicts cognitive decline and dementia.
- IL6 elevation is associated with chronic lumbar radicular pain.
- Persistent increase of the pro-inflammatory substances IL6 and IL8 in serum after disc herniation.
- IL6 is a growth and survival factor in human glioblastoma cells and plays an important role in malignant progression.
  IL6 increased levels have been associated with elevated cancer risk, and also these levels have been found to be a prognostic factor for several cancer types.
- In addition, increased levels have been found in coronary heart disease, insulin resistant patients, advanced stage cancer patients, atopy/asthma and in patients with blood circulating micro metastasis (circulating tumour cells).

Interleukin 7 (IL7)
- Hematopoietic growth factor secreted by red marrow and thymus.
- Stimulates the differentiation of multipotent (pluripotent) hematopoietic stem cells.
- Elevated IL7 levels detected in the plasma of HIV-infected patients.
- Elevated IL7 promotes tumour development and progression.
- IL7 is linked with NFkB in malignancies (acute lymphoblastic leukemia).
- IL7 is a proliferative and trophic cytokine that induces the development and proliferation of haematopoietic cells and malignancies.
- The production of IL7 is linked in the process of tumour genesis and upregulated in several solid tumours including breast, lung, prostate, renal, ovarian, melanomas as well as head and neck tumours.
- An important marker in cancer activity.
Interleukin8 (IL8)
IL8 & Cardiovascular Disease
- IL8 was first characterized in 1987. Since then, knowledge regarding its role in leucocyte trafficking and activation has advanced rapidly, especially in the field of cardiovascular disease. In the scientific literature, there is sufficient evidence to support beyond any doubt the involvement of IL-8 in the establishment and preservation of the inflammatory microenvironment of the insulted vascular wall.
- IL8 strongly contributes to the inflammatory basis of atherosclerosis and a potential mediator of the biochemical pathways of lesion (plague) formation.
- IL8 is identified with systemic inflammation of the blood and involved in cerebrovascular disorders and cardiovascular disease.
- IL8 and other pro-inflammatory chemokines are produced in several tissues upon infection, inflammation, ischemia, trauma etc – the main cause of local neutrophil accumulation.
- Gross overproduction of IL8 from endothelial cells occurs in the presence of hypoxia (low oxygen).
- IL8 is identified in chronic systemic inflammation including progressive vascular disease, atherosclerosis lesions, main source for atherosclerosis plagues, predictive biomarker for ischemia induced oxidative stress.
- IL8 is associated with the pathogenesis of hypertension, and in the progression of ischemic induced necrosis.
- IL8 elevated in ventricular fibrillation complicating myocardial infarction.
- IL8 is a powerful independent predictive factor for cardiovascular disease and overall mortality in patients with end stage renal disease.
- IL8 is an important biomarker of outcome following cardiopulmonary arrest.

SPECT Imaging (Single Photon Emission Computed Tomography) demonstrates regions of cerebral hypoperfusion. Typically, these are the regions of the brain associated with chronic ‘over expression’ of pro-inflammatory cytokines including IL1, IL8, TNFα, S100B and lowered BDNF.

Chemokine Interleukin-8 (IL-8) in Alzheimer’s and Other Neurodegenerative Diseases
- Neuroinflammation is a critical component in the pathogenesis of neurodegenerative diseases. Evidence suggests that activated microglia serve as a primary source for a host of inflammatory mediators which in assemblage can lead to neurotoxicity in inflamed brain.
- Mobilization of chemokine factors is a response to changes in brain homeostatic conditions leading to localized accumulation of reactive microglia at target sites. In particular, levels of the chemokine IL8 are significantly elevated in neurodegenerative disease.
- IL8 is linked with neuroinflammation associated with activated microglia resulting in neurotoxicity in the inflamed brain.
- IL8 are significantly elevated in neurodegenerative disease.
- Activated microglia increased levels of IL8 which contribute to a positive feedback process amplifying and sustaining inflammatory reactivity in Alzheimer's Disease brain.
- Chronic microglial activation is associated with sustained cellular production of a milieu of inflammatory mediators including pro-inflammatory cytokines including IL8, reactive oxygen species and matrix metalloproteinases which cause abnormalities to blood vessels (weak VEGF) and neurotoxicity.

Interleukin 17 (IL17)
- High levels of this cytokine IL17 are associated with several chronic inflammatory diseases including rheumatoid arthritis, psoriasis and multiple sclerosis.
- IL17 is an inflammatory infiltrate in tendinopathy, rotator cuff injuries and repetitive strain injuries.
- Increased levels of IL17 coupled with TNF-α, IL-6 in torn supraspinatus promoting tissue destruction and degeneration during inflammation.
- IL17 has been linked with inflammatory arthritis and more recently associated with chronic symptoms associated with ‘Lyme like illness’.
- High levels of IL17 have been found in patients with confirmed, chronic ‘borreliosis’ in conjunction with elevated IL1, IL6, TNFα.
- Oral high dose vitamin D intake reducing IL17 levels in MS patients in a double blind randomized clinical trial. 94 patients with a diagnosis of relapsing remitting multiple sclerosis (RRMS). 50,000 IU vitamin D3 every five days for 12 weeks showed significant reduction in RRMS patients.

Tumour Necrosis Factor alpha (TNFa)
- TNFα is a cytokine produced by white blood cells, released during the acute inflammatory response. It plays a pivotal role in systemic inflammation as it induces the synthesis of C-reactive protein, vasodilatation, and vascular permeability.
- TNFα is a ‘master regulator of the human inflammatory response’ and linked with many autoimmune disorders including chronic pain, arthritis, tendinitis.
- Proinflammatory tumor necrosis factor-alpha (TNF) is a key mediator of neuropathic pain pathogenesis. TNFα is elevated at sites of nerve injury, in the spinal cord, and supraspinally during the initial development of pain. Chronic neuropathic pain is correlated with elevated TNFa.
- The hippocampus, an area of the brain most notable for its role in learning and memory formation, plays a fundamental role in pain sensation. Neurogenesis refers to the growth and development of neurons. Research has shown that the human hippocampus retains its ability to generate neurons throughout life.
- Elevated TNFα in the brain hippocampus results in atrophy and is associated with traumatic brain injuries, post-traumatic stress disorders, concussion syndrome and conditions depression, psychosis, addiction and dementia.
- Animal studies demonstrate that infusion of an anti-TNFα agent adjacent to the hippocampus completely alleviated chronic neuropathic pain.
- Elevated pro-inflammatory cytokines (IL1, IL6, IL7, IL8, S100B) and TNFα are linked with chronic and progressive neurodegenerative disease - often referred to as Cytokine Storm leading to multisystem inflammatory cascade (autoimmune erosion). The body due to autoimmune dysfunction - attacks itself. Reason for many ‘retired’ athletes combating depression and other progressive mental health issues.

S100B
https://www.oxymed.com.au/s100b
- S100B is a neurobiochemical marker of brain damage and used as a measure of Blood Brain Barrier (BBB) integrity and dysfunction. S100B levels in serum are a useful marker of brain tissue fate in TBI. Several difficult clinical situations, such as determining the need for CT scanning in mild TBI, monitoring unconscious TBI patients, predicting outcome and validating treatment effect, may be facilitated by the use of S100B.
- S100B is chronically elevated with many mental health issues including dementia, Alzheimer’s but also a marker of other systemic issues including circulatory arrest, stroke and traumatic brain injury.
- S100B is elevated with Chronic Traumatic Brain Injury (TBI and CTE), Post Traumatic Stress Disorders (PTSD), shock blast injury, concussions syndromes, blunt head injury and progressive neurodegeneration disorders.
- S100B is mainly expressed in glial cells.
- The levels of S100B in the blood may function to predict the progress or the prognosis of many kinds of diseases, such as cerebrovascular diseases, neurodegenerative diseases, motor
neuron diseases, traumatic brain injury, schizophrenia, depression, diabetes mellitus, myocardial infarction, cancer, and infectious diseases.

- S100B has been implicated in the pathological process of these diseases, S100B should not be simply regarded as a biomarker, it may also function as therapeutic target for these diseases.
- The role of S100B may formulate innovative therapeutic strategies for multiple diseases.

**Anti-inflammatory Cytokine Expressions**

**Granulocyte Macrophage Colony Stimulating Factor (GM-CSF)**


- GMCSF are glycoprotein growth factors. Often referred to as the regulator of ‘innate immune modulation’. GM-CSF is typically a “good-guy” and part of the family of anti-inflammatory gene expressions and function.
- GM-CSF are Growth factors - proteins made in the body and some of them make the bone marrow produce blood cells and makes stem cells move from the bone marrow into the blood. Stem cells are the cells in the bone marrow from which red blood cells, white cells and platelets develop.
- GM-CSF makes the body produce white blood cells to reduce the risk of infection after some types of cancer treatment.
- GM-CSF stimulates blood stem cells to produce more white blood cells (neutrophils, eosinophils, basophils, and monocytes) to reduce the risk of infection notably after types of cancer treatment.
- GM-CSF facilitates development of the immune system and promotes defence against infections.
- GM-CSF attenuated inflammation in the CNS and the periphery in a mouse model of ALS and thereby delayed the progression of the disease.

**STEM CELLS 2007;25:2066 –2073**

- GM-CSF stimulates bone marrow and make stem cells move from the bone marrow into the blood. In addition, GM-CSF can have intrinsic spinal cord repair mechanisms (indirect pathway), including neuroprotection from apoptosis, endogenous stem cell activation, inhibition of glial scar formation, and microglial cell activation.
- GM-CSF decreased neuronal apoptosis and improved the functional outcome in SCI animal models.
- GM-CSF stimulates microglial cells to increase brain-derived neurotrophic factor (BDNF) synthesis.
- The total number of recruited white blood cells in the peripheral blood was elevated after GM-CSF (SGS) administration. The number of white blood cells in patients showing improved neurologic function was significantly higher.
- Following GM-CSF - Spinal MRI Findings - 42.9% of patients in the GMCSF treated group showed an increase in the diameter of the spinal cord at the cell transplantation site. 28.6% showed evidence of spinal cord enhancement.
- GM-CSF are being used in numerous “vaccines” to enhance the immunogenicity and increase the effectiveness of the vaccine. Vaccines including influenza vaccinations include GM-CSF.
- Many individuals tested for Cytokines are demonstrating over expression of GM-CSF and other proinflammatory cytokines.
- What are the potential indications associated with chronic over-expressions of GM-CSF contributing to immune confusion - Cytokine Storm.
**Interleukin 4**
- Studies of IL-4 have revealed a wealth of information on the diverse roles of this cytokine in homeostatic regulation and disease pathogenesis.
- IL4 is an Th2 anti-inflammatory cytokine, acting synergistic with IL10 and IL13 responsible for cell growth factor that stimulates the growth and survivability of B cells and T cells.
- IL4 inhibits the production of pro-inflammatory cytokines including TNF, IL1, and IL6.
- IL4 is an immune-stimulating molecule. More recent targets being studied for new asthma treatments.
- IL4 has striking antitumor activities expressing potent biologic agents to enhance immune elimination of certain tumor cells.
- Ameliorates non-resolving neuro-inflammation that causes neuropathic pain after nerve injury (crush injury), failed surgery, complex regional pain syndromes, disc prolapse.
- It is closely related and has functions similar to Interleukin 13.

**Interleukin 10**
- IL10 is a potent anti-inflammatory TH2 cytokine that has a critical role in limiting the immune response to pathogens to prevent host damage.
- IL10 is a strong inhibitor of inflammation.
- Elevated levels in parasitic infection, high expression levels of IL10 are also found in retroviral infections inducing immunodeficiency.
- The immunosuppressive properties of IL10 suggest a possible clinical use in suppressing rejections of grafts after organ transplantations.
- Patients with Crohn's disease react favourably to treatment with bacteria producing recombinant IL10.
- Pre conditioning elevation of IL10 induces a resistance of the brain cells to ischemia-evoked damages.
- This protective effect in cultured hippocampal cells is developed rapidly after application of IL10, capable to exert the rapid neuroprotective effects through transcription-independent modulation of ischemia-induced intracellular Ca(2+) responses in the brain cells.
- IL10 upregulates BNDF production.

**Interleukin 13**
Hyperbaric Oxygenation of Hypoxic Glioblastoma Multiforme Cells Potentiates the Killing Effect of an Interleukin-13-Based Cytotoxin
- IL13 has anti-tumour effects and when combined with HBO enhances the killing effects of Glioblastoma and other cancers. Interleukin-13 receptor-targeted cytotoxin (IL13-PE38) is highly cytotoxic to human glioblastoma (GBM) cells.
- IL13 based T cell immunotherapy is emerging as a powerful strategy to treat cancer and may improve outcomes for patients with glioblastoma (GBM).
- Chimeric Antigen Receptor (CAR) T cell immunotherapy targeting IL-13 receptor α2 (IL13Ra2) for the treatment of GBM. The general premise of CAR-T cells is to artificially generate T-cells targeted to markers found on cancer cells. Scientists can remove T-cells from a person, genetically alter them, and put them back into the patient to attack the cancer cells.
- Intracranial delivery of CAR T cells elicits superior anti-tumor efficacy as compared to intravenous administration, with intraventricular infusions exhibiting possible benefit over intracranial tumor infusions.
- IL-13 specifically induces physiological changes in parasitized organs that are required to expel the offending organisms or their products. For example, expulsion from the gut of a variety of mouse helminths requires IL-13 secreted by Th2 cells.
- IL-13 induces several changes in the gut that create an environment hostile to the parasite, including enhanced contractions and glycoprotein hyper-secretion from gut epithelial cells, that ultimately lead to detachment of the organism from the gut wall and their removal.

**Brain Derived Neurotrophic Factor (BDNF)**


- BDNF are neural growth factor genes.
- Chronic elevation of pro-inflammatory cytokines typically supresses BDNF functions.
- Neurotrophic factors are found in the brain and the periphery. BDNF acts on certain neurons of the central nervous system and the peripheral nervous system, helping to support the survival of existing neurons, and encourage the growth and differentiation of new neurons and synapses.
- In the brain, BDNF is active in the hippocampus, cortex, and basal forebrain—areas vital to learning, memory, and higher thinking.
- BDNF are also expressed in the retina, motor neurons, the kidneys, saliva, and the prostate.
- BDNF itself is important for long-term memory. Mice born without the ability to make BDNF suffer developmental defects in the brain and sensory nervous system, and usually die soon after birth, suggesting that BDNF plays an important role in normal neural development.
- Certain types of physical exercise have been shown to markedly (threefold) increase BDNF synthesis in the human brain, a phenomenon which is partly responsible for exercise-induced neurogenesis and improvements in cognitive function.
- BDNF improves cognitive performance and global function in neurodegenerative disorders with 'increased daily quality living'.
- BDNF activates cerebral mechanisms related to attention and memory processes.
- BDNF improves mild to moderate progressive neurodegenerative disease including multiple sclerosis, Parkinson's disease, Alzheimer's disease, dementia, acute and chronic Stroke, acute traumatic brain injury, childhood autism and cerebral palsy.
- BDNF attenuates motor neuron damage in spinal cord with significant motor recovery. reducing chronic nerve cell inflammation in both acute and chronic neurodegenerative diseases.
- BDNF are neuroprotective and neurorestorative properties, demonstrates 'anti-aging' with benefits 'improving cognition, memory function, brain metabolism with capacity.
- BDNF reduces brain Aβ deposition, and tau-related neuropathology. Modulates neuroinflammation, attenuating microglia activation and IL-1β release, reducing the elevated serum levels of TNF-α and TNF receptor-1 in AD patients.
- BDNF have neurotrophic-like actions on neuronal survival and outgrowth, increases circulating IGF-1. BDNF enhances the supply of glucose to the brain and ameliorates the slowing of brain bioelectrical activity.
- BDNF promotes neural plasticity, neurogenesis and neuronal survival protecting from apoptosis and degeneration.

**Hyperbaric Oxygen Therapy**

- Hyperbaric Oxygen is breathing enriched Oxygen whilst under pressure.
- The Tiered system is based on different pressure levels for different effects.

**Tier 1: 1.0 - 1.5ATA**

- Tier 1 are 'soft inflatable' low pressure HBOT chambers where the pressure is limited to 1.3-1.5 ATA using 'pressurised air' (21%) or 5-8 litre per minute Oxygen concentrator (93%).
- Tier 1 chambers are typically 'soft' (shallow dive) inflatable chambers.
- Tier 1 are recommended for general wellbeing, recovery and some limited medical conditions.

**Tier 2: 1.5ATA - 2.4ATA**

- Tier 2 are ‘mid-range’ chambers where the protocols are greater than 1.5 ATA (5-12m depth) using 100% Oxygen or high flow (20-30 LPM) medical grade Oxygen concentrations (96%).
- Tier 2 chambers are typically 'hard' chambers - non-hospital, free standing clinics.
- The International Hyperbaric Medical Association (IHMA) recognises over 70-conditions at higher pressure protocols. [https://www.oxymed.com.au/hyperbaric-international-conditions](https://www.oxymed.com.au/hyperbaric-international-conditions)
- Tier 2 pressures (2.0ATA using 100% O2) are required for stem cell mobilisation and cytokine gene expression inflammatory modulation. (Thoms et al, 2005).

**Tier 3: 2.4ATA – 3.0ATA**
- Tier 3 chambers are 'hospital' based where HBOT is provided at higher pressures for individuals suffering 'emergency' and 'life threatening conditions'.
- Medicare funding is restricted to 6-conditions under Tier 3.

**OXYMED Tier 2:**
- Stem cell mobilisation and cytokine modulation requires enriched Oxygen typically at Tier 2 protocols.
- HBOT increases dissolved Oxygen into the blood plasma 10-15-fold (1000-1500%).
- Normal blood plasma carries only 1-2% oxygen with red blood cells carrying approximately 98% oxygen.
- The effect of increased Pressure & Oxygen tension into the blood plasma has significant Epigenetic effects on immune modulation.
- The increased oxygenation causes the hypoxic (low oxygen) cells throughout the body to “wash-out”. Simply stated “Oxygen in – garbage comes out”.
- However, your current blood makers are only what is circulating and not what is trapped at a deeper cellular level. This is evidenced when we re-test your cytokine markers after the initial 60 hours of HBOT saturation and again at 120-hours. Typically, at 60-hours there is a “massive cytokine washout” (Oxygen in – garbage out).

**The human frame is Oxygen dependent:**
- Oxygen levels vary widely across the body and for each individual. For example, in healthy adult lung tissue the Oxygen concentration is about 15 percent, while the inner lining of the intestine is around 0 percent. The rate of aging and the impact of chronic autoimmune challenges means Oxygen levels at a cellular level will also vary dramatically.
- All drugs require Oxygen - poor Oxygen at a tissue level means treatment response to medications including chemotherapy, are inferior increasing the risk of side effects and further complications.
- If you are considering surgery, then consider Hyperbaric Oxygen therapy before and after surgery. This is common practise in the USA and many other countries. HBOT prior to surgery immediately raises circulating blood plasma Oxygen levels reducing the risk of hospital-based infections and secondary complications associated with surgery.
- Hyperbaric Oxygenation (HBOT @ 1.5-2.4 ATA using 100% O2) is considered safe and effective but also not without risk.
- The upper level of HBOT pressure adopted at OXYMED is Tier 2.
- HBOT is NOT promoted as a 'cure' but synergistic to 'orthodox' and 'complementary' treatments and therapies.
- HBOT is non-invasive.
- HBOT ‘reactivates the body’s immune system’ so it is able to target cells that are compromised or destructive - HBOT modulates immune responses.
- HBOT reactivates (jump-starts) mitochondrial respiration, function and regulation.
- Hypoxia is the lack of Oxygen at a cellular level resulting in mitochondrial (energy power house) dysfunction.
- Suppressed mitochondrial function due to hypoxia rapidly leads to an over-expression (excess production) of inflammatory cytokines, accumulation of toxic debris (apoptosis), altered DNA fragments inducing a host site for chronic opportunistic infections and cellular mutations (disease).
- HBOT promotes patient specific ‘homing’ bone marrow stem cell production, mobilization and circulation accelerating healing time.
- After 'cytokine wash-out' (herxheimer's reaction); HBOT down-regulates pro-inflammatory cytokines associated with autoimmune disorders.
- HBOT reduces chronic pain, edema and cellular degeneration.
- HBOT inhibits bacterial replication and hospital-based infections.
- HBOT accelerates regeneration by upregulating 'anti-inflammatory gene expressions' including vascular growth (VEGF) and brain derived neural growth factors (BDNF).
- HBOT promotes blood brain barrier function promoting antioxidant effects.
- Chronic pain syndromes improve due to the dramatic rise in the anti-inflammatory cytokines ie GMCSF (stem cell mobilisation), IL4 (reduces neuropathic pain syndromes), IL10, IL13, BDNF (brain derived neurotrophic factor), VEGF (vascular endothelial growth factor) etc.
- Anti-inflammatory cytokines are part of the immune’s capability to ‘stabilise and regenerate’ and part of the “innate gene expressions” – ‘releasing the power within’.

**Conclusion:**
- Hyperbaric Oxygen Therapy Effects Traumatic Brain Injury: Oxygen, Pressure & Gene Therapy (Harch) 2015
  'As many as 8100 genes were either up- or down-regulated over 24 h after a single exposure to HBOT'.
- Up~Regulated genes were primarily growth and repair hormones and the anti-inflammatory genes. Down~Regulated genes were the pro-inflammatory and apoptotic genes.
- HBO Up~Regulates the patient's own target specific Stem Cells [an 8-fold (800%) increase in circulating CD34+]•
- HBO enhances Mitochondrial function.
- HBO proliferates Vascular Endothelial Growth Factors (VEGF) & Brain Derived Neural Growth Factors (BDNF & GDNF).
- HBO reduces Telomeres degeneration and more ...
- HBO Down~Regulates toxic intra and extra cellular inflammatory Cytokines (IL1, 2, 6, 7, 8, 17), Tumour Necrosis Factor Alpha (TNFα), GlycA, S100B, chronic opportunistic Anaerobic (MRSA, VRE) and co-infections (Viral, Bacterial, Parasitic), Cell Sepsis and more ...

I trust this information will assist you with the challenges you face.

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The purpose of my life is to be 'complete', to live in God's Grace and Blessing, to lift the 'Spirit of Humanity' for myself and others. I am passionate with the vision that people of all nations will gain the opportunity to access the abundant benefits of Oxygenation – ‘the corner stone of HealthCare in the modern era’.