

MAPS – Costa Mesa Spring 2016

Applying Genetics in pediatrics- Dr Ben Lynch

www.seekinghealth.org

www.mthfr.net

epigenetic control is the more important piece than knowing every SNP
disease process alters how our genes function

his passion is pre-conception care

SAM/SAH ratio and low glutathione has increased chance for having an autistic child 70:1

Translational epigenetics is important to understand for pre-conception

- whatever mother and father are doing will translate to fetus

60% of pregnant women in America are obese

- babies often born with fatty livers as a result of this

inferior genetics are getting into the gene pool as we are encouraging babies to go full term that would not have typically survived without interventions

Cancer is not a noun.....it is a verb (it is a process)

Fatty liver is first sign of a metabolic shift from aerobic to anaerobic and this sets you up for cancer

There are fatty liver calculators online

Methionine is methyl-homocysteine

MTR (homocysteine to methionine)-

- supported by mB12, 5-MTHF and zinc, SAM, TMG
- inhibited by lead, mercury, NO, acetylaldehyde from yeast and alcohol, high SAM, TNF-alpha, nitrous oxide

to make SAM, methionine needs magnesium and ATP

Nitrous oxide: destroys B12 (now being given to women at birth to calm them during pregnancy). Also used often in dentistry. Giving mB12 and glutathione will offset the oxidation effect on B12

Lead stored in bones

Mercury stored in fats

C677T- mutation in how riboflavin binds to it (needs more B2)

A1298C- SAME doesn't bind to it very effectively (needs more SAME)

GAMT- linked with pain. Supported with creatine

Tyrosine- tough for someone with C677T and COMT/MAO-A issues to handle- gets irritable and mean

Mitochondria:

- all play off oxygen. Making sure someone is breathing properly is essential

breathing:

- inhale then count out loud as you exhale
- you need it to be 60-70 at least

Thousands of gallons of air we breath each day

Building a strong foundation:

- air filters
- water purifiers
- avoiding fragrance
- good nutrition

Heart Rate Variability is a great way to measure sympathetic tone and inflammation

- there are app's for your phone even

Life is 10% what happens, and 90% how you respond to it

Folic acid down-regulates folate binding proteins

Avoid:

- folic acid has to be avoided
- folic acid enriched foods avoided
- go off dairy
- reduce stress

dairy antibodies interfere with folate binding proteins (and stimulate antibodies against folate receptors)

they are starting to add folic acid now to corn

Eastern Washington is having an upswing in neural tube defects

Gut regenerates the lining every 7 days- this is a lot of DNA repair that is folate dependent

- someone with inflammatory bowel will have larger folate needs

85% of all methylation reactions occur in the liver

betaine: important for homocysteine recycling

- high in beets, lamb, quinoa

www.whfoods.org has some good food lists

DMG is feedback inhibiting and can lead to elevated homocysteine

TMG is not feedback inhibiting

Glutathione resulting in breathing attack after an IV:

SAMe trial:

- 250mg at night before bed (destroyed by stomach acid so has to be absorbed in mouth)
- if they fall asleep, you know their methylation cycle is working (helps convert serotonin to melatonin)

- if it keeps them up, then you know their methylation is not working well (mag and B6)- give niacin 50mg every 30 minutes for the reactions

For flares of over-methylation:

- niacin 50mg every 30 minutes

don't go too high on niacin- hard on liver and depletes methylation if too much (gram doses)

70-80% of SAM goes toward making:

- creatine (energy and ATP in muscle)
- phos choline (gallbladder support and bile)

10:1 phos choline to cholesterol for bile to get out of the gallbladder

gallbladder issues:

- underlying issue is methylation and phos choline needs

Early interventions:

- low doses phos choline (work up to finding effective dose) and creatine starting with 500mg up to 2500mg BID and having enough water (safer than giving SAME)- better if creatine is bound to magnesium
- this will help to conserve SAME
- Then later: B12, Methyl-folate, magnesium, zinc

GAMT is associating with no speech

- creatine can help

It takes 3 SAME to convert PEMT to phos choline

- estrogen stimulates this
- when women are menopausal, they may have more needs for PC

Quercetin can decrease the ability for your body to fight pathogens

mid-line defects and neural tube defects are methylation deficiencies (not just folic)

70% of pregnant women are deficient in folate

be careful about supporting methylation during cancer, but definitely support after once you know the cancer is gone

ha has videos on YouTube on what types of B12 to use

- methyl- methylated and easiest for body to utilize
- hydroxo- requires becoming methylated to work, but also lowers NO levels. Also supports hydrogen sulfide level binding (like with those with IBD or sulfur gas)
- adenosyl for mitochondria

body stores cysteine as glutathione

- cysteine is highly reactive (nitrogen)

high oxidative stress- these people may feel worse on high protein/high nitrogen diet. They may feel better on low sulfur diet and low protein

- over time the body will break down glutathione to form cysteine
- they may get breathing difficulties if on low sulfur diet prolonged due to hydrogen sulfide depletion

taurine- important for heart and mind

#1 reason for elevated familiar homocysteine is from a CBS defect (slowed down)

- glutathione and taurine levels will go down

glutathione peroxidase (for glutathione to reduce hydrogen peroxide) is dependent on selenium

- think of selenium for people who try glutathione without any benefit

you get a better yield when doing a provoked metal challenge when adding liposomal glutathione

glutathione negative reaction:

- headaches, asthma, feeling bad
- can be from negative feedback to GCL....results in more cysteine and more sulfites

sulfites:

- asthma, headaches
- people who react to these have slowed glutamate processing also
- supported with molybdenum and oxygen and water and supporting glutathione production
- slowed with arsenic
- Molybdenum dose 15-500mcg (higher if there are sulfate producing bacteria in the gut)
- More pain may come from glutamate

SOD: associated with ALS

- NRF2 helps
- Needs: manganese, copper, zinc

BH2 goes to IFN-gamma which then produces neopterin (see pathway at top middle of biopterin recycling)

He thinks it is important to test for H. pylori if there are positive antibodies against it

- it depletes NO and arginine
- can result in immunosuppression

95% of tryptophan goes down kynurenic pathway

- increased more during inflammation and stress (sucks up B6 like crazy)
- if this continues, you trigger immunosuppression and cancer

elevated quinolinic acid results in more NMDA
(think NMDA receptor antagonists)

tyrosine and 5-HTP can help during these times with sleep and depression

If 5-HTP doesn't help like it should, try adding B6 rather than increasing dose

Test anxiety, but good focus normally: think slowed COMT

- adaptogens can help
- focus good since dopamine levels stay high normal normally

kids that can't focus:

- they need more protein
- they need **more tyrosine**
- they crave sugar
- these kids likely have no defects in COMT which is why they are burning through dopamine

addictive behavior, constant need for new things

- they are craving dopamine
- help this with tyrosine and B6

arginine pathway:

- helps get rid of ammonia

arginine:

- helps make creatine
- if you take creatine, you will conserve arginine so it can do other things
- can help fight infections
- supports vasodilation
- H pylori depletes arginine levels
- Depleted with stress, infection or elevated catecholamines

Adaptogens are some of his favorites

- Withania
- Eleutherococcus
- Ashwaganda
- Holy basil
- Rhodiola
- Bacopa

Linked with auto-immunity:

- elevated putrescine, spermidine and spermine

Histamine metabolism:

- nausea, car sickness are both related to high histamine
- linked with DAO enzyme
- if a woman is histamine intolerant (nausea, sea sickness)- you know she has a methylation defect (methylation helps break down histamine)
- Treatment: reduce histamine containing food and drinks (red wine, protein)
- B6 dependent and folate dependent
- Support with: B2, making sure they have enough T4, zinc, vit C, niacin, B1, B6
- Some lactobacillus make a lot of histamine, so watch for this
- Bifidobacters don't contribute to histamine
- Focus is to heal the gut and balance gut pathogens
- Strawberries are high histamine and so is pineapple and fruit juice
- Think of this with atopic dermatitis
- See frequent nosebleeds with elevated histamine
- Exercise induced asthma has to do with adenosine and histamine (support mitochondria, electrolytes and histamine support)

Blood histamine levels are not good, since it has a half-life of 1 minute

Urinary histamine is reflective of histamine from the gut only

Folates:

- reduced folates are what the body uses
- folinic acid and methyl-folate are the only reduced forms as supplement
- otherwise green leafy
- he likes using both folinic and methyl-folate
- folinic: acid supports DNA base repair and cell replication
- methyl-folate supports methylation
- folinic acid is good for hair loss during chemo

#1 nutrient deficiency caused from chemo is niacin

- this is in the bone marrow
- leukemia is a common secondary cancer after cancer treatment likely for this reason

GAPS and Paleo diet are high histamine and so are fermented foods

Low ferritin- think low oxygenation

Cravings:

- 5-HTP and tyrosine can help

Valerian added to light bulbs and be nice as a calming effect on home (some vets do this)

One day fast can help to re-set the palate for healthier food

Tyrosine:

- if it gives them a headache they are likely low in glutathione
- go slow and infrequent if they have COMT concerns

elevated glutamine on labs.....think ammonia (gets broken down to glutamine)

40% of body's ATP at rest is used to shuttle magnesium and electrolytes

hydrogen peroxide levels in the brain increase with stress

- he thinks nebulizing glutathione is essential

difficulty waking up in the morning: NADH first thing in the morning away from food. Can also be good before sports

Metabolomics and the Measurement of Environmental Triggers of Childhood Disease- Dr Robert Naviaux

Specialist in mitochondrial disease

The deeper you get into genetics, the more you turn to metabolism for answers

Diseases rising 2-10 fold since 1980's

30% children born today suffer with chronic disease

1988 earth reached max capacity to provide resources for population

we now have over 1 billion more people living tapping beyond those resou

Purine metabolism was the top pathway associated with autism (also impacts methylation)

Metabolomics will soon offer a chem 500 and Toxicomics Tox 500

Biochemical genetics is the specialty that come up with newborn genetic screening

- there has been a lapse of new doctors getting trained in this in the last 30 years

NextGen metabolomics (NGM) sequencing is what he is referring to

They are looking for anti-purinerbic products- likely rainforest herbs not yet discovered

Anju Usman- Genetics, etc

Important: methyl-rich pre-conception diet also rich in choline

Women not taking a pre-natal in the 3 months before and 1st month of pregnancy are more likely to have an autistic child

Homozygous COMT mom's are 70% more likely to have a child on the spectrum

- that methyl group comes from methyl-folate and SAME

Methylation defects results in impairments in redox/oxidation and detox abilities

Genes she looks at:

- COMT 2 main ones
- MAO-A (warrior gene)
- MTHFR
- CBS
- MTRR

MAT gene is mitochondrial related and needs for magnesium as a co-factor

Giving enough of the co-factors will overcome the gene polymorphism

MTR and MTRR:

- mB12 is helpful to overcome these blocks

MTHFR:

- if weak, we don't make enough of our main methyl donor
- can get miscarriages from coagulation issues
- niacin is helpful as well as folic avoidance
- take a combo of methyl-folate and folinic

COMT:

- is weak (+/+), methyl groups aren't used up as well and can get a build up of methyl
- these patients may be very sensitive to methylation
- clean up environment and gut first
- catecholamine-O-methyl transferase
- they also tend to have issues with histamines
- these are phenolic structures that will accumulate
- the patient may also have amine (histamine) and phenol issues

- get anxiety, attention issues, rages and hyperactivity
- these are her toughest kids to treat
- be careful with quercetin, curcumin, green tea, phenols, methyl donors, environment, histamine

MAO-A warrior gene

- associated with anger or aggression
- progesterone upregulates both this and COMT (helpful)- help with mood
- be thinking adrenals (they convert pregnenolone to progesterone, DHEA, aldosterone, cortisol)
- she likes adaptogens for this
- associated with anxiety also

she likes to rotate adaptogens and anti-microbials for the gut

caution: some herbs are high phenolic and high oxalate

she is using pregnenolone and adaptogens with good results

caution with rhodiola- it can upregulate epinephrine

caution with licorice- it can increase cortisol by decreasing cortisol T1/2 and so need to avoid at night and avoid in those with high cortisol

- it is soothing for the gut lining

CBS: cystathione beta synthase

- if gene is defective it is often up-regulated
- up-regulation results in:
 - homocysteine drops
 - hole in the methylation bucket
- B6 is an important co-factor that will up-regulate glutamate to GABA, but could also up-regulate this gene even more, so be careful
- Activity is also increased/up-regulated with inflammation, SAME and TNF-alpha and so does vit D
- Testosterone decreases CBS activity
- Converts cysteine to hydrogen sulfide

She refers often to Dr Dieth

Phospholipid methylation:

- important for membrane fluidity
- methylation of phospholipids leads to membrane fluidity
- better flow of nutrients happens this way

Down Syndrome:

- CBS sits on chromosome 21 and they get a big up-regulation

Normalization on one study by Jill James in 3 weeks of methylation labs:

- folinic 800mcg BID
- mB12 shots
- TMG

NOS: result is low arginine to NO and get a lack of vasodilation

SOD1 in cytoplasm

SOD2 in mitochondria

SOD3 is extracellular

Needs for copper, zinc and manganese

SOD is a powerful anti-inflammatory when working properly

Dose for cerebral folate deficiency:

- 0.5-2mg/kg/day (Rx Leucovorin can be compounded to avoid lactose)
- folinic is the non-methylated active form
- 5-MTHF is the methylated form that is the most active

clean environment, diet, gut and open pathways a bit to start with

B vitamins or antioxidants for phase 1 detox

B6, P5P, B1, biotin, molybdenum

Glycine

Taurine

Epsom salt baths

DMG, TMG, SAM, mB12, folinic, methylfolate

Glutathione conjugation- glutathione, NAC, selenium, milk thistle

Glucuronidation support w/ cal d-gluc

NAC:

- she likes it nebulized for sinusitis and lung issues
- Mucomist is used in ER for Tylenol overdose
- Dose 1.2-2.4grams/day
- Also good for hyperinsulinemia

Neurology: Dr. Schneider

20% of the autistic kids have macrocephaly (mainly white matter growth that myelinates between age 1-2)

6 layers of the neocortex involved in thinking

- there are clear changes in this in ASD

BBB:

- endothelia needs many mitochondria for energy dependent transport

if someone has a leaky gut, assume they have a leaky BBB

- when this occurs, normal amounts of yeast or clostridia or other organisms that would not be a problem for a healthy person become a major issue

Area postrema has a high density of dopamine receptors and toxins here induce nausea and/or vomiting and gets feedback from vagal nerve

Prefrontal cortex concerns:

- lack or dulling of emotions
- inability to make decisions
- guilt, shame, compassion, responsibility
- our moral compass

Caudate Nucleus involved especially with PANDAS

Nucleus Accumbens:

- all addictions involved here
- dopamine and opiod pathways (reward neurotransmitters)
- self- stim behaviors are likely a part of this also

problems in basal ganglion:

- anxiety or panic attacks
- tics that come and go
- bruxism (caudate nucleus)
- phobias
- poor temp regulation
- big startle reflex
- resting tremor
- stuttering
- shuffling gait
- perspiration when waking
- low motivation

She suspects we will see Parkinsons early onset with many of the autistic children, since it is problems in the same area

Stuttering: often a mB12 deficiency

B12:

- brain levels found to be at least 3 times lower in almost all testing ASD kids compared to controls
- oral absorption is less than 2% with a healthy gut and less in unhealthy gut
- she always starts with mB12 as injections (even if not showing peripheral deficiency, since brain transport is likely compromised)
- she often goes higher than Neubrandner's suggestions and will go up to daily
- she may even start with EOD injection dosing, especially if there is a disrupted gut

glutathione levels also found to be low in brain measurements

visit 1:

- she runs labs and sometimes will start B12 shots while waiting on results

Physical:

- she tries to get head circumference on all kids each visit

histamine:

- acts as a neurotransmitter
- inflammatory chemicals have easy access to the brain
- she sees more seizures in the Spring that she thinks is from allergies promoting brain inflammation

she doesn't put much credit to a spot urine neurotransmitter levels (she doesn't think it is reflective of true brain values)

if she sees tyrosine deficiency she assumes they can't make dopamine
 if she sees low tryptophan, she assumes concerns with serotonin
 she always runs a fasting blood amino acid panel for this reason

Clinical Pearls:

- she always assumes there is brain inflammation if there is abnormal behavior
- assess everyone for nutritional deficiencies

What she screens for:

- toxicity: RBC mineral and toxin levels
- nutritional deficiencies

Gives them:

- mB12
- glutathione IV when manic or other concerns
- MTHF-folate if tolerated

If she sees a mid-line defect (heart defect, cleft lip, hypospadias) or high arched palate, she assumes there is a methylation problem

Carbs or loaded with synthetic folic acid

This plugs the receptors for folate to limit brain absorption

She doesn't love pharmaceutical folates since they are full of dyes and corn and casein and others

High sarcosine levels on labs show big needs for methyl-folate

Flat affect, depression:

- these people need high MTHF-folate support and help making dopamine

folate doses:

- 40lb child start 500-1000mcg daily divided and work up

Kids with ADD:

- clean up diet
- methylation support

precursors for dopamine that can be helpful:

- tyrosine
- B6

B12 helps you make glutathione

You have to address the gut and diet first before being aggressive with B12 or you will trigger them

Neurotransmitters- Anju Usman (Dr Frye's lecture)

Acetylcholine- excitatory or inhibitory

Excitatory biogenic amines:

- dopamine
- noradrenaline
- serotonin (can be excitatory and inhibitory)

amino acids:

- GABA- inhibitory
- Glutamate (see excitatory repetitive behaviors)
- Glycine- inhibitory

Seeking rewards and pleasure: think dopamine

OCD behaviors: serotonin, dopamine (SSRI's may help)

Cunningham Panel:

Dopamine receptor 1 related to OCD

Dopamine receptor 2 related to tics

BH4:

- BH2 generates to BH4 as folate cycle moves properly
- Converts tyrosine to dopamine and tryptophan to serotonin
- Pushing methylation may bring levels up

If on amino acid tests you have high tryptophan and tyrosine, you have to think BH4 is not being produced properly

NOS:

- will have issues recycling BH4 and will have urea cycle issues and elevated ammonia
- arginine also not getting converted to citrulline and get more oxidative stress from peroxynitrite (microglial brain excitation)
- likely they are hyper and can't sit still

COMT

- breaks down catecholamines (serotonin, dopamine, NE)
- these kids with concerns here can get over-stimulated easily

MAO-A :

- issues breaking down serotonin
- helped with pregnenolone to up-regulate GABA receptors
- Warrior gene- fight for what you believe in, but some anxiety and aggression can also happen

ONO: peroxynitrite that is excitatory/oxidative stressor

CSF:

- if doing this also test for BH4 levels

Kuvan is the BH4 drug used for PKU (helps convert phenylalanine to tyrosine)

- could get coverage if there is confirmed CSF BH4 deficiency also possibly

Methylphenidate:

- short term help with dopamine attention and reward
- long term studies not showing them to be helpful

MTR and MTRR:

- extremely important with attention
- related to copper, aluminum, lead, mercury
- related to phospholipid metabolism
- Richard Dieth has spoken on this lots
- Also important to those very sensitive to lead (leads to lead retention)

Attention issues: always check for lead

Irritability and behavior:

- Respiradol
- Abilify
- Both are anti-dopaminergic (block release of dopamine through synapse)

Strattera (atomoxetine):

- NE reuptake inhibitor
- Helps mainly with hyperactivity

Propranolol:

- down-regulates noradrenergic activity and get better focus
- for performance anxiety, PTSD, migraines prophylaxis, test anxiety
- good for COMT +/- and MAO-A concerns
- helpful for aggression and self-injurious behaviors as well as Graves

Guanfacine/Intuniv:

- can be used for tic disorders and PDD
- alpha agonist
- for hyperactivity, impulsivity, inattention
- well tolerated and very little BP or HR effect
- can help with insomnia also

SSRI's:

- for sleep, mood and behavior
- improvements in social and language
- can help with OCD
- may help with neurogenesis (consider with Down Syndrome)

NMDA receptors:

- magnesium is the gate for this
- stimulated by glutamate or even glycine (may see excitatory response paradoxically in some kids)

Namenda: blocks the glutamate receptor

Dextromethorphan also acts as an NMDA receptor antagonist

Chlortrimeton (anti-histamine) also has an NMDA effect

Help for OCD/PANDAS flares:

- chlortrimeton
- benedryl

PANDAS/PANS:

- for acute regression you have to figure out what the trigger was
- often goes along with handwriting change and poor bladder control
- infection, chemical, histamine/allergen
- CAM kinase that upregulates tyrosine hydroxalase to get an up-regulation of dopamine and production of antibodies against dopamine re-uptake
- Histamines play a huge role in this
- Thoughts are working to support calcium channel genes (maybe calcium channel blockers, lithium, magnesium , vit K)

Kynurenine and quinolinic acid are very stimulating and trigger inflammation

- problems with tryptophan metabolism
- can be by-passed with 5-HTP

yeast is phenolic

phenols block dopamine to NE

getting bugs (and hence phenols and benzoic acid) under control, will help with phenylalanine and dopamine metabolism

L. Rhamnosus probiotic helps with GABA receptors in the brain

Glutamine → ammonia and glutamate (be careful)

Acetylcholine:

- inhibitory and controls parasympathetic nervous system

damaged vague nerve:

- results in gut and brain inflammation in rat studies

up-regulating parasympathetics:

- Phos choline, Phos serine, methylation support lecithin, galantamine or other acetylcholinesterase inhibitors
- Piracetam

Suzanne Goh- Seizures in ASD

Seizure disorder:

- 2 unprovoked seizures triggered by an unknown cause (no illness, etc)

steriotopy:

- things like hand flapping as a result of emotional excitement

tics: often happen more when child relaxes

frontal, cental or temporal are mainly epileptiform areas

EEG reflects mainly the cortex

Mutations in BCKD-kinase linked with treatable form of autism with epilepsy

- treatment is dietary with certain amino acids leucine, iso-leucine and valine

Cerebral folate deficiency:

- not common to run a CSF level
- genetic testing
- tests for antibodies to folate receptors

levotiracetam SE's can be avoided if giving 100-200mg pyridoxine with it

In general, valproate should be avoided in the ASD population (mitochondrial damaging)

Complex partial seizures are the most common

Watch for elevated markers of mito needs:

- creatine kinase
- ammonia
- pyruvate or lactate
- LFT's mildly

Diets that are helpful:

- low glycemic index diet
- ketogenic
- modified Atkins

NeuroInflammation- Rossignol

rossignolmd@gmail.com

He is no longer doing many spinal taps anymore

Link to moms with auto-immunity and ASD kids

ANA positive in 20% of kids on spectrum- correlated with more severe autism

Washington university in St Louis runs auto-antibodies to brain Landau-Kleffner

- regression of speech
- responds to steroids
- 2 month turn-around time
- he orders this if there is a speech problem not improving, seizure activity suspected and positive ANA

Anti-Inflammatory treatments:

- minocycline- inhibits microglial activation and being used in Parkinsons. 1.4mg/kg or higher
- Naltrexone
- Celecoxib
- Pentoxifylline
- Memantine (Namenda)
- Spironolactone- SE may be constipation, anti-androgen

Naltrexone: he goes up to 1-2mg/kg/day in psychotic kids

Vit C with mino can help to prevent the tooth staining in kids

- it stains the secondary teeth that have not descended

pulsing high dose prednisone once a week (10mg/kg/week)

good article cited on why IVIG may be helpful and the immune effects it is having

Other:

- HBOT
- IVIG
- Prednisone pulse
- Curcumin
- Fish oil
- Vit D
- Resveratrol
- Probiotics

Rossignol likes these anti-histamines:

- ketotifen
- singulair
- hydroxyzine
- quercetin
- luteolin
- pycnogenol

Speech helpers:

- he is working on a publication discussing different treatments that are symptom specific

Cases:

Lucia:

- Anti-folate receptor antibodies: iliad lab is running this
- MECP2 is Rett testing

If you suspect folate antibody issues eliminate all dairy

Elevated branch chain amino acids in relation to others – think P5P deficiency

BH4 levels she is getting from Genova (but she is not running them now)- most results will be abnormal so why run it

Schneider is in Phoenix (Neurologist)

Seizures:

- P5P
- Taurine
- Mag taurate
- Mag threonine
- Glutathione suppositories
- Medical marijuana CBD

Glutathione IV's:

- she would do 200-400mg for a small child like this (22 months old) as a slow push over minutes

Case: Rossignol, not in our materials

- 25 yr old male from Venezuela
- aggressive and hitting self in chest
- scope found esophagitis and aggression stopped with treatments
- scope saw yeast
- EEG relatively normal but saw slowing

Improve myelination:

- B12
- Fatty acids

Neurosensory concerns:

- heavy metals unless proven otherwise
- myelin support
- B12
- Fatty acids
- Magnesium
- Chelation
- Glutathione
- Calming supplements

Speech:

- L-carnosine 500mg once daily or more
- B12 shots
- Leucovorin/folinic acid or methyl-folate- he still aims for 2mg/kg (generic leucovorin is covered by insurance but does contain lactose)

Panel he runs: fasting in the morning

- CBC
- TSH
- Ferritin
- Mag
- Vit D
- Chol
- CMP
- Carnitine
- Lactic acid
- Creatine kinase
- Alanine (in aa, look for it being high)
- Acylcarnitine profile
- Lead
- ANA
- RBC zinc
- CRP
- Plasma amino acids
- He often does a folate receptor antibody test also
- Others to consider: copper, RBC magnesium, homocysteine

Low glutathione drains homocysteine down

IV he did: (5 OVER 3 weeks)

- vit C 2000mg
- GSH 900mg
- NAC 600mg (10mg/kg)
- CaEDTA 800mg (10-20mg/kg)
- DMPS 100mg (2mg/kg)
- Infused over 3-5 minutes

HBOT 1 hr a day up to 6 days a week right after the IV

- starts at 1.5atm with 100% oxygen
- if seizures start at 1.3 with no added oxygen
- may go up to 1.75 or 2.0atm for 75 min total, 60 min at pressure

he sometimes uses oral versed for sedation for IV's

carnitine SE's:

- loose stools
- stimmy

enzyme that breaks down carnitine is B2 dependent

- if kids get fishy with carnitine think 100-200mg B2 and treating clostridia also alanine over 450 thinks mito issue

glutamic acid normal up to 97 (if high think elevated glutatmate and needs for taurine, NAC, Namenda, Glutamate antagonists)

folate receptor antibody being positive:

- give active forms of folate
- remove dairy
- treat mito dysfunction
- if there is no antibody, this does not exclude CFD

Cases:

Usman- Mito/metals

Whole blood lead level only for 20 day time period

Magi noodles are common in India and contaminated with lead like crazy

Signs of mito issues:

- ophthalmoplegia
- facial myopathy
- drooling
- exercise intolerance
- muscle weakness
- fatigue
- hypotonia

Morova Criteria for mito dysfunction to rate if mito issue is likely or not

Her eval of mito function:

- ammonia

- lactic acid
- pyruvic acid
- ck
- plasma aminos (for ala/lys to make sure it is less than 2.5)
- acyl carnitine
- buccal swab for complex 1 and 4 and citrate synthase mjgoldenthanl@gmail.com \$250
- carnitine
- if AST is 2.2 times or more the ALT it is a soft sign
- OAT testing (elevated suberic and adipic)

High carb diet will put more stress on mitochondria

Yeast may also be a factor since it interferes with carb metabolism

Mito tests are best to do when they are sick or after exercising or some stressor

Support mito function: United mitochondrial disease organization has specific guidelines

- B1 B2, B3 5mg/kg/day
- Antioxidants:
 - glut
 - ALA
 - coQ10
 - E
 - K
 - D
 - Biotin 5-20mg/day
- L-carnitine (50-100mg/kg/day)
- Ribose
- creatine
- She also does a multi-mineral and multi-enzyme

Brocca's area has the highest need for creatine (Speech)

Carnitine deficiency associated with apraxia

She has done trials with carnitine up to 5gm TID

Pathway dependent on SAME

Other options to consider:

- PQQ 10mg BID is a common dose
- Galactose (my suggestion)
- T3 works on mitochondria (Erica Pearson writes on this for Down specifically)

Down syndrome kids have lots of mito issues- PQQ can help with them specifically

Rossignol is finding 1/3rd of the kids are positive ANA

UBI he is using 78 gamma

He suggests 20 gauge needle to avoid hemolysis

Lower gamma is more for promoting growth and healing

Ozone upregulates the NAD/NADH levels to help with mitochondria

Gardasil damage- thought to be related to B1 deficiency possibly

1/4mg-10mg/kg/day CBD dose for seizures (you want one with 0.5-1% THC)

- Cannavest
- CWbotanicals
- Go slow and lower doses tend to be better

Guanfacine time released can help get around the fatigue/sedation effect with it

Fish tapeworm:

- Niclosamide is drug of choice
- He found this flaring Webber-Christian Disease symptoms and the med pulsed helped keep it in remission

He likes nitazoxanide for clostridia

Good test for parasites:

- Eko University of Medicine and Health Sciences in Nigeria
- drwilcoxofficemanager@gmail.com or call Dave at 505-771-4998
- lab run by Hamed Ibraheem
- specimens submitted to Dr Glenn Wilcox in Albuquerque to arrive on a Tuesday
- can run on stool, saliva, urine and semen
- cost is \$350-\$400 depending on sample

Niclosamide:

- a salicylate antiparasitic
- also anti-inflammatory
- benefits in multiple cancers (targets the tumor suppressor gene)
- benefits DM2 due to mitochondrial uncoupling

He thinks parasites when B12 or folate continue to run low despite supplementation

It does cause nausea

- 2000mg once a week
- has to be compounded

Alinia:

- 500 BID 7 days on, 7 days off
- he is liking this a lot for clostridia and everything else

The Portland ND has a Canadian source of Alinia for \$1 per pill

Cunningham panel:

Anti-dopamine antibodies are molecular mimicry (in theory need this elevated for PANDAS diagnosis)

Cam Kinase elevation is auto-immunity

Anti-tubulin

CD 16/56 are cells that are ready for battle (should be 300-400)

CD 57+3-= killer cell count should be over 100 (suppressed by viruses and Lyme)

Babesia is a protozoa

Coartem- 2 caps BID, 3 days every 2 weeks

Zithromax (not on the same day) 250mg 4 days a week)