Navigating Resistant SIBO with Precision Medicine

Optimizing Gut Health

Presented by Amy Rolfsen, ND

Big Take-Home Messages

- SIBO is not the only cause of bloating
- SIBO is rarely an isolated phenomenon
- If SIBO is relapsing, look deeper

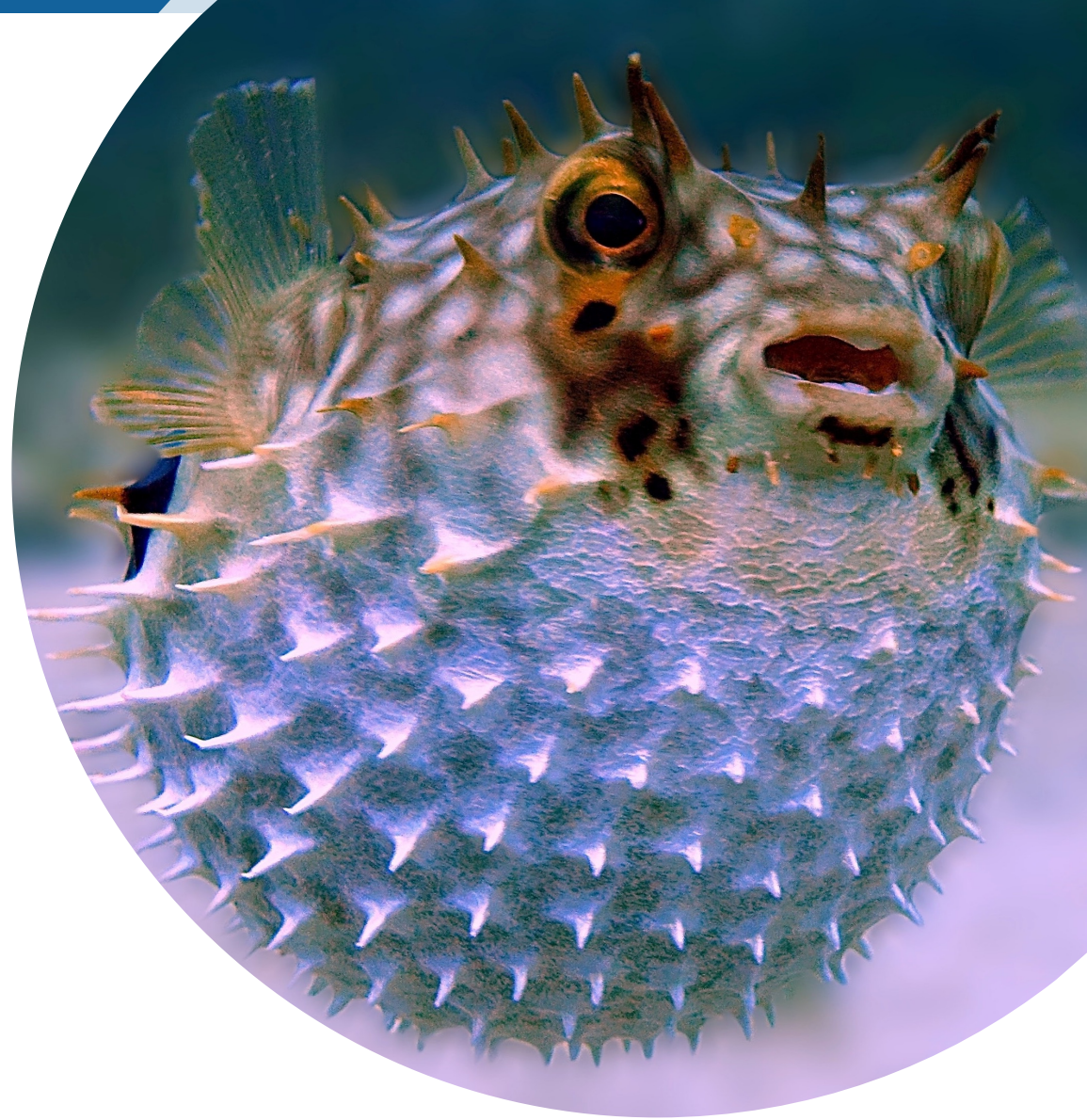
Let’s talk about …

Why SIBO is so challenging

- What can mimic SIBO?
- What can complicate SIBO?
- Use stool testing to understand SIBO
- Other considerations

What can mimic SIBO?

- Gas
- Bloating
- < complex carbohydrates
- Abdominal pain
- Loose stools
- Constipation
- Extraintestinal symptoms



Symptom Overlap

Disease	Symptoms
Bile-acid malabsorption	Diarrhea, urgency
Exocrine pancreatic insufficiency	Abdominal discomfort, bloating, diarrhea, greasy stools
Carbohydrates intolerance	Abdominal discomfort, bloating, diarrhea
Small intestinal bacterial overgrowth	Abdominal discomfort, bloating, constipation, diarrhea, distention, sensation of incomplete evacuation, urgency
Small intestinal fungal overgrowth	Abdominal discomfort, bloating, diarrhea, distention, urgency
Dyssynergic defecation	Abdominal discomfort, bloating, constipation, diarrhea, distention, sensation of incomplete evacuation, straining, urgency
Ehlers-Danlos syndromes-hypermobility type	Abdominal pain, bloating, constipation, distention, sensation of incomplete evacuation, straining, pelvic floor dysfunction
Mast cell activation syndrome	Abdominal discomfort, bloating, dynamic allergies, diarrhea, distention, sensation of incomplete evacuation, urgency
Eosinophilic gastroenteritis	Abdominal pain, bloating, diarrhea
Intra-abdominal adhesions	Abdominal pain, bloating, distention
Irritable bowel syndrome	Abdominal discomfort, bloating, diarrhea /constipation, distention, sensation of incomplete evacuation, urgency
Celiac disease	Abdominal discomfort, bloating, diarrhea
Giardiasis	Abdominal discomfort, bloating, diarrhea

Barros, L. L., Farias, A. Q., & Rezaie, A. (2019). Gastrointestinal motility and absorptive disorders in patients with inflammatory bowel diseases: Prevalence, diagnosis and treatment. *World journal of gastroenterology*, *25*(31), 4414–4426. https://doi.org/10.3748/wjg.v25.i31.4414

What can Complicate SIBO?

- Co-infections
- GI ecology imbalance
- GI conditions
- Non-GI medical conditions
- Bacterial products (histamine, biofilm etc.)
- Motility disturbance
- Visceral hypersensitivity

Using stool testing to understand SIBO

Look for:

- Common SIBO organisms
- Common SIBO signs
- Co-infections
- Other considerations

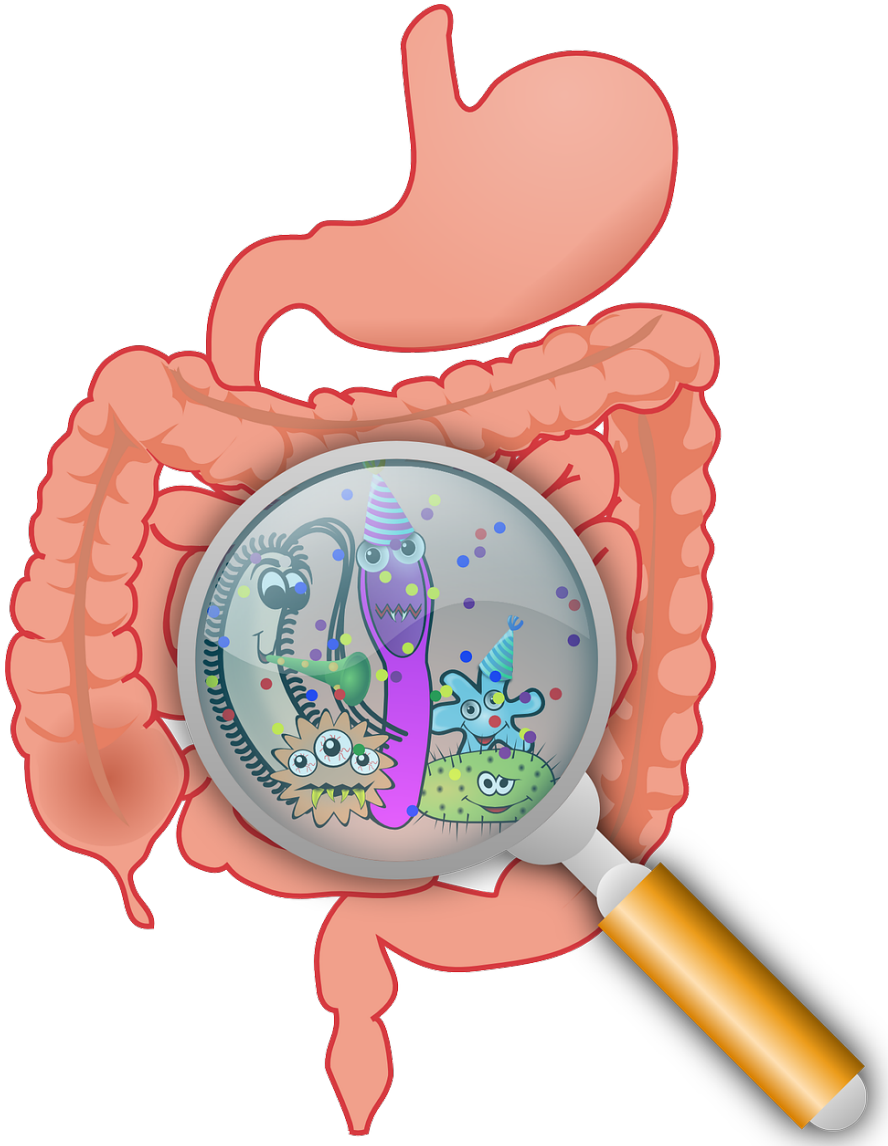
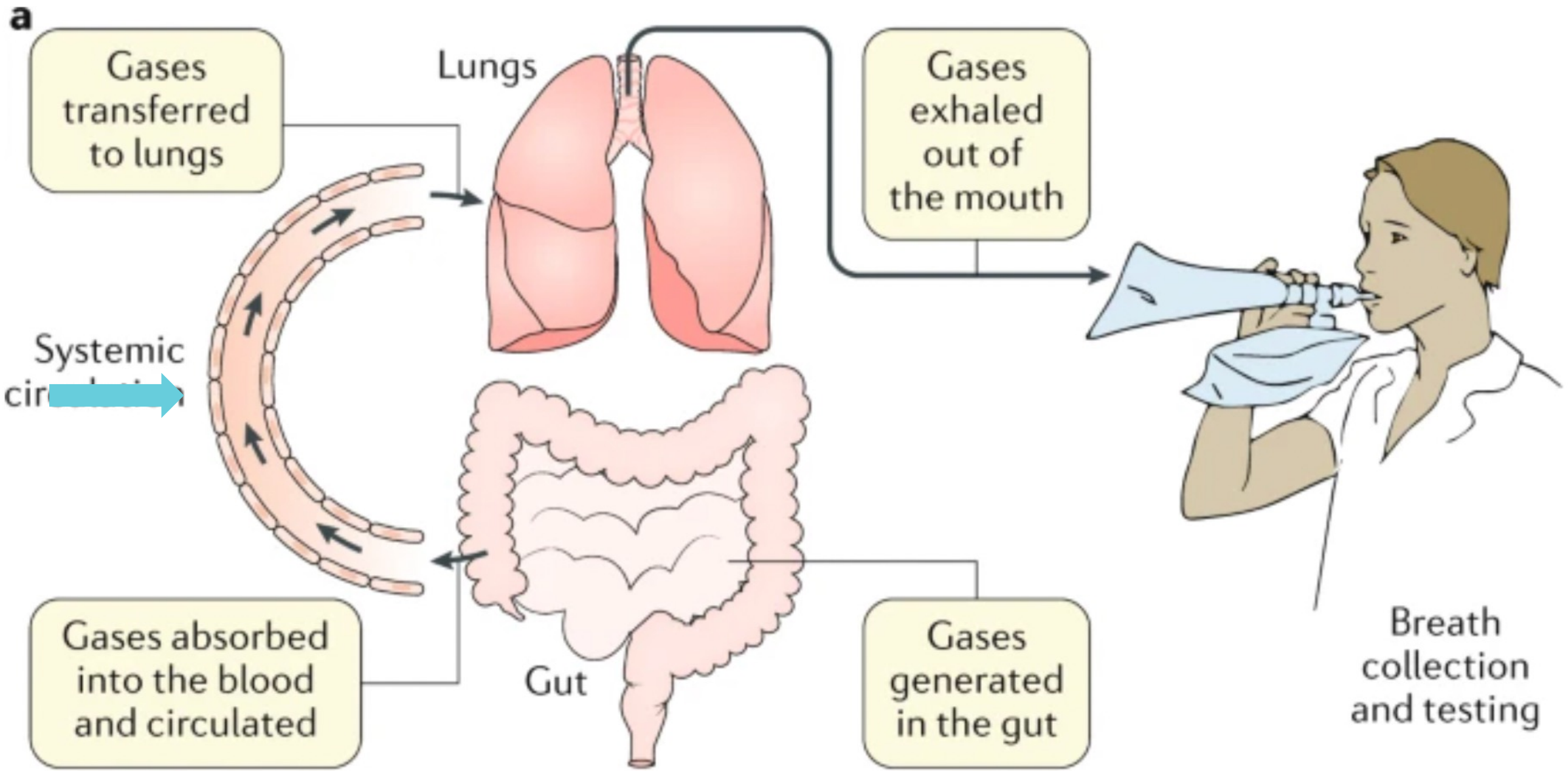


Fig. 5: Breath testing for gut gases.



Kalantar-Zadeh, K., Berean, K.J., Burgell, R.E. *et al.* Intestinal gases: influence on gut disorders and the role of dietary manipulations. *Nat Rev Gastroenterol Hepatol* **16,** 733–747 (2019).

Common SIBO organisms

Hydrogen Producers

Normal Bacterial Flora			
	Result		Normal
Bacteroides fragilis	**3.29e11**	**High**	1.60e9 - 2.50e11
Bifidobacterium spp.	**7.28e11**		>6.70e7
Enterococcus spp.	**5.12e8**	**High**	1.9e5 - 2.00e8
Escherichia spp.	**2.47e7**		3.70e6 - 3.80e9
Lactobacillus spp.	**6.24e7**		8.6e5 - 6.20e8
Clostridia (class)	**7.58e7**	**High**	5.00e6 - 5.00e7
Enterobacter spp.	**1.23e7**		1.00e6 - 5.00e7
Akkermansia muciniphila	**<dl**		1.00e1 - 5.00e4
Faecalibacterium prausnitzii	**2.16e6**		1.00e3 - 5.00e8
Phyla Microbiota	Result		Normal
Bacteroidetes	**8.53e12**	**High**	8.61e11 - 3.31e12
Firmicutes	**9.90e11**	**High**	5.70e10 - 3.04e11

Common SIBO organisms

Hydrogen Producers

Opportunistic Bacteria			
Additional Dysbiotic/Overgrowth Bacteria	Result		Normal
Bacillus spp.	**2.95e5**	**High**	<1.50e5
Enterococcus faecalis	**7.38e4**	**High**	<1.00e4
Enterococcus faecium	**4.03e3**		<1.00e4
Morganella spp.	**2.54e5**	**High**	<1.00e3
Pseudomonas spp.	**3.13e6**	**High**	<1.00e4
Pseudomonas aeruginosa	**1.09e4**	**High**	<5.00e2
Staphylococcus spp.	**1.92e6**	**High**	<1.00e4
Staphylococcus aureus	**2.46e4**	**High**	<5.00e2
Streptococcus spp.	**1.85e4**	**High**	<1.00e3
Methanobacteriaceae (family)	**9.89e9**	**High**	<5.00e9

Botanicals/Neutraceuticals For:

Hydrogen-Producing Organisms

- Berberis/coptis
- Usnea
- Ginger
- Garlic
- Black cumin seed
- Wormwood
- Oregano

Common SIBO organisms

Methane Producers

Opportunistic Bacteria			
Additional Dysbiotic/Overgrowth Bacteria	Result		Normal
Bacillus spp.	**2.95e5**	**High**	<1.50e5
Enterococcus faecalis	**7.38e4**	**High**	<1.00e4
Enterococcus faecium	**4.03e3**		<1.00e4
Morganella spp.	**2.54e5**	**High**	<1.00e3
Pseudomonas spp.	**3.13e6**	**High**	<1.00e4
Pseudomonas aeruginosa	**1.09e4**	**High**	<5.00e2
Staphylococcus spp.	**1.92e6**	**High**	<1.00e4
Staphylococcus aureus	**2.46e4**	**High**	<5.00e2
Streptococcus spp.	**1.85e4**	**High**	<1.00e3
Methanobacteriaceae (family)	**9.89e9**	**High**	<5.00e9

Botanicals/Neutraceuticals For:

Methane-Producing Organisms

- Garlic
- Oregano
- Manage hydrogen-producing organisms

Common SIBO organisms

Hydrogen Sulfide Producers

Escherichia spp.	**1.43e10**	**High**	3.70e6 - 3.80e9
Morganella spp.	**2.54e5**	**High**	<1.00e3
Pseudomonas spp.	**3.13e6**	**High**	<1.00e4
Pseudomonas aeruginosa	**1.09e4**	**High**	<5.00e2

Potential Autoimmune Triggers	Result		Normal
Citrobacter spp.	**<dl**		<5.00e6
Citrobacter freundii	**8.62e5**	**High**	<5.00e5
Klebsiella spp.	**2.02e5**	**High**	<5.00e3
Klebsiella pneumoniae	**1.61e4**		<5.00e4
M. avium subsp. paratuberculosis	**<dl**		<5.00e3
Prevotella spp.	**1.90e6**		<1.00e8
Proteus spp.	**4.31e7**	**High**	<5.00e4
Proteus mirabilis	**1.75e8**	**High**	<1.00e3
Fusobacterium spp.	**7.56e6**		<1.00e8

Botanicals/Neutraceuticals For:

Hydrogen Sulfide-Producing Organisms

- Berberis/coptis
- Wormwood
- Ginger
- Garlic
- Thyme
- Oregano
- Rosemary
- Neem
- Black cumin seed
- Manuka honey
- Biofilm management

Common SIBO Signs

Low normal flora

Normal Bacterial Flora			
	Result		Normal
Bacteroides fragilis	**2.01e10**		1.60e9 - 2.50e11
Bifidobacterium spp.	**2.46e10**		>6.70e7
Enterococcus spp.	**1.80e4**	**Low**	1.9e5 - 2.00e8
Escherichia spp.	**9.00e7**		3.70e6 - 3.80e9
Lactobacillus spp.	**1.15e6**		8.6e5 - 6.20e8
Clostridia (class)	**3.15e5**	**Low**	5.00e6 - 5.00e7
Enterobacter spp.	**3.41e5**	**Low**	1.00e6 - 5.00e7
Akkermansia muciniphila	**3.47e4**		1.00e1 - 5.00e4
Faecalibacterium prausnitzii	**3.86e2**	**Low**	1.00e3 - 5.00e8
Phyla Microbiota	Result		Normal
Bacteroidetes	**2.04e11**	**Low**	8.61e11 - 3.31e12
Firmicutes	**1.31e9**	**Low**	5.70e10 - 3.04e11

Botanicals/Neutraceuticals For:

Normal Flora Support

- Manage dysbiosis
- Manage inflammation
- GI repair
- Plant-forward high-fiber diet
- Fermented foods
- Time restricted feeding
- Polyphenols
- Butyrate
- Ω3 fatty acids
- *Lactobacillus*
- *Bifidobacteria*
- *Bacillus*
- *S. boulardii*

Common SIBO Signs

Low digestive capacity

Intestinal Health			
Digestion	Result		Normal
Steatocrit	**7**		<15 %
Elastase-1	**147**	**Low**	>200 ug/g
GI Markers	Result		Normal
b-Glucuronidase	**2615**	**High**	<2486 U/mL
Occult Blood - FIT	**0**		<10 ug/g
Immune Response	Result		Normal
Secretory IgA	**398**	**Low**	510 - 2010 ug/g
Anti-gliadin IgA	**44**		0 - 157 U/L
Inflammation	Result		Normal
Calprotectin	**3**		<173 ug/g

Botanicals/Neutraceuticals For:

Low Digestive Capacity

Short term:

- Digestive enzymes
- Ox bile
- HCl if indicated
- Food elimination
- Food hygiene

Long term:

- GI repair
- Stress reduction
- Continued food hygiene

Common SIBO Signs

Low gut immunity

Intestinal Health			
Digestion	Result		Normal
Steatocrit	**<dl**		<15 %
Elastase-1	**515**		>200 ug/g
GI Markers	Result		Normal
b-Glucuronidase	**2012**		<2486 U/mL
Occult Blood - FIT	**0**		<10 ug/g
Immune Response	Result		Normal
Secretory IgA	**115**	**Low**	510 - 2010 ug/g
Anti-gliadin IgA	**47**		0 - 157 U/L
Inflammation	Result		Normal
Calprotectin	**39**		<173 ug/g

Botanicals/Neutraceuticals For:

Gut Immune Support

Short term:

- Immunoglobulin
- Colostrum
- Immune stimulants
- Vitamins A, D, Zinc

Long term:

- Manage chronic infections
- GI repair
- Nutrient repletion
- Stress reduction
- Rule out selective IgA def.

Common SIBO Signs

Elevated ß Glucuronidase

Intestinal Health			
Digestion	Result		Normal
Steatocrit	**<dl**		<15 %
Elastase-1	**293**		>200 ug/g
GI Markers	Result		Normal
b-Glucuronidase	**2917**	**High**	<2486 U/mL
Occult Blood - FIT	**0**		<10 ug/g
Immune Response	Result		Normal
Secretory IgA	**716**		510 - 2010 ug/g
Anti-gliadin IgA	**84**		0 - 157 U/L

Botanicals/Neutraceuticals For:

Elevated ß glucuronidase

- Manage bacterial dysbiosis
- Calcium-D-glucarate
- Milk thistle
- N-Acetyl Cysteine
- Consider binders
- Ø High fat/High protein diet
- Increase fiber as tolerated

Co-Infections

Pathogenic bacteria

Pathogens			
Bacterial Pathogens	Result		Normal
Campylobacter	**<dl**		<1.00e3
C. difficile, Toxin A	**6.78e4**	**High**	<1.00e3
C. difficile, Toxin B	**7.15e3**	**High**	<1.00e3
Enterohemorrhagic E. coli	**7.42e6**	**High**	<1.00e3
E. coli O157	**<dl**		<1.00e3
Enteroinvasive E. coli/Shigella	**<dl**		<1.00e2
Enterotoxigenic E. coli LT/ST	**<dl**		<1.00e3
Shiga-like Toxin *E. coli* stx1	**<dl**		<1.00e3
Shiga-like Toxin *E. coli* stx2	**<dl**		<1.00e3
Salmonella	**<dl**		<1.00e4
Vibrio cholerae	**<dl**		<1.00e5
Yersinia enterocolitica	**<dl**		<1.00e5

Botanicals/Neutraceuticals For:

Pathogenic Bacteria

- Bacteriophages
- Immune support
- HCl & digestive support
- L-glutamine
- *S. boulardii*
- *Lactobacilli*
- *Bifidobacteria*
- Anti-microbials
- Carminatives

Co-Infections

Helicobacter pylori

H. pylori			
	Result		Normal
Helicobacter pylori	**1.1e3**	**High**	<1.0e3
Virulence Factor, babA	**Positive**		Negative
Virulence Factor, cagA	**Negative**		Negative
Virulence Factor, dupA	**Negative**		Negative
Virulence Factor, iceA	**Negative**		Negative
Virulence Factor, oipA	**Negative**		Negative
Virulence Factor, vacA	**Negative**		Negative
Virulence Factor, virB	**Negative**		Negative
Virulence Factor, virD	**Negative**		Negative

Botanicals/Neutraceuticals For:

Helicobacter Pylori

- Mastic gum
- Oregano
- Berberine
- Wormwood
- Zinc carnosine
- DGL
- Sulforaphane
- S. boulardii
- L. reuterii
- Biofilm disruptors

Co-Infections

Candida & fungi

Fungi/Yeast			
	Result		Normal
Candida spp.	**7.93e6**	**High**	<5.00e3
Candida albicans	**3.10e5**	**High**	<5.00e2
Geotrichum spp.	**<dl**		<3.00e2
Microsporidium spp.	**<dl**		<5.00e3
Rodotorula spp.	**<dl**		<1.00e3

Botanicals/Neutraceuticals For:

Fungal Organisms

- Undecylenic acid
- Lauric acid
- Oregano
- Garlic
- Neem
- Pau d’arco
- Berberine
- Black cumin seed

Co-Infections

Parasites

Parasitic Pathogens	Result		Normal
Cryptosporidium	**2.94e8**	**High**	<1.00e6
Entamoeba histolytica	**8.04e3**		<1.00e4
Giardia	**<dl**		<5.00e3

Parasites			
Protozoa	Result		Normal
Blastocystis hominis	**3.29e1**		<2.00e3
Chilomastix mesnili	**<dl**		<1.00e5
Cyclospora spp.	**<dl**		<5.00e4
Dientamoeba fragilis	**2.31e6**	**High**	<1.00e5
Endolimax nana	**<dl**		<1.00e4
Entamoeba coli	**<dl**		<5.00e6
Pentatrichomonas hominis	**1.07e3**	**High**	<1.00e2

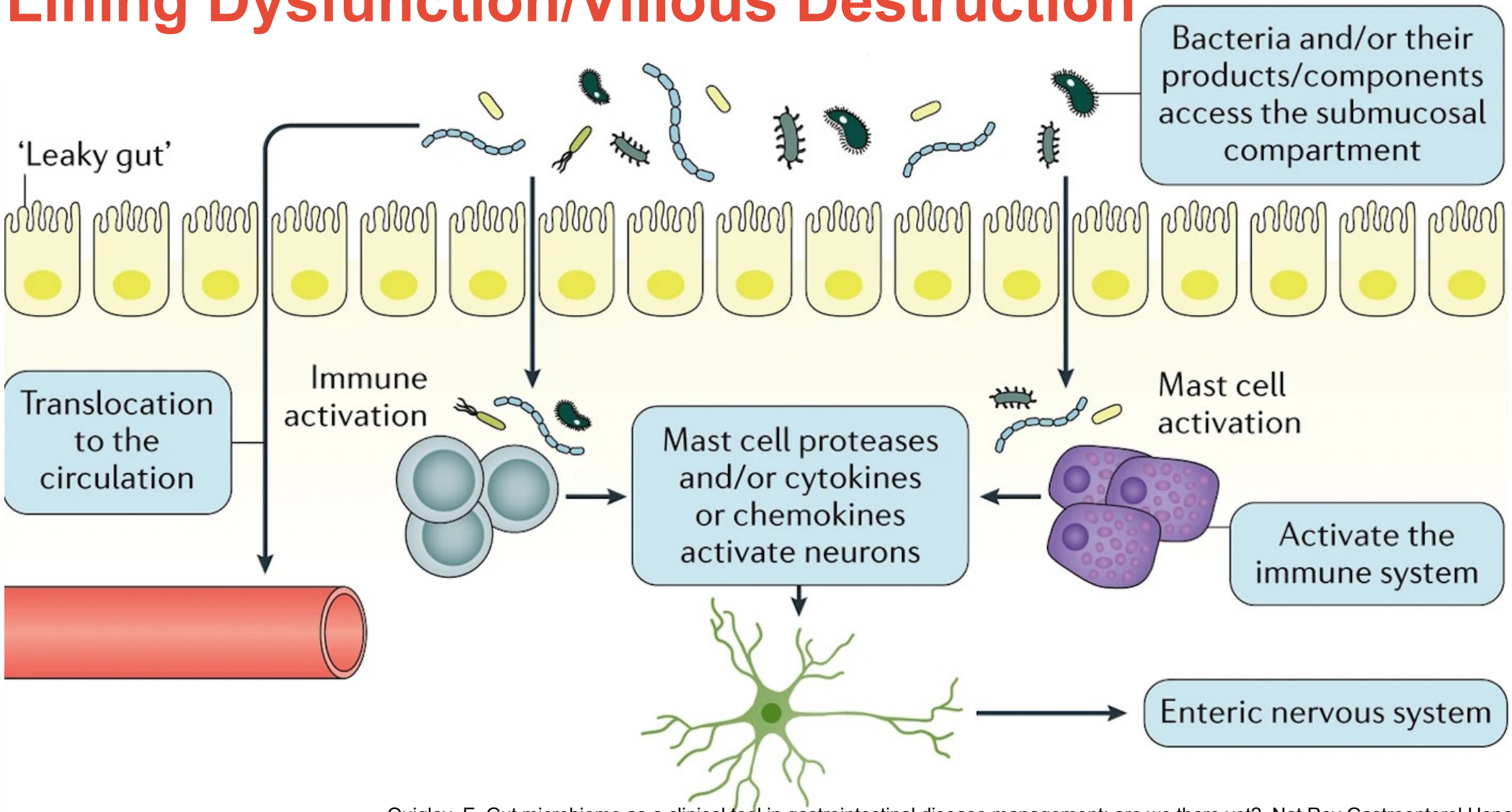
Botanicals/Neutraceuticals For:

Protozoal Organisms

- Immunoglobulin
- Balance GI ecology, esp. pH
- Mimosa pudica
- Walnut
- Wormwood
- Berberine
- Garlic
- Fiber
- Bromelain
- *S. boulardii*

Other Considerations

GI Lining Dysfunction/Villous Destruction



Quigley, E. Gut microbiome as a clinical tool in gastrointestinal disease management: are we there yet?. Nat Rev Gastroenterol Hepatol 14, 315–320 (2017). https://doi.org/10.1038/nrgastro.2017.29

Botanicals/Neutraceuticals For:

GI Lining Repair

- Glutamine
- Zinc carnosine
- Aloe
- Quercetin
- N-acetyl glucosamine
- Collagen
- Butyrate
- Ω3 fatty acids
- Protective organisms
- Immunoglobulins
- Licorice
- Gotu kola

Other Considerations

Histamines

Escherichia spp.	**1.43e10**	**High**	3.70e6 - 3.80e9
Morganella spp.	**2.54e5**	**High**	<1.00e3
Pseudomonas spp.	**3.13e6**	**High**	<1.00e4
Pseudomonas aeruginosa	**1.09e4**	**High**	<5.00e2

Potential Autoimmune Triggers	Result		Normal
Citrobacter spp.	**<dl**		<5.00e6
Citrobacter freundii	**8.62e5**	**High**	<5.00e5
Klebsiella spp.	**2.02e5**	**High**	<5.00e3
Klebsiella pneumoniae	**1.61e4**		<5.00e4
M. avium subsp. paratuberculosis	**<dl**		<5.00e3
Prevotella spp.	**1.90e6**		<1.00e8
Proteus spp.	**4.31e7**	**High**	<5.00e4
Proteus mirabilis	**1.75e8**	**High**	<1.00e3
Fusobacterium spp.	**7.56e6**		<1.00e8

Add-on Test	Result		Normal
Zonulin	**370.0**	**High**	<107 ng/g

Histamine Management Approach

Short Term

- DAO enzyme
- Quercetin
- Nettles
- B Complex with extra B5
- Perilla
- Low histamine diet

Long Term

- Address histamine-producers
- Repair GI lining

Other Considerations

Biofilms

- Produced my many/most bacteria
- Some opportunists/pathogens produce heavy biofilm
- Promote persistence of infections
- Promote resistance to treatment

Biofilm Disruptors

- Berberis/Mahonia
- Cinnamon
- Clove
- Curcumin
- Ginger
- Grapefruit juice
- Green tea
- Lemongrass
- Licorice
- Quercetin
- Resveratrol
- Black Cumin
- Enzymes
- Neem
- Manuka honey
- Thiols (NAC, ALA, glutathione)

Other Considerations

Quorum Sensing Inhibition

- Basil
- Berberis/Mahonia
- Berries
- Curcumin
- Garlic
- Ginger
- Grapefruit juice
- Green Tea
- Kale
- Quercetin
- Rosemary
- Thyme

Other Considerations

Motility Disturbance

- Fasting between meals
- Fasting overnight
- Vagal nerve tone
- Ginger
- Artichoke
- Chamomile
- Peppermint
- Fennel
- Candytuft
- 5HTP

Other Considerations

Visceral Hypersensitivity

- Repair GI lining
- Address pelvic inflammation
- Address *Proteobacter*
- Butyrate
- Melatonin
- Vitamin B5
- Myrrh
- Curcumin
- Angelica sinensis
- Garlic (if tolerated)
- Ginkgo
- Gotu kola

Other Considerations

Constipation

- Movement
- Hydration
- Fibre as tolerated
- Magnesium – citrate, oxide
- Gentle herbal laxatives

How do we individualize treatment?

- Address GI ecology using a top-down approach
- Identify and treat any underlying medical conditions
- Identify all bacterial & archaeal players
- Identify and address co-infections
- Correct motility disturbance
- Rebalance normal flora & GI ecology

Take Home Messages

If you have a patient who is not recovering from SIBO

- Stay curious
- Look deeper at organisms
- Look at underlying causes
- Treat the whole GI Tract
- Treat the whole person

THANK YOU!