


Small Intestinal Bacterial Overgrowth

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Definition

- Presence of excessive numbers of bacteria in the small bowel causing gastrointestinal (GI) symptoms
- Gram-negative aerobic and anaerobic
- $\geq 10^3$ colony-forming units per milliliter (CFU/mL) in a duodenal/ jejunal aspirate as diagnostic of SIBO
- Linking SIBO to diseases such as IBS, IBD, cirrhosis, fatty liver.....

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- 78% of IBS subjects suffer from SIBO
 - 16.8% of patients with Crohn's disease in endoscopic remission had SIBO
 - Abdominal pain, boating, and diarrhea could result from SIBO vs that of active inflammation, bile acid malabsorption, or postoperative strictures.

The signs and/or symptoms

- ➡ The most common symptom of SIBO is **bloating**
- ➡ Abdominal pain, diarrhea, and/or constipation
- ➡ In extreme cases weight loss, anemia, deficiencies in fat soluble vitamins
- ➡ Folate may be elevated in SIBO

DIAGNOSIS OF SIBO

1. We suggest the use of **breath testing** (glucose hydrogen or lactulose hydrogen) for the diagnosis of SIBO in patients with IBS
 - (conditional recommendation, very low level of evidence).



Breath testing


- Inexpensive, noninvasive, easy, and widely available
- Low sensitivity and specificity?
- Avoid use of antibiotics for 4 weeks and pro motility agents and laxatives for at least 1 week
- Fermentable foods should be avoided one day, and patients should fast for 8–12 hours
- During the breath test, avoid smoking and minimize physical exertion

Breath testing

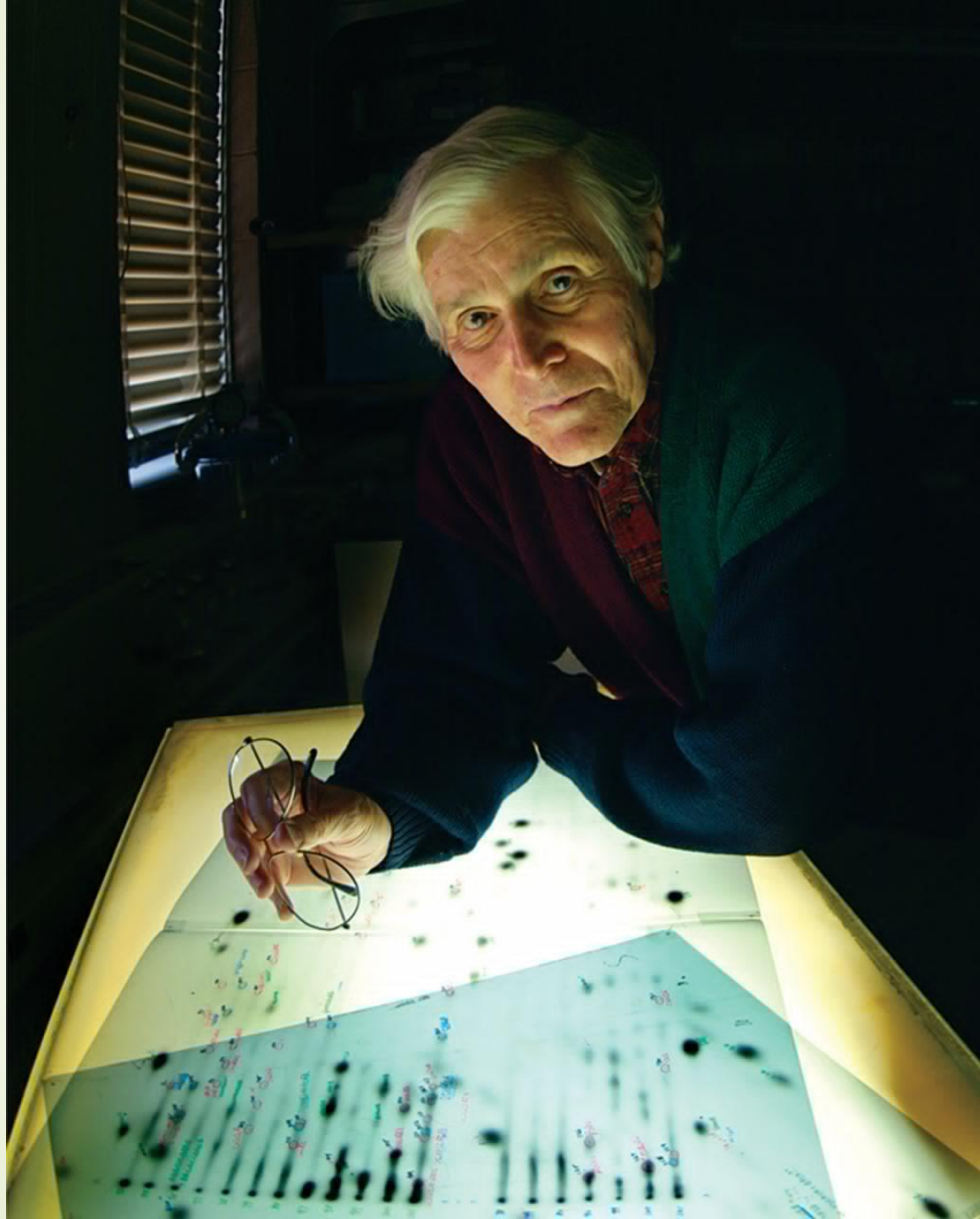
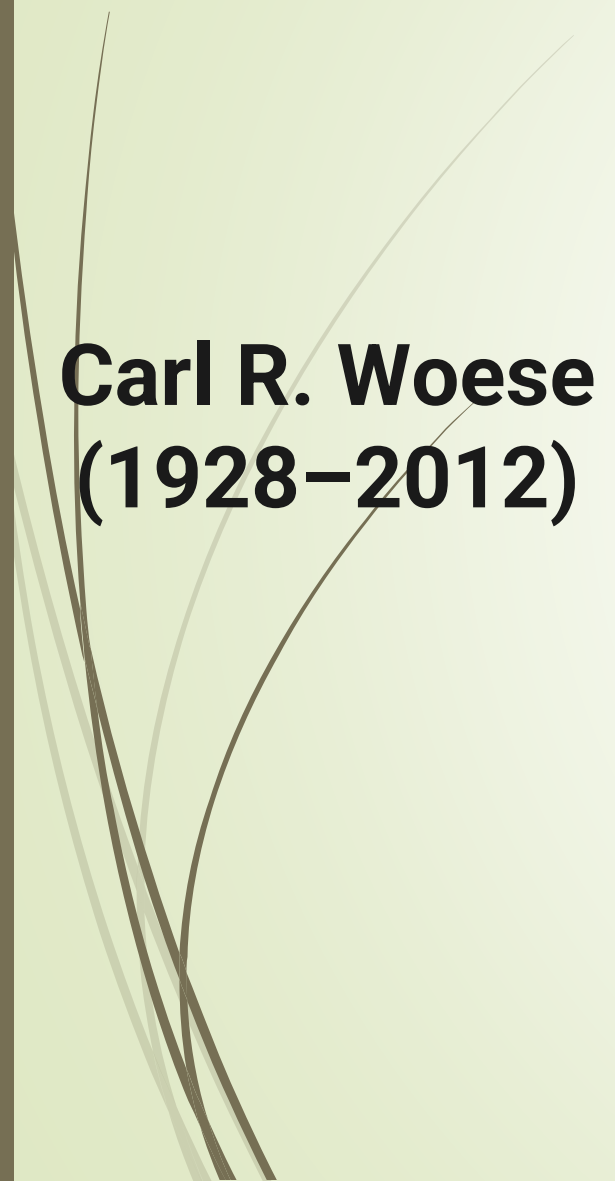
- Administering 75-g glucose or 10-g lactulose, either taken with or followed by 1 cup of water (250ml)
- The breath samples should be measured for hydrogen and methane
- An increase in hydrogen concentrations of ≥20 ppm from baseline within 90 (120?) minutes is recommended to be diagnostic of SIBO
- For methane, a concentration of ≥10 ppm at any point during the test is indicative of methanogen colonization

IMO

- Methanogens are not “bacteria” (representing the “B” in SIBO) but belong to the domain **Archaea** and may also overgrow in the **colon** and not just the **small intestine** (representing the “S” in SIBO)
- **New term**, intestinal methanogen overgrowth (**IMO**)
- **Prokaryotic** organisms, represent the third domain in the 3- domain system of life
- **Methanobrevibacter smithii**



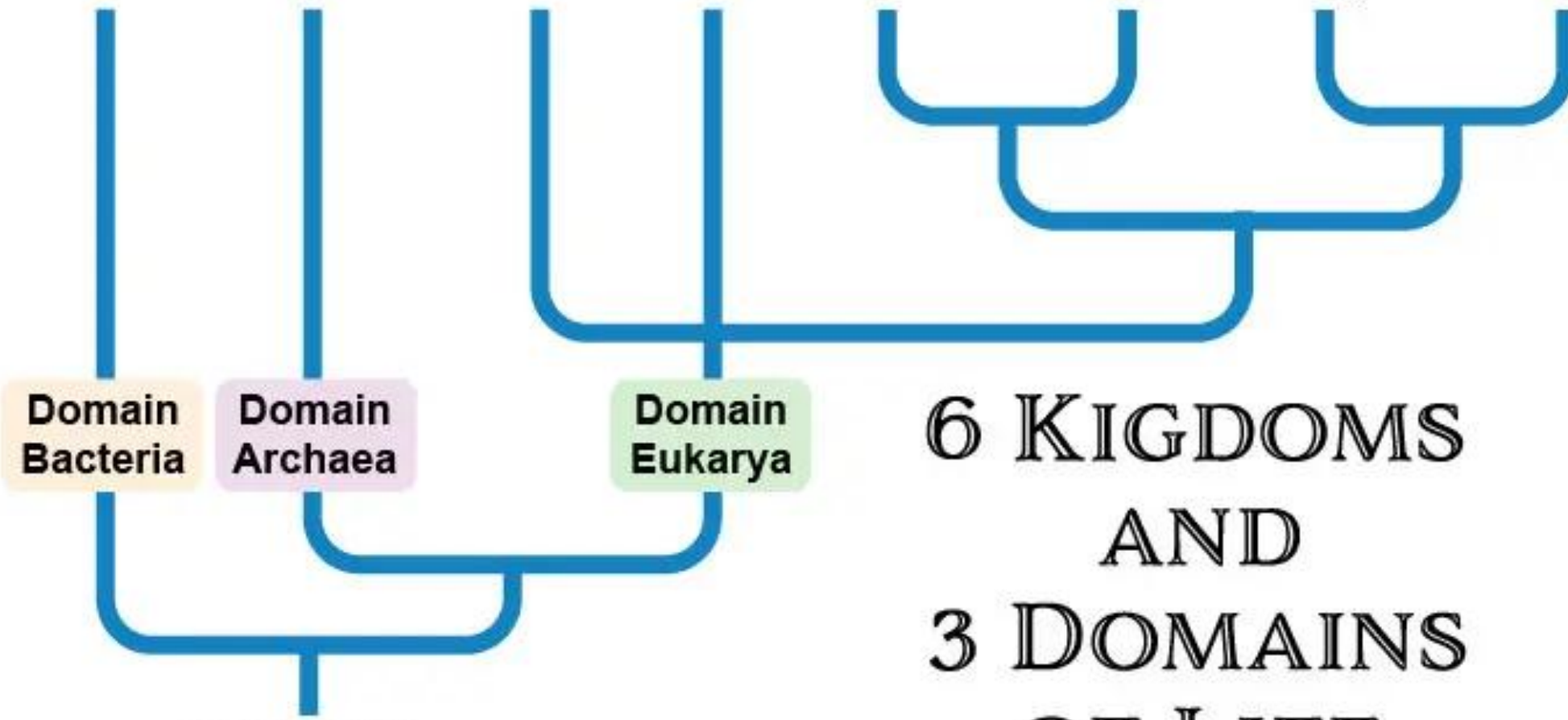
**Carl R. Woese
(1928–2012)**



**discovered a
third domain
of life,
Archaea**

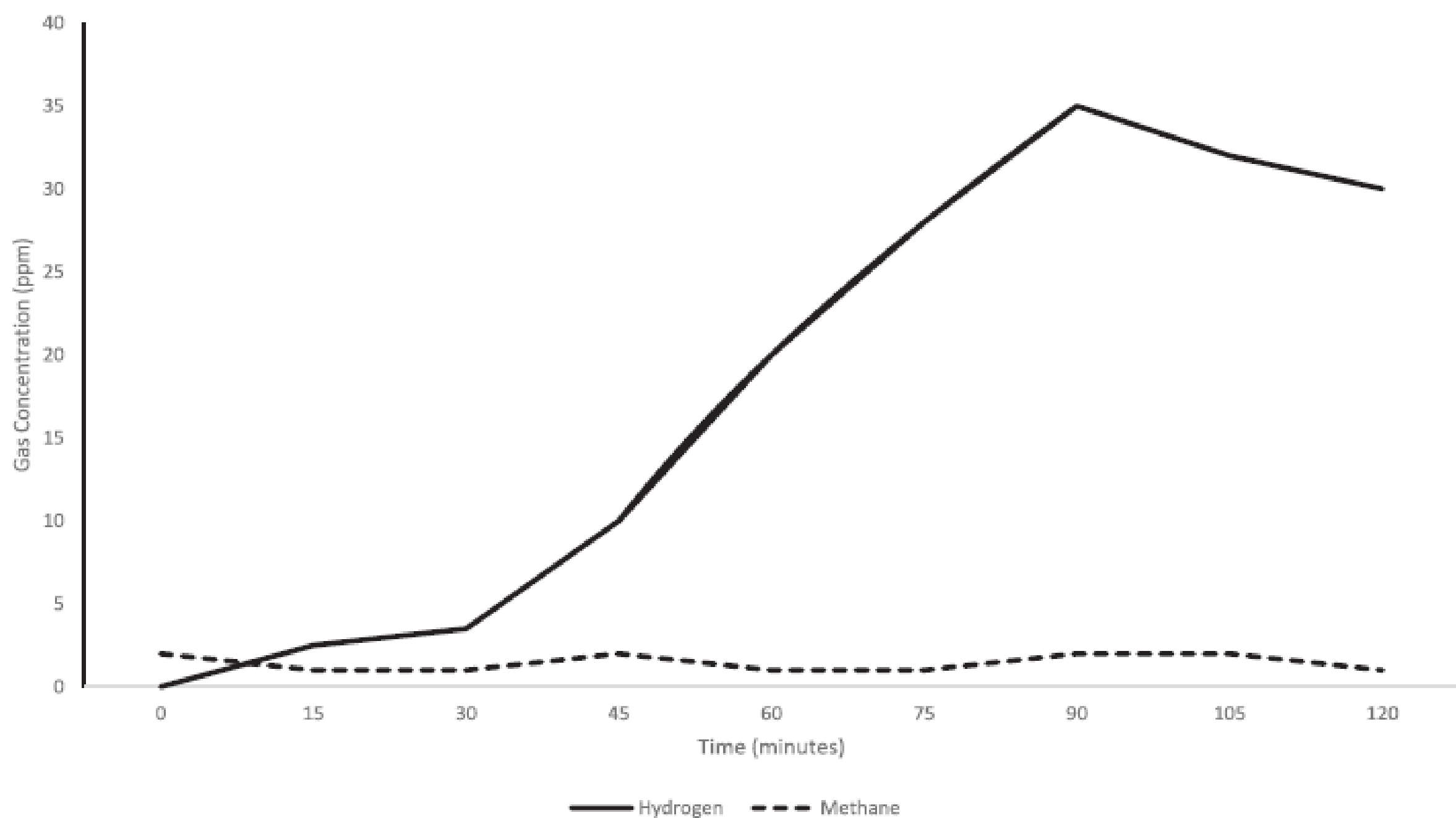


Bacteria **Archaea** **Protists** **Plants** **Fungi** **Animals**

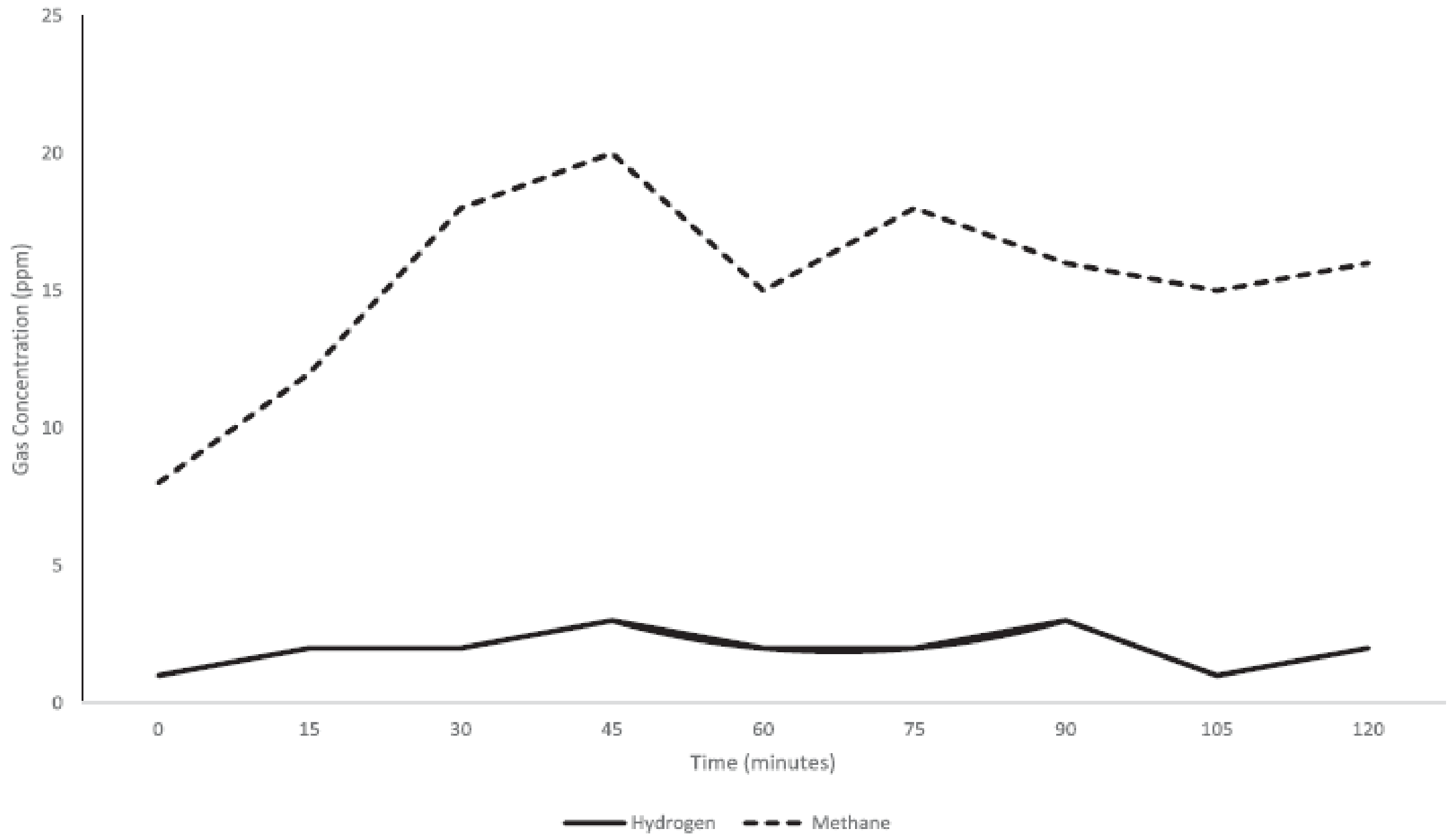


**6 KINGDOMS
AND
3 DOMAINS
OF LIFE**

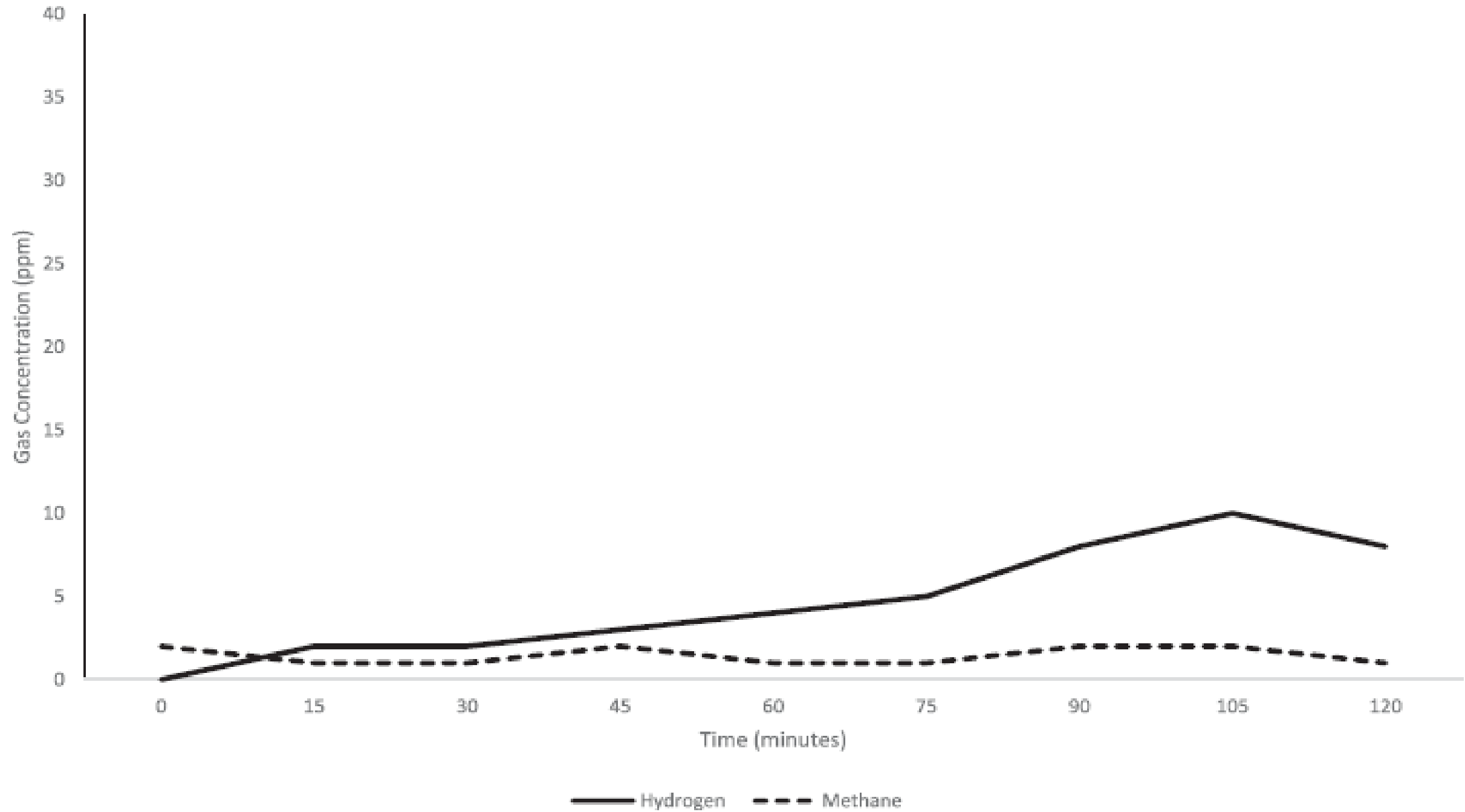
a



b



C




Small bowel aspiration and culture

- The gold standard
- Time-consuming, expensive and invasive
- During an upper endoscopy, a deep duodenal intubation while minimizing suction during the insertion of the scope and preventing cross-contamination of secretions from outside the duodenum
- A 2-mm Liguory catheter (COOK Medical) with multiple side holes is passed into the third and fourth portions of the duodenum

Small bowel aspiration and culture


- Using gentle suction, **3–5 mL** of duodenal fluid is aspirated, and the specimen is sent for aerobic/anaerobic **culture**
- Wearing of **sterile gloves** both by the endoscopist and assistant when assembling the catheter and collecting samples and placing a sterile cap on the syringe are all key components for proper specimen collection
- Not to report results as positive or negative but to **describe the growth of organisms** as a precise colony count in CFU/ml





2. We suggest using glucose hydrogen or lactulose hydrogen breath testing for the diagnosis of SIBO in **symptomatic patients** with suspected **motility disorders**

➡ (conditional recommendation, very low level of evidence).



3. We suggest testing for SIBO using glucose hydrogen or lactulose hydrogen breath testing in **symptomatic patients** (abdominal pain, gas, bloating, and/or diarrhea) with previous **luminal abdominal surgery**

➡ (conditional recommendation, very low level of evidence).

Table 3. Mechanisms for maintaining small bowel ecological homeostasis

Mechanism	Rationale
Gastric acid	Most ingested bacteria in food cannot survive the acidic stomach.
Pancreatic enzymes	Digestive enzymes in the proximal small bowel may also digest bacterial products. Efficient digestion of nutrients leaves less substrates for bacteria.
Bile acids	As detergents, bile acids can have an effect on bacterial membranes.
Small bowel motility	Migrating motor complexes and other events cleanse the small intestine of debris during fasting.
IC valve	The IC valve protects the small bowel from retrograde movement of colonic flora into the small bowel.
Immune system	Mucosal immunity may be important in the maintenance of a stable microbiota of the intestinal lumen.

IC, ileocecal.


Table 4. Conditions associated with small intestinal bacterial overgrowth

Category	Specific condition
Mechanical causes	Small bowel tumor Volvulus Intussusception Postsurgical causes
Systemic disease	Diabetes Scleroderma Amyloidosis
Motility	IBS Pseudo-obstruction Visceral myopathies Mitochondrial diseases
Medications	Opiates Potent antisecretory agents
Malabsorptive conditions	Pancreatic insufficiency Cirrhosis (altered bile acid composition) Other malabsorptive conditions
Immune-related	Human immunodeficiency virus Combined variable immunodeficiency IgA deficiency
Other	Aging (the elderly) Small bowel diverticulosis
IBS, irritable bowel syndrome; IgA, immunoglobulin A.	



4. We suggest **against** the use of breath testing for the diagnosis of SIBO in **asymptomatic patients** on proton-pump inhibitors (PPIs)


➡ (conditional recommendation, very low level of evidence).



5. We suggest testing for methane using glucose or lactulose breath tests to diagnose the overgrowth of methane-producing organisms (IMO) in **symptomatic patients** with **constipation**

➡ (conditional recommendation, very low level of evidence).

➡ In vitro experiments methane can **augment contractility** and **delay** ileal peristaltic conduction velocity through effects on **cholinergic neurons**

Feature 	SIBO (Small Intestinal Bacterial Overgrowth)	IMO (Intestinal Methanogen Overgrowth)
Microorganisms	Overgrowth of bacteria	Overgrowth of archaea (methane-producing)
Key Gas Produced	Hydrogen	Methane
Typical Symptom	Diarrhea	Constipation
Diagnosis	High hydrogen levels on a breath test	High methane levels on a breath test
Treatment	Often treated with specific antibiotics like rifaximin	May require a combination of antibiotics, such as rifaximin and neomycin

TREATMENT OF SIBO

6. We suggest the use of **antibiotics** in **symptomatic patients** with SIBO to eradicate overgrowth and resolve symptoms

➡ (conditional recommendation, low level of evidence).

Table 5. Suggested antibiotics for treatment of small intestinal bacterial overgrowth

Antibiotic	Recommended dose	Efficacy
Nonabsorbable antibiotic		
Rifaximin	550 mg t.i.d.	61%–78%
Systemic antibiotic		
Amoxicillin-clavulanic acid	875 mg b.i.d.	50%
Ciprofloxacin	500 mg b.i.d.	43%–100%
Doxycycline	100 mg q.d. to b.i.d.	^a
Metronidazole	250 mg t.i.d.	43%–87%
Neomycin	500 mg b.i.d.	33%–55%
Norfloxacin	400 mg q.d.	30%–100%
Tetracycline	250 mg q.i.d.	87.5%
Trimethoprim-sulfamethoxazole	160 mg/800 mg b.i.d.	95%

^aIn the study, no testing performed to reassess small intestinal bacterial overgrowth, although all participants had other objective measures of improvement.

Low FODMAP diet



VEGETABLES



lettuce, carrot,
cucumber

FRUITS



strawberries,
pineapples, grapes

PROTEINS



chicken, eggs,
tofu

FATS



oils, butter,
peanuts

STARCHES, CEREALS AND GRAINS



potatoes, popcorn,
tortilla chips



garlic, beans,
onion



blackberries,
watermelon, peaches




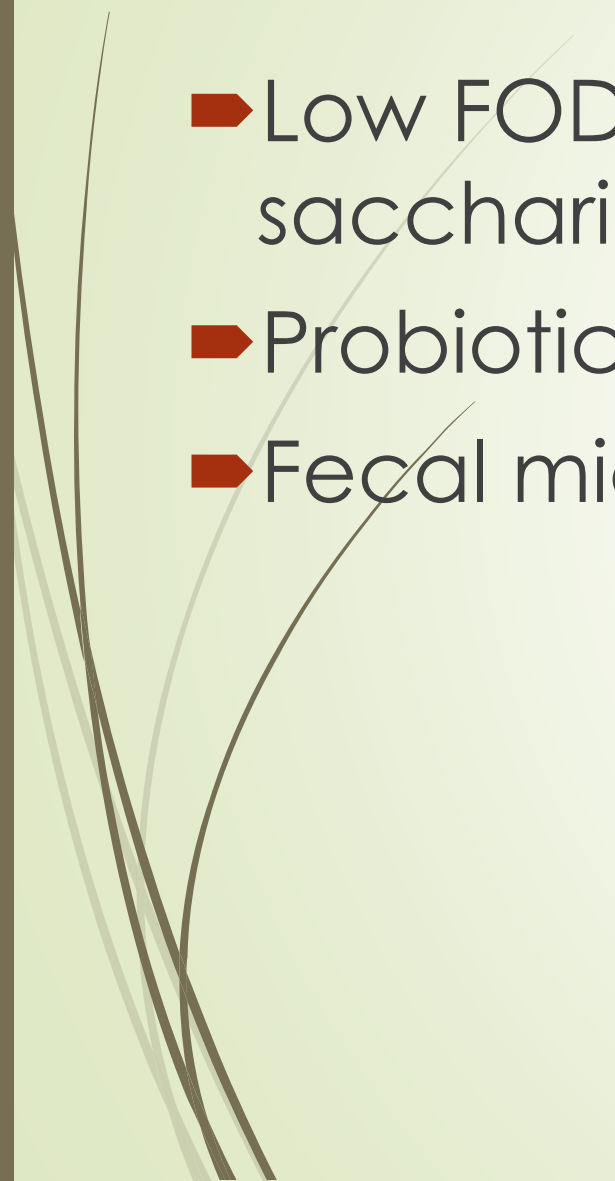
sausage, battered fish,
breaded meats



almonds, avocado,
pistachio



beans, muffins,
gluten-based bread

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- Low FODMAP (Fermentable, Oligo-, Di-, Mono-saccharides, and Polyols) diet
 - Probiotics?
 - Fecal microbiota transplant?
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Thanks for listening

References

