Gut Microbiome TTT-GI Kit Assembly Instructions

The instructions described here are for a single kit, with each team of 3-4 students needing access to a single kit.

Assembly of kit:
Each kit consists of the K'nex pieces described below in the table, as well as a set of 9-cards, printed front and back. The front of each card should have the bacterial phylum and specific genus and species of the bacterial organism, along with representative drawing of bacterial colonies or cells. The cards should also include the carbohydrates the bacterium targets for breakdown (categorized as 'favorite foods'), which include the specific chemical bonds that can be digested and the SCFA(s) that are produced upon bond breakage. The back of each card should have representative figures and amount of fermentation products, also shown in K'nex piece form, produced when the bacterium successfully breaks a certain carbohydrate bond. We encourage printing these cards in color on thick paper (e.g., cardstock) and consider laminating them, if possible. Instructors may also consider printing them with Braille for visually impaired students.

Containing the kit:
The kit can easily be contained in a small or medium sized loose or tight container. We found that former micropipette tip boxes (when emptied) worked well to store the K'nex pieces and card deck of the kit.

Table 1: K'nex pieces necessary to build a single kit. There are no extra K'nex pieces included once the three representative carbohydrate structures are built.

18 gray half-circles Gray 4-Way 3D Connector SKU: 909091	
9 dark blue rods Classic size Blue Rod, 54mm length SKU: 90952	
2 yellow rods Classic size Yellow Rod, 86mm length SKU: 90953	

2 flexible orange rods Classic size Orange Flexible or Bendable rod, 86mm length SKU: 91282	
1 small dark green rod Classic size Green Rod, 16mm length SKU: 90950	
1 orange connector Classic size Orange 2-way Straight or Ladder Connector SKU: 90902	

Digital card deck

Bacterial taxa and fermentation products

Front

Phylum

Genus and *species*

Picture of bacterial cells

Favorite carbohydrate to eat

Which chemical bond(s) it can digest

Which short chain fatty acids it produces

Use for Part 1: Bacterial digestion (p. 2-3)

Back

Fermentation Products

How many molecules of acetate and/or propionate and/or butyrate the bacteria can produce from each different carbohydrate

Use for Part 1: Fermentation products (p. 4)

Actinobacteria

Bifidobacterium thetaiotaomicron

Favorite Food: Amylose

Enzymes Digest: α-1,4

Fermentation Products: Acetate

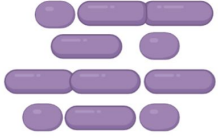
Fermentation Products

from Amylose:

6 Acetate

Bacteroidetes

Prevotella



Favorite Food: Amylose, Amylopectin

Enzymes Digest: α-1,4 and α-1,6

Fermentation Products: Acetate

Fermentation Products

from Amylose:

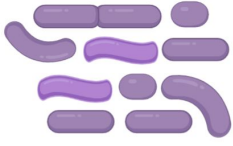
6 Acetate 

from Amylopectin:

9 Acetate 

Bacteroidetes

Bacteroides ruminicola



Favorite Food: Amylose

Enzymes Digest: α-1,4

Fermentation Products:
Acetate

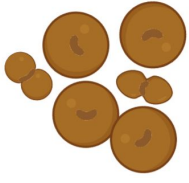
Fermentation Products

from Amylose:

6 Acetate

Gammaproteobacteria

Succinomonas amylolitica



Favorite Food: Amylose

Enzymes Digest: α-1,4

Fermentation Products:
Acetate, Propionate

Fermentation Products

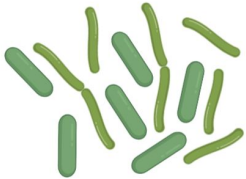
from Amylose:

3 Acetate 

2 Propionate 

Firmicutes

Roseburia



Favorite Food: Amylose, Amylopectin

Enzymes Digest: α-1,4 and α-1,6

Fermentation Products: Propionate, Butyrate

Fermentation Products

from 2 Amylose:

3 Propionate

4 Butyrate

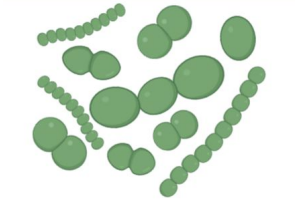
from Amylopectin:

2 Propionate

3 Butyrate

Firmicutes

Ruminococcus bromii



Favorite Food: Amylose

Enzymes Digest: α-1,4

Fermentation Products:
Propionate, Butyrate

Fermentation Products

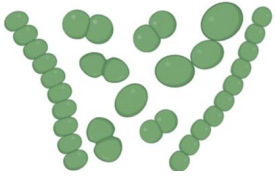
from Amylose:

4 Propionate 

3 Butyrate 

Firmicutes

Ruminococcus albus



Favorite Food: Cellulose

Enzymes Digest: β-1,4

Fermentation Products:
Acetate

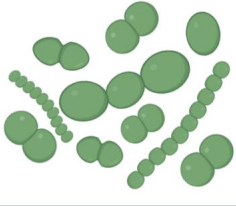
Fermentation Products

from Cellulose:

12 Acetate

Firmicutes

Ruminococcus flavefaciens



Favorite Food: Cellulose

Enzymes Digest: β-1,4

Fermentation Products:
Butyrate

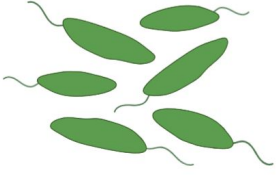
Fermentation Products

from Cellulose:

6 Butyrate 

Firmicutes

Butyrivibrio fibrisolvens



Favorite Food: Cellulose

Enzymes Digest: β-1,4

Fermentation Products:
Acetate, Butyrate

Fermentation Products

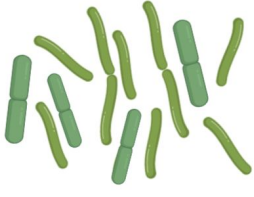
from Cellulose:

8 Acetate 

2 Butyrate 

Firmicutes

Clostridium lockheadii



Favorite Food: Cellulose

Enzymes Digest: β-1,4

Fermentation Products:
Acetate, Butyrate

Fermentation Products

from Cellulose:

8 Acetate 

2 Butyrate