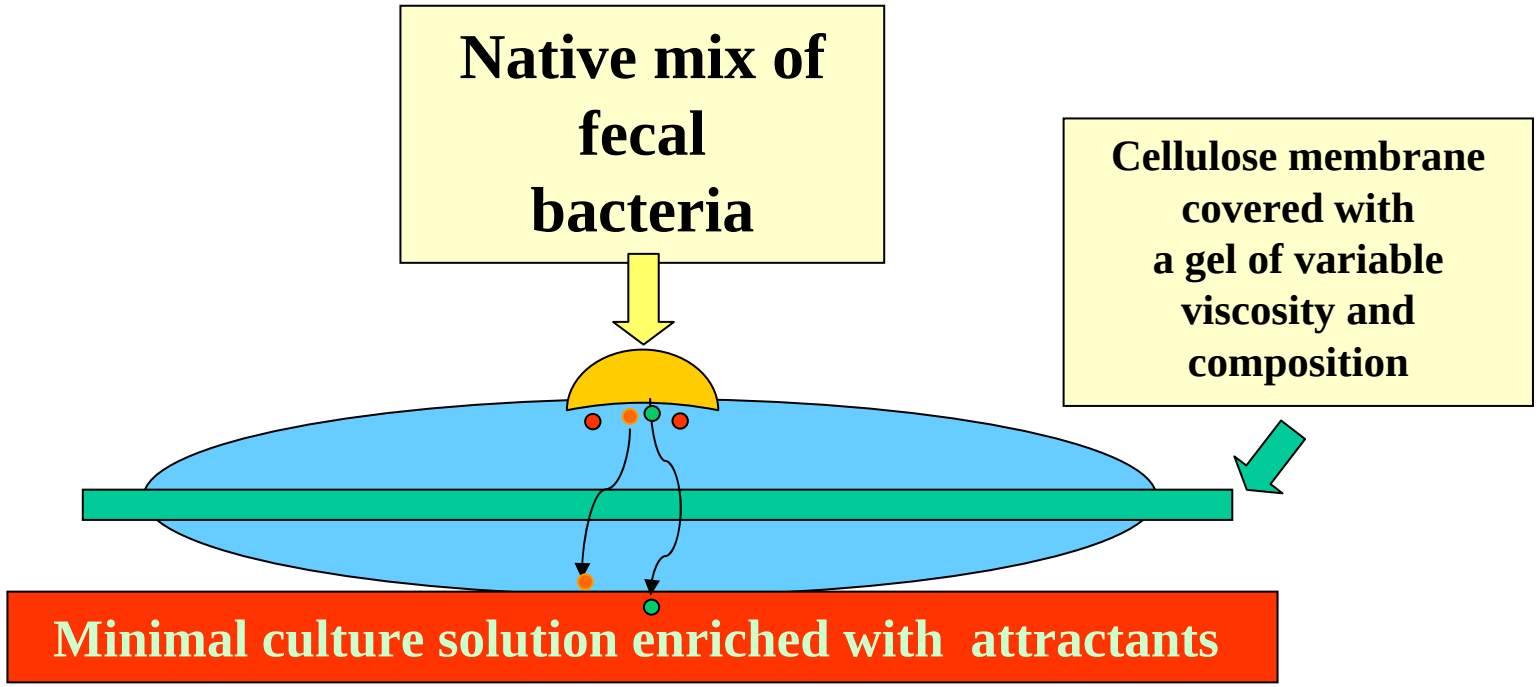
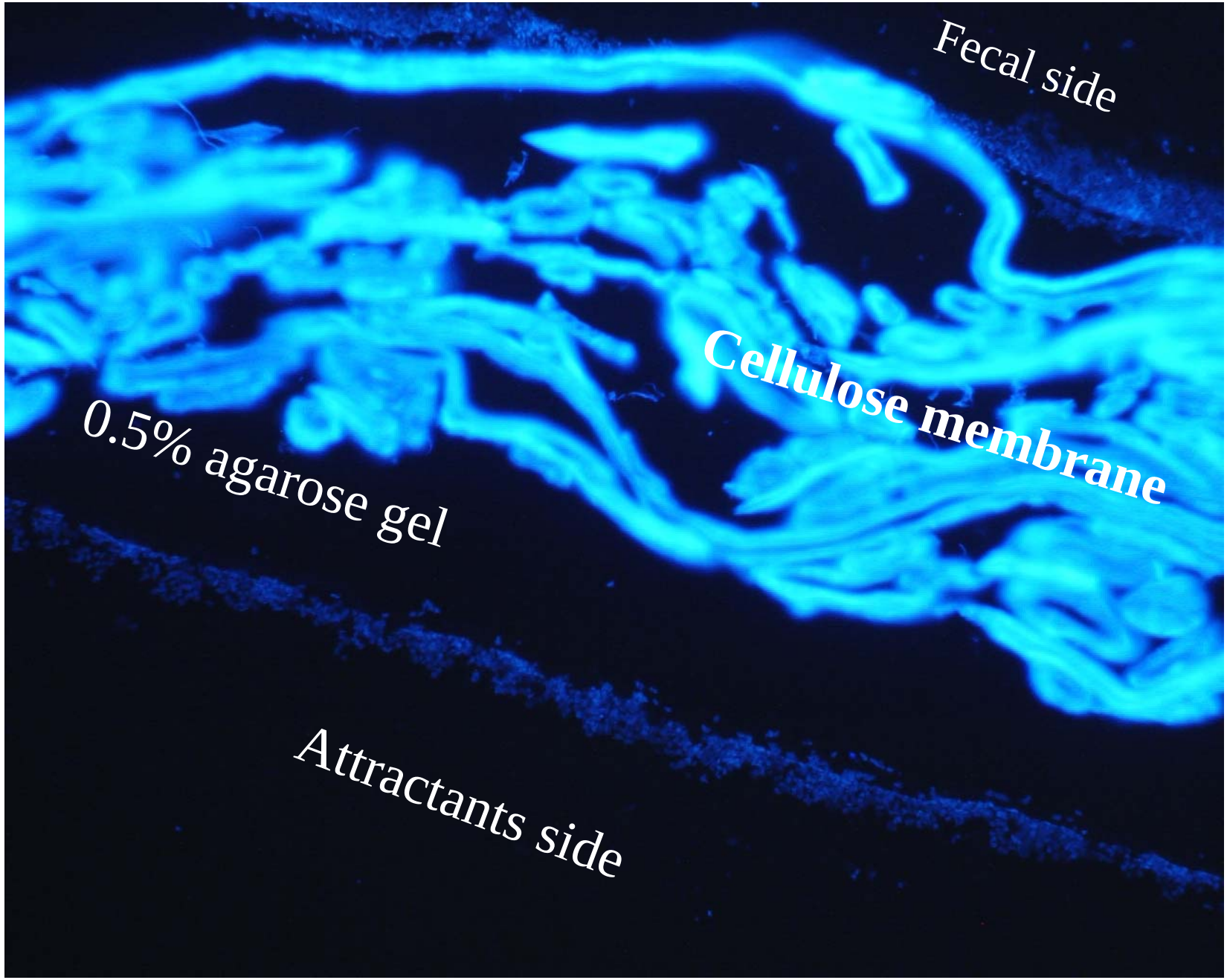
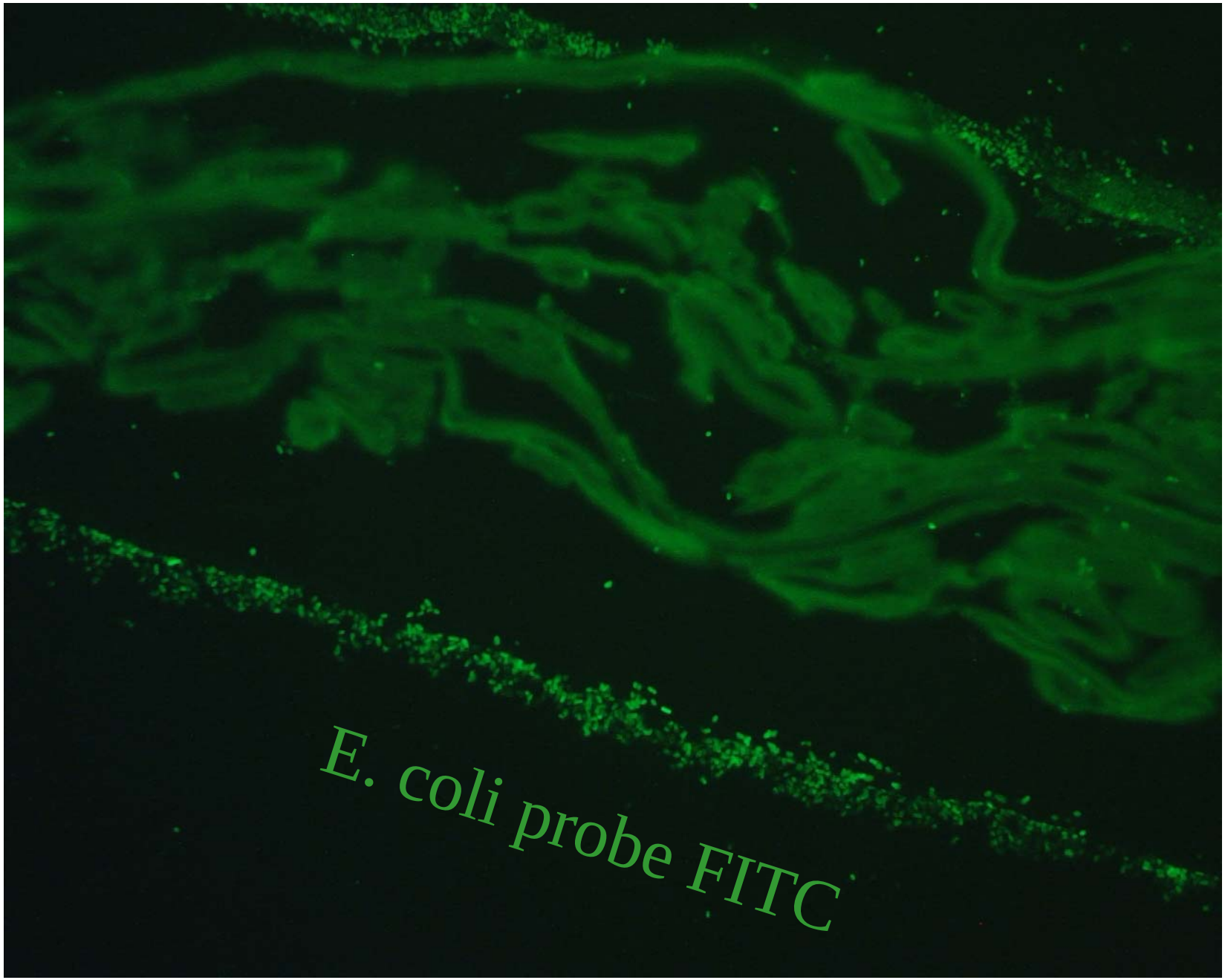
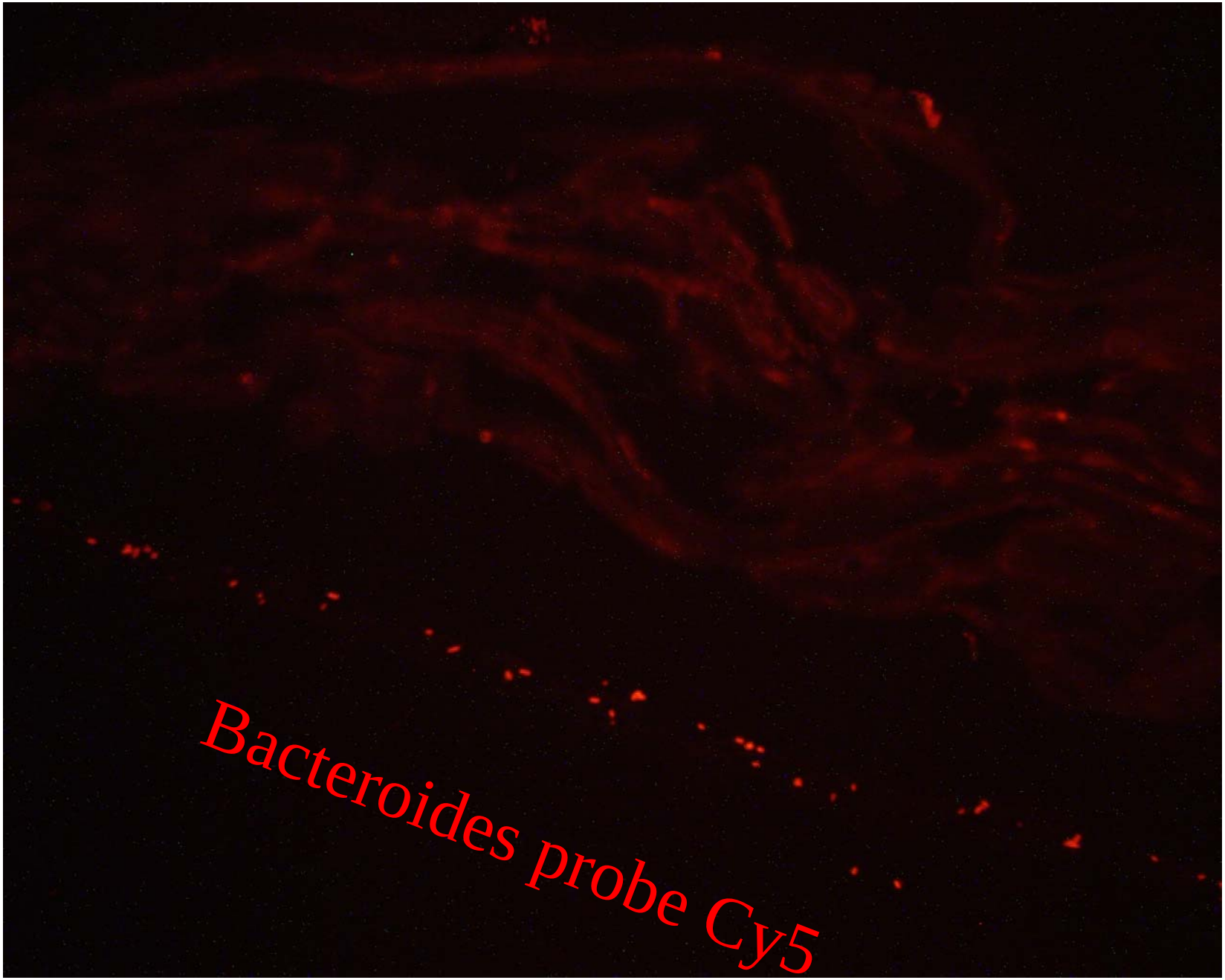
Mucus simulation in vitro

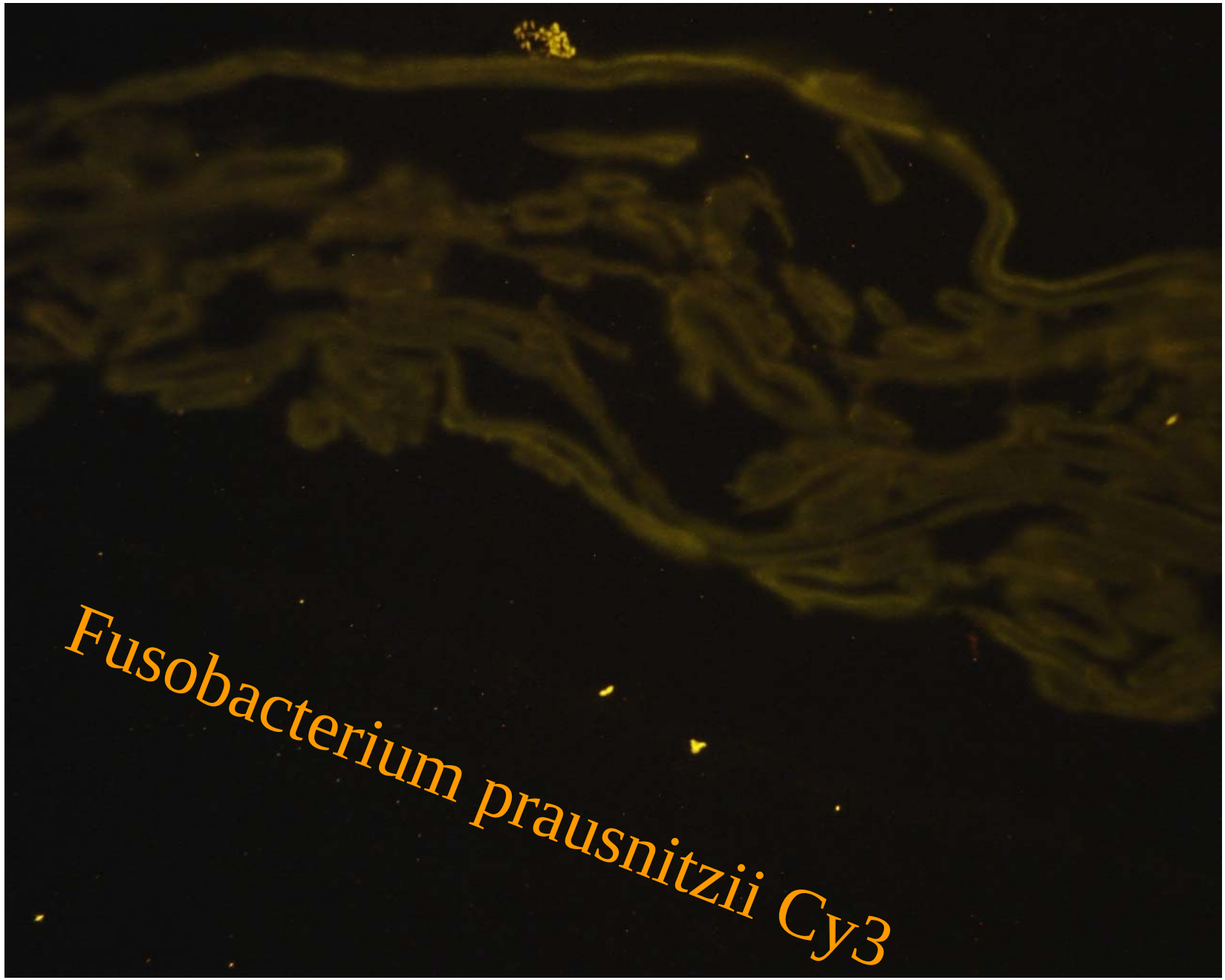


- 0.5% agarose minimal medium gel
- Treat with media ± 5-ASA or DSS.
- Hybridize with Bacteroides-Cy5, Fusobacterium prausnitzii-Cy3, and Enterobacteriacae-FITC probes; DAPI counterstain.

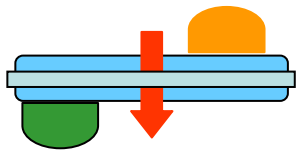
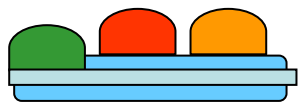
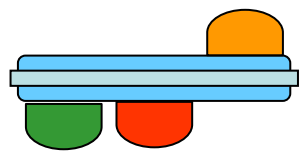
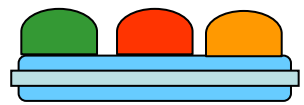
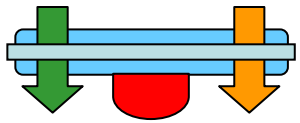
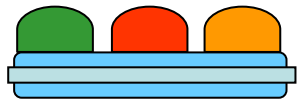
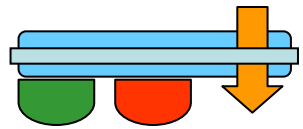
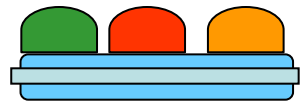
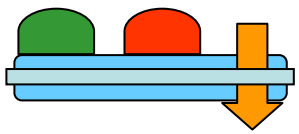
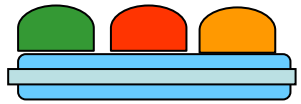
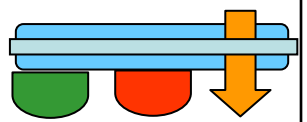
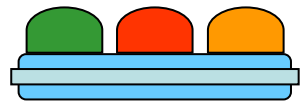

Fecal side
Cellulose membrane
0.5% agarose gel
Attractants side


E. coli probe FITC


Bacteroides probe Cy5


Fusobacterium prausnitzii Cy3

The influence of gel viscosity, 5-ASA and DSS on mobility of fecal bacteria

	MM (Minimal medium)	MM +5-ASA	MM +DSS	MM +DSS +5-ASA
0.3%				
0.5%				
0.7%				

E. Coli Bacteroides Fprau

- **The mucus hinders contact of fecal bacteria with colonic mucosa and thus prevents development of adherent biofilm.**
- **This blockade is selective and segment-specific in mouse and probably absolute in man.**

- **Healthy human controls have no biofilms on the mucosal surface.**

- **Bacterial biofilms can be found in many different conditions**
  - **IBD (inflammatory bowel disease)**
  - **IBS (irritable bowel syndrome)**
  - **Self-limited colitis**
  - **Diverticulosis**
  - **Carcinoma**
  - **Autoimmune diseases?**
- **However, the composition of the mucosal biofilm is disease specific.**

•Detergents like DSS lead to higher bacterial mobility within viscous gels and uncover mucosa for contact with fecal bacteria. This may explain why intestinal inflammation upon oral challenge of mice with DSS leads to colitis but not to inflammation of the small bowel. The small bowel is normally free of bacteria.

•The widespread use of detergents in every home and emulsifying agents in food industry may also explain the increase of IBD incidence in the last decades.

•5-ASA suppresses the metabolism of the bacterial biofilm in vivo (low amenability to FISH probes in IBD patients treated with 5-ASA). It also suppresses the mobility of bacteria within viscous gels and reverses the effects of DSS on bacterial motility in vitro.

•We can now investigate the different components of this complex process and determine factors important for prevention and treatment of the IBD

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Following questions seem to be especially important:

Do fecal bacteria (especially Bacteroides and E. coli) from IBD patients and differ from those of healthy controls in their ability to migrate through viscous gels?

Do bacteria-free fecal extracts from IBD patients contain substances that promote the motility of bacteria within viscous gels?

What dietary and environmental factors are important for the integrity of the mucus layer?

How do different drugs and substances influence the mobility of bacteria in mucus and what effect do they have on the biofilm formation?

How do defined extracts and cell components from the mucosal tissue influence the mobility of bacteria within gels?

Is it possible to develop an in vitro model that incorporates mucus layer as well as enteric epithelial cells?

Environmental substances with potential impact on mucus barrier

Natural additives (e.g. glutens)

Home detergents

Toothpaste

EU permitted additives for food industry

E425, Konjak
E432 bis E436, Polysorbat
- E432, Polyoxyethylen-sorbitan-monolaurat (Polysorbat 20)
- E433, Polyoxyethylen-sorbitan-monooleat (Polysorbat 80)
- E434, Polyoxyethylen-sorbitan-monopalmitat (Polysorbat 40)
- E435, Polyoxyethylen-sorbitan-monostearat (Polysorbat 60)
- E436, Polyoxyethylen-sorbitan-tristearat (Polysorbat 65)

E440, Pektine, Amidiertes Pektin
E442, Ammoniumsalze von Phosphatidsäuren
E444, Saccharose-acetat-isobutyrat
E445, Glycerinester aus Wurzelharz/Kolophonester
E450 bis E452, Phosphate
E459, Beta-Cyclodextrin
E460 bis E469 Cellulose und Celluloseverbindungen
- E460, Cellulose, Mikrokristalline Cellulose, Cellulosepulver
- E461, Methylcellulose
- E463, Hydroxypropylcellulose
- E464, Hydroxypropylmethylcellulose
- E465, Ethylmethylcellulose
- E466, Carboxymethylcellulose, Natriumcarboxymethylcellulose
- E468, Vernetzte Natrium-Carboxymethylcellulose
- E469, Enzymatisch hydrolysierte-Carboxymethylcellulose

E470a und E470b, Salze von Speisefettsäuren
- E470a, Natrium-, Kalium- und Calciumsalze von Speisefettsäuren
- E470b, Magnesiumsalze von Speisefettsäuren

E471 bis E472f, Mono- und Diglyceride von Speisefettsäuren
- E471, Mono- und Diglyceride von Speisefettsäuren, Monoglycerid
- E472a, Essigsäureester von Mono- und Diglyceriden von Speisefettsäuren
- E472b, Milchsäureester von Mono- und Diglyceriden von Speisefettsäuren
- E472c, Citronensäureester von Mono- und Diglyceriden von Speisefettsäuren
- E472d, Weinsäureester von Mono- und Diglyceriden von Speisefettsäuren
- E472e, Mono- und Diacetylweinsäureester von Mono- und Diglyceriden von Speisefettsäuren
- E472f, Gemischte Essig- und Weinsäureester von Mono- und Diglyceriden von Speisefettsäuren

E473, Zuckerester von Speisefettsäuren
E474, Zuckerglyceride
E475, Polyglycerinester von Speisefettsäuren, Polyglycerinester
E476, Polyglycerin-Polyricinoleat
E477, Propylenglycolester von Speisefetten
E479, Thermooxidiertes Sojaöl mit Mono- und Diglyceriden von Speisefettsäuren
E481 bis E483, Natriumstearoyl-2-lactylat, Calciumstearoyl-2-lactylat, Stearyltartrat
E491bis E495, Stearin- und Palmitatverbindungen
- E491 Sorbitanmonostearat
- E492, Sorbitantristearat
- E493, Sorbitanmonolaurat
- E494, Sorbitanmonooleat
- E495, Sorbitanmonopalmitat