CAPSULE TRAVELS THROUGH THE GUT

Smart capsules are going to improve our understanding of how food affects the bacteria and processes in our intestines, and what effects that has on our health. During her PhD research, Mara van Trijp developed a liquid that stabilizes the intestinal sample in the capsule, as well as methods of analysing the samples.

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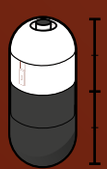
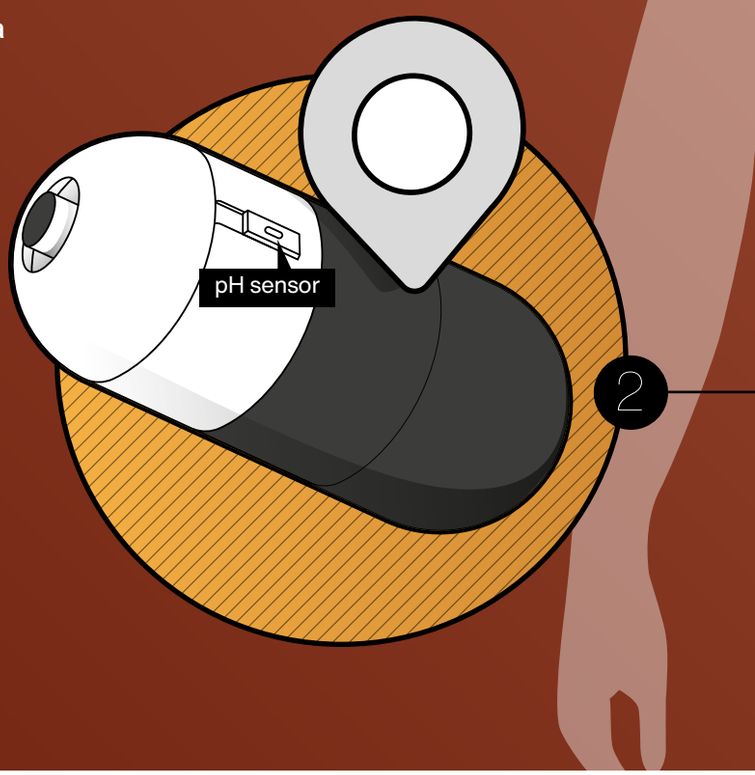
Infographic Pixels&inkt



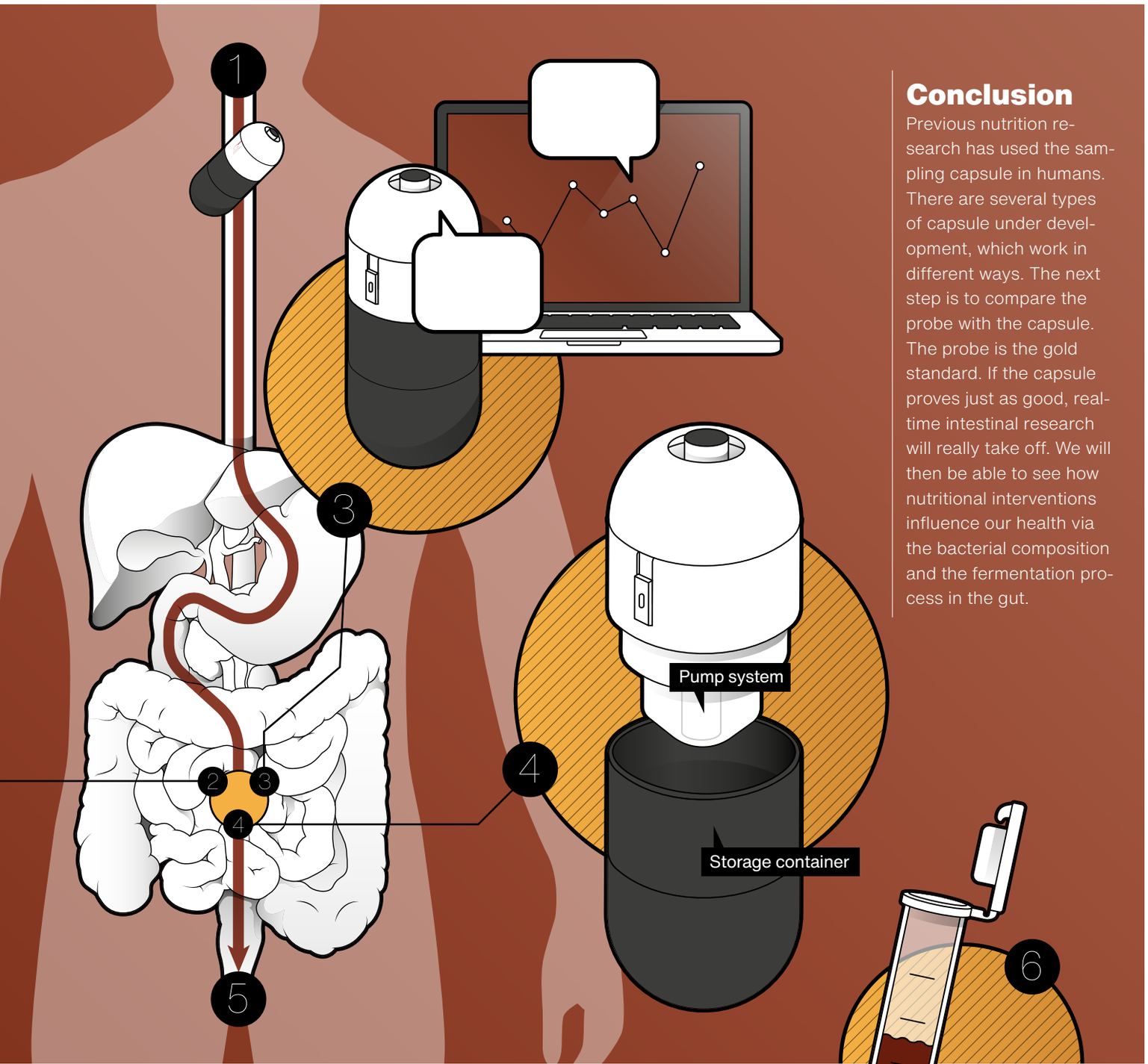
20 MM
The capsule has a length of about 20 millimetres.



Dietary fibre is good for our health. Bacteria in the gut break it down through fermentation into short-chain fatty acids that can inhibit inflammation and nourish our intestinal cells. But quite how fermentation works in our guts is pretty much a black box. Mara van Trijp (Human Nutrition and Health) gained a better understanding of this by taking samples from the gut in real time via intestinal probes. However, inserting and removing the three-metre probe causes discomfort to the test subject. A small pill-shaped capsule is a sampling method that would be easier to swallow. Unfortunately, Van Trijp could not test the capsules, but she did make improvements to methods of using them. So how might such capsules work in the future?

1 **SWALLOWING**
Before a test subject swallows the capsule, the researcher adds a stabilizing liquid to the reservoir of the capsule. The liquid neutralizes the sample (see step 4).

2 **THE RIGHT PLACE**
The capsule contains a pH sensor. When the sensor detects from the pH that it is in the right place, it sends a signal. The pH in the stomach is low (2-3), while the digestive juices in the small intestine are less acidic and the pH rises to 7. In the large intestine, the pH decreases again to pH 5.5 due to bacterial acids.



Conclusion

Previous nutrition research has used the sampling capsule in humans. There are several types of capsule under development, which work in different ways. The next step is to compare the probe with the capsule. The probe is the gold standard. If the capsule proves just as good, real-time intestinal research will really take off. We will then be able to see how nutritional interventions influence our health via the bacterial composition and the fermentation process in the gut.

3 ACTIVATION
A device in the test subject's trouser pocket captures the signal and transmits it to a computer. There, the researcher can activate the capsule using a special program. Inside the capsule, a mechanism starts running and a valve opens.

4 ABSORBING
The capsule sucks gut contents into the reservoir until the examiner stops sampling and the valve closes. The test subject does not notice this. Van Trijp's stabilizing fluid stops fermentation in the sample, kills the bacteria and protects their DNA so that the sample remains stable until the capsule leaves the body.

5 EXCRETING
The capsule also contains a temperature sensor, which emits a signal as soon as the temperature drops below 37 degrees. The capsule has now left the body and is in the faeces. This takes anywhere between a number of hours and a few days after it was swallowed.

6 IN THE LAB
The researcher can analyse the sample in the laboratory. Van Trijp combined protocols for analysing bacterial composition, bacterial substances (short-chain fatty acids), and dietary fibres in order to use the sample of just 200 milligrams as efficiently as possible.