Press Release

EMBL

My microbes

Our gut bacteria's collection of genomes is unique, and remains stable over time

Heidelberg, 5 December 2012 – We all have *E.coli* bacteria in our gut but each of us carries a version that is genetically slightly different. The same can be said of most gut microbes: our own gut metagenome, that is the sum of all the genomes of all our gut microbes, appears to be really specific to each of us, and to remain stable over time. For the first time, researchers from the European Molecular Biology Laboratory (EMBL) have studied this metagenome at such a high resolution that individual mutations in the various strains could be analysed. Their findings, published today in *Nature*, could have widespread consequences in medicine: gut microbes are known to be essential for functions as vital as digesting food or providing vitamins, but can also be involved in diseases if they carry certain mutations.

The scientists analysed the gut metagenome of 207 individuals from Europe and the USA, matching more than 7 billion pieces of DNA (of 100 lettres each) to the genomes of our most abundant gut microbial species. "This large scale analysis showed that, at least when healthy, we carry a unique set of bacterial strains and their mutations in our gut, over a long time," explains Peer Bork who led the study at EMBL. "It is like a second genetic signature, but one that probably does not come from our parents but that we acquire from the environment in early childhood."

When comparing the specific mutations from the same individual over time, the researchers found that the metagenome remains stable for at least one year, and probably much longer when the individuals are healthy. Results also show that there is only little geographic difference when comparing metagenomes of European with North-American individuals. This indicates that gradual adaptation is possible.

For each individual, approximately 6 billion DNA letters of their gut metagenome have been analysed, many more than the 3.3 billion DNA letters of human DNA that we inherit from each of our parents. These 6 billion DNA letters belong to hundreds of microbes, each with thousands of different strains or variants: mapping each DNA fragment of the metagenome to its right place, in the right bacterial genome, is extremely complex. To achieve this breakthrough and carry the analysis down to the single DNA letter, scientists had to develop various new computational methods. In the current study more than 10 million mutations have been detected in the 207 individuals.

All these detailed data is now stored in public databases, such as dbSNP, freely available to the scientific community. These findings could lead to the development of new approaches in the identification of gut diseases, pathogens, or antibiotic resistance. On the longer term, they may also open new avenues for personalised therapies. ●

Source Article
Genomic variation landscape of the human gut microbiome
Siegfried Schloissnig, Manimozhiyan Arumugam, Shinichi Sunagawa, Makedonka Mitreva, Julien Tap, Ana Zhu, Alison Waller, Daniel R. Mende, Jens Roat Kultima, John Martin, Karthik Kota, Shamil R. Sunyaev, George M. Weinstock and Peer Bork. *Nature*, Advanced online publication: 5 December, 2012.

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About EMBL

The European Molecular Biology Laboratory is a basic research institute funded by public research monies from 20 member states (Austria, Belgium, Croatia, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom) and associate member state Australia. Research at EMBL is conducted by approximately 85 independent groups covering the spectrum of molecular biology. The Laboratory has five units: the main Laboratory in Heidelberg, and Outstations in Hinxton (the European Bioinformatics Institute), Grenoble, Hamburg, and Monterotondo near Rome. The cornerstones of EMBL's mission are: to perform basic research in molecular biology; to train scientists, students and visitors at all levels; to offer vital services to scientists in the member states; to develop new instruments and methods in the life sciences and to actively engage in technology transfer activities. Around 190 students are enrolled in EMBL's International PhD programme. Additionally, the Laboratory offers a platform for dialogue with the general public through various science communication activities such as lecture series, visitor programmes and the dissemination of scientific achievements.