§1

In this presentation, I will introduce a freshly brewed beginning of a fieldwork. It all started in the biomedical research center of Liege, called the GIGA. It is quite large. Over there, just as in most hospitals and medical research centers in Belgium, but also in Europe and US, genomic testing and diagnosis are becoming more and more important. Experimental research is being made; slowly, there are some attempts — limited attempts in scope — to turn this research into medical practices. Investments are being made, new instruments are installed at a very fast pace, sophisticated machineries which enable so-called "*high throughput sequencing*" techniques. "High throughput" is a bit of a harsh expression but what it entails is actually rather simple: it entails a capacity to process digital data, which means you need like quite powerful computers with good processors. Yeah, that's what processors do: they process. They process data.

"Sequencing" is the name for the technique itself; the technique of slicing a genome into bits and pieces. Basically, every living organism has a genome; you have a genome, I have a genome, the birds out there in the trees have a genome, even the trees themselves, and corn crops as well, they all have a genome. Well, actually… I shouldn't say "have a genome". It's not like if you own it right? It can be read, deciphered from the very depths on your own body. It can be traced back, identified, aligned… A genome, it is basically the totality of the genes contained in an organism. These genes can be identified, put together, they can be mapped and aligned. So basically a genome is an assemblage of your genes which, as Evelyn Fox Keller pointed out, thoroughly challenged circulating notions of what a gene is and what it can do. But that's another story. The genome is just that: a particular map to your organism. How so? How does that work? I'll get to it.

§2

But wait a minute! Because, in the meantime, something happened which struck me with great surprise. So, I come to this biomedical research center which is located in a human, very human hospital, where you have geneticists, scientists, researchers, patients. I start to make some exploratory interviews and, very quickly, I learn that most routine genomics analysis in volume don't have anything to do with humans but instead… with cows! Bovines. Livestock. Cattle.

I don't have the precise proportions for all that matters, but I can tell you that, at the GIGA biomedical research center, 1000 to 1200 genomics testing are routinely conducted on cows raised by the dairy industry. There is nothing experimental to it, it is a business on its own which bring cash liquidities to the GIGA. This whole thing of course has a story, where the vet Faculty is very much mixed up with other research centers and medical faculties, with people travelling back and forth so that animal / human research and clinical practices are constantly intertwined. Unfortunately, I can't dig into that story.

§3

Ho, there's something I just want to make clear. This whole bovine genome sequencing has nothing to do with a clinical practice, in the sense of, let's say, a "health-oriented" practice. That's too bad, though, because Alex Nading has written a very compelling piece called

"Humans, Animals, and Health. From Ecology to Entanglement", in which he traces back the circulation of diseases, illnesses or pathogens agents, mostly from animals to humans, the risks of an epidemic and all the multispecies entanglements — including some of which that are not cool, such as massive livestock slaughtering perpetrated so as to avoid the propagation of a disease, without questioning the industrial practice which renders the forms of life of the cattle so homogeneous that it becomes vulnerable to disease propagation.

So, bovine genetic sequencing is not directly about health. Alas! But we certainly do have an interesting entanglement, and perhaps, at some point, an ecology on its own — that's the main question of my coming inquiry. No no no. The purpose is about *selection*. These genetic tests on bovine are mundanely run to predict and select, into brackets, "the best" reproducers. So, if you wish, based on many genomes of cows, you can anticipate, to a satisfying degree of accuracy, a sort of *genomic encounter* with some selected bull seeds. As one of my informants puts it: "They can accurately predict the phenotype. And then that's what they do. Instead of selecting bulls based on they descendants, they select them *before before* they were born".

§4

Let me show you how it works. It all happens, bovines and human alike, behind that door [show the dias].

#1 PCR: classical. You cook the blood and amplify the signal.

#2 Chip: two sides: one is the reference genome, that is an assembly which represents a species. You have only one reference by species: one human genome which stands for all humans, one bovine genome which stands for all bovine. These are pretty much stabilized. They form the norm, the reference. Departing from this reference, the genes of a singular organism, say a cow, are identified and matched to the reference. If you would take the whole genome, you get probably something like 98 or 99 % of similarities between an individual's genome and the reference genome. But all that matters rests with the other 1 or 2 %.

#3 This is what you get when you put your chip in this machine. "Ho, sorry, that one is six months old!". It scans, on the one side, the "reference" genes and and it displays the individual specificities on the other side.

#4 What is displayed on the screen are the "variations", litteraly "what varies", what diverge. Using variations, you can now, within the same species, identify populations, that is set of individuals which share a specific variation in common. Around London, there is "Pakistanis genetic toolkits". In Belgium, we have "Italian genetic toolkits" for specific diseases or means of diagnosis.

#5 One of my informants says: "So, yeah, we all have our genome which is 99% identical but there are small differences. Those small differences are the ones who… make us different. Among others. So now what they can do, somehow, is to determine all these differences". It

Genomics are not about homogenization, but rather about working out singularities: what makes a singular organism diverge from a conventionally established norm? This is just what happens with bovines.

§5 ISU index

Basically, they don't do full sequencing of the genome. Instead, they selected a limited range of genes that have been related to different factors such as milk production. Interestingly enough, since artificial insemination has been around, it so happened that a rarefaction of the genetic pool occurred with bovines. That is, the industry would rely only on a set of very productive bulls to inseminate cows, namely *the most* productive bulls. You get the greater amounts of milk out of a cow thanks to these "superstar" reproducers. But at the end, there were only too few of them, and it wouldn't suffice to entertain a satisfying genetic diversity.

So what you can do, with genomics, is to take into account a broader array of parameters. Of course, you take milk production into account and, up to this day, this is still and by far the most prevalent criteria of selection. But you can *mitigate it*. Other genetic parameters have been identified and are now taken into account in the selection processes. An index has been created which enables to chose different parameters and to ponder their respective importance: milk production, of course, but also resistance to mastitis (a disease: an udder infection). You can also take into account the longevity of life, the morphology (the development of the body) or, obviously, parameters of animal welfare, such as genetic endurance to stress. There are many different indexes. They are conventionally established, sometimes locally, sometimes by big international consortia that include breeding companies, scientists or representatives of industry. Some of them have been and are used in order to select the best reproducers, i.e. "the best" cows to inseminate so as to deliver "the best" descendants.

But what does "the best" entail then? Now, you can understand that, in response to the rarefaction of the genetic diversity and through genomic testing, what matters from now on is not to select the most productive cows, but rather a very productive cows all things equal. That is a very productive cow which also has other interesting feature for you as an industrial breeder or dairy producer: resistance to some genetically-based conditions, resistance to stress, length of life, morphology, and so on. This I like to call it: "the calculus of the optimal cow". Not "the best" cow in absolute, but a "best average" cow, obtained by a ponderation of different mitigated criteria.

§6 Conclusion

From there on, I just can't take the jump back to human health and human populations. I mean, I strongly feel there are connections, circulations, bindings which need to be documented, retraced, followed, described. But, hey, if I simply transplant what happens with bovine breeding to human populations, I will end up with a flat and massive warning about eugenics and, well, I don't want to do that. Through genomic selection, probably I could criticize for-profit healthcare systems and the political economy of it, because capitalism is… wrong, but that doesn't prevent it from functioning. I don't think we'd learn anything interesting in the process.

However, I do think this too short of a story tells us something about industrial practices and aims, about the standardization of forms of life, or yet about the sovereignty of what I could call a “blunt productivism”. That is producing a lot, but not *too* much. Producing but, insofar as possible, not at the expense of the very organisms which are the producers. Sustainability. Long-lasting, enduring, persisting productivism. I have that feeling that bovine genomics can deliver great insights into the design and maintenance of a population diverse-enough, but not too diverse, productive-enough, but not too productive, healthy-enough but, for all that matters in this respect, the goal is to avoid what dairy producers have come to term “economically relevant diseases”.

Fitter.
Healthier.
More productive.
Not drinking too much.
A cow in a cage on antibiotics.