Sequencing Genomes

The key to what you are is contained within your DNA sequence, which is true for all organisms on earth.

For a wealth of information about genome sequences, check out:
http://www.genome.gov/

the process of sequencing a genome is shown here:
http://www.genome.gov/25019885

What are the lessons of sequencing various animals?

1/ Sequences coding for proteins are highly conserved

2/ More related organisms (for example monkeys and primates) have genomes that more alike than less related organism (for primates and dogs). You can scan your favorite gene in your favorite genome at: http://ecrbrowser.dcode.org

3/ Outside the protein coding regions, other conserved elements are found around genes, and these sequences are often involved in the regulation of gene expression (so called enhancers)

4/ DNA is not coding for proteins, nor involved in regulation of gene expression, and appears to be just “along for the ride”. Many of these sequences can be recognized as the remains of viruses and transposable elements.

Species Differences
The interesting observation that the sequences coding for genes are generally well conserved, and that thus the proteins encoded by these sequences are conserved demonstrates that animals are made of the same protein building blocks. This implies that differences between species are largely caused by when and where proteins are expressed. The sequences that determine when and where genes are expressed are usually located around the affected genes and are called enhancers. Enhancers in turn bind proteins that serve as switches for these genes, and are called transcription factors. During the lecture I showed you an example how a small piece of DNA from a bat (an animal with very long limbs) engineered into the mouse genome resulted in longer legs on these mice.
In short, much of evolution acts on enhancers, changing when and where genes are expressed, thereby generating differences in phenotype.

Human Genome sequences
The genome sequences of many humans are known, and as expected we all have virtually identical genomes. However, the small differences are important, since they represent the normal variation in our population, en must also be responsible for the genetic basis of the differences between individuals. Of

course some of these differences are relatively inconsequential (such a blood type) or might have some consequences (such as pigmentation), or might be very important, such as the genetics that are the basis of inherited diseases, of which you were given many examples.
With the help of ever growing computing power, as well as novel ways to sequence large amounts of DNA, soon sequencing any individual's DNA is going to be affordable. Since knowing your personal DNA sequences can have significant consequences (both good and bad) it is really important that you are very aware who will have access to your DNA sequence and who owns these data.