

¿Do we have Black Chromatin?

Ricky Lim mailto:rickylim19@gmail.com

Guillaume Filion

Centre for Genomic Regulation (CRG), Barcelona, ES
Universiteit van Amsterdam (UvA), Amsterdam, NL

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THE ORIGIN OF BLACK CHROMATIN

IN 2010, Filion and his colleagues [1] discovered five principle types that govern the organization of chromatin in *Drosophila*. This discovery has advanced our view on chromatin from the traditional binary (active and inactive) classification into a more comprehensive view of chromatin states. They discriminated these five states by colors.

“Chromatin state is a segmentation of our genome based on a unique combination of chromatin marks.”

Among these five colors, **black** turns out to be the most surprising one as a novel type of repressive chromatin!

HOWEVER, black chromatin was only identified so far in *Drosophila*, and therefore it fires such a burning question whether black is also present in us (Humans) ?

¿WHAT DOES IT MEAN TO BE BLACK?

CHARACTERISTICS of black chromatin in *Drosophila* [1]:

- Neither known histone marks nor transcription factors is found to populate black
- Black covers 48% of the genome
- Harboring ~ 4000 genes that are linked to developmental regulation

OUR INPUT: ENCODE DATA

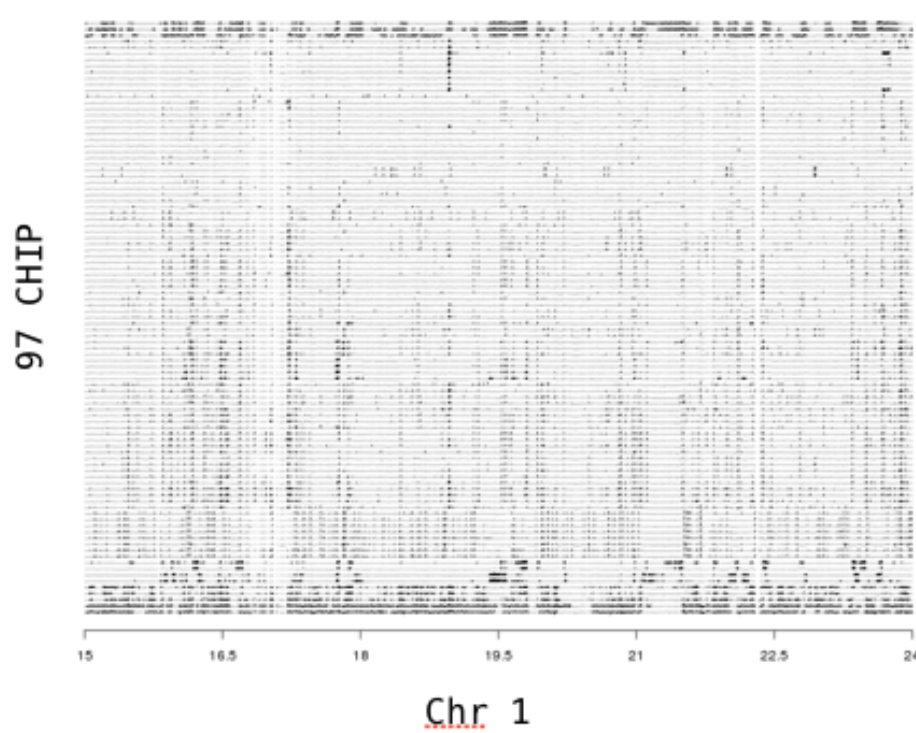


Figure 1: CHIPseq Profiles in H1-hESC (Human embryonic stem cell). These profiles [2] were used in constructing color classification.

CHROMATIN STATES OF hESC

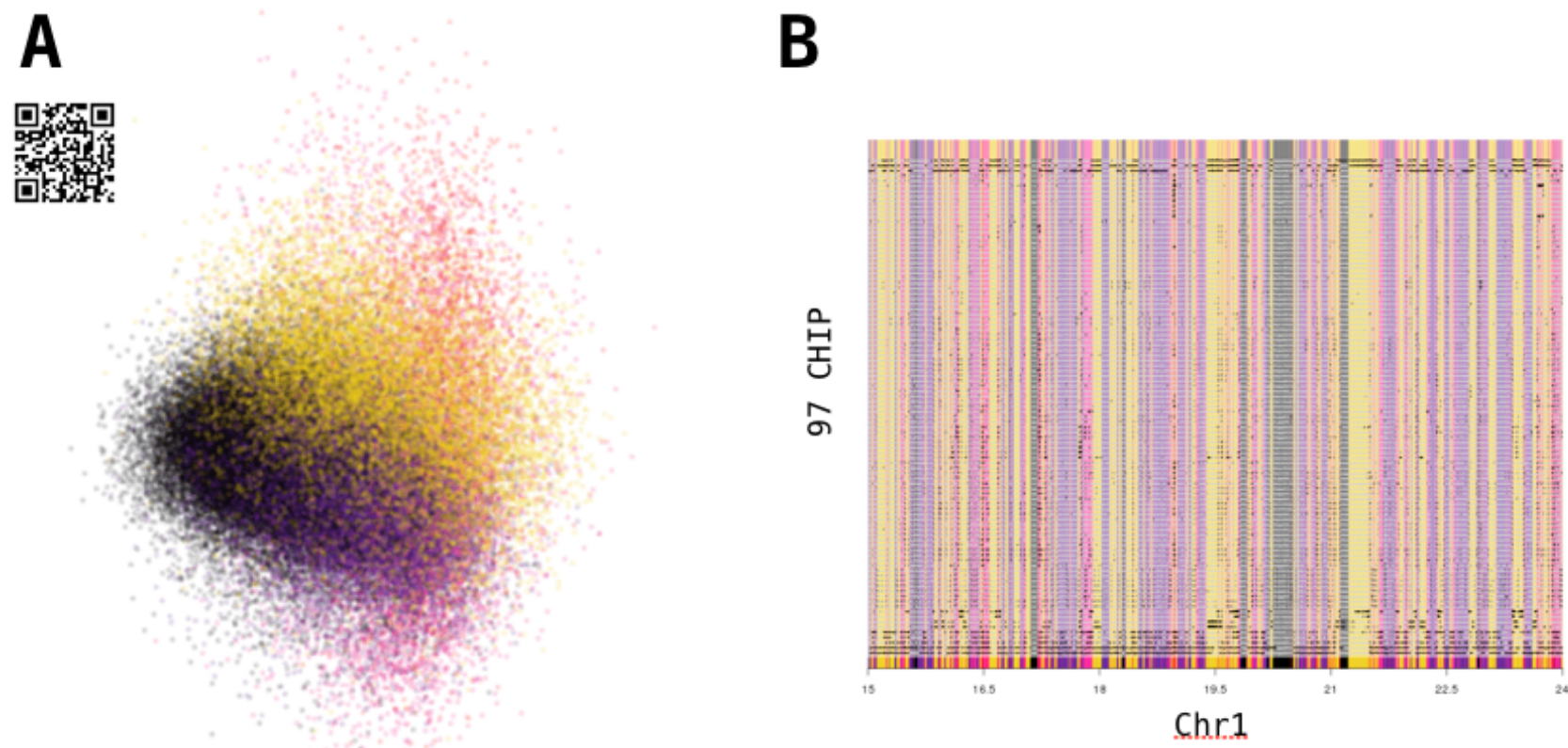


Figure 2: A) 3D PCA projection. Colors representing distinct chromatin states. Barcode encodes the URL (<https://dl.dropbox.com/u/82788830/human-1PC.mov>) to play 3D PCA. B) Representation of Color States across CHIPseq profiles in a detail of chromosome 1. Five clusters were built as color states consisting of black, purple, yellow, pink, and red.

CHROMOSOME PAINTING

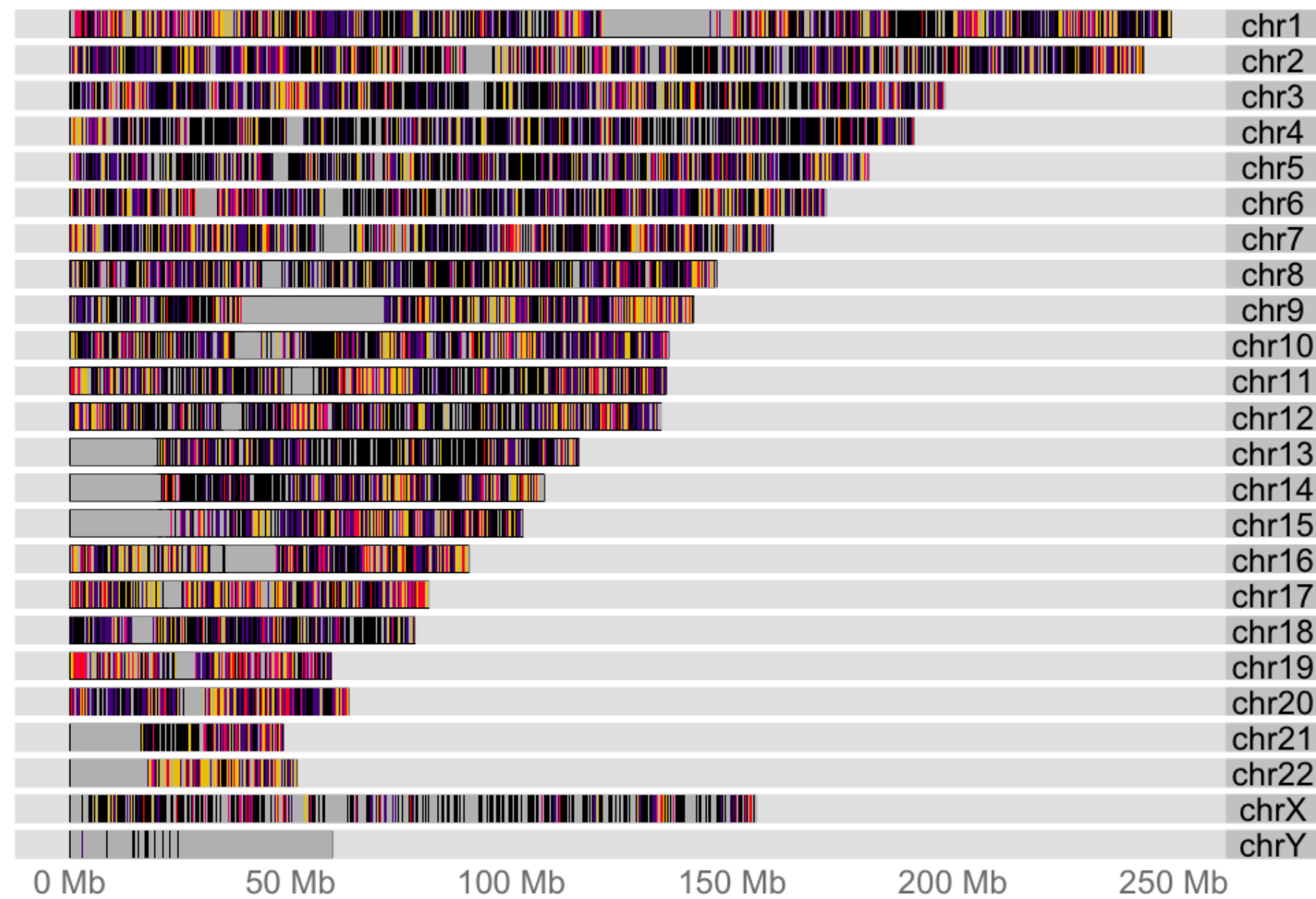


Figure 3: Color States Painted across all Chromosomes. Gray zones indicate regions of repeats.

INGREDIENTS

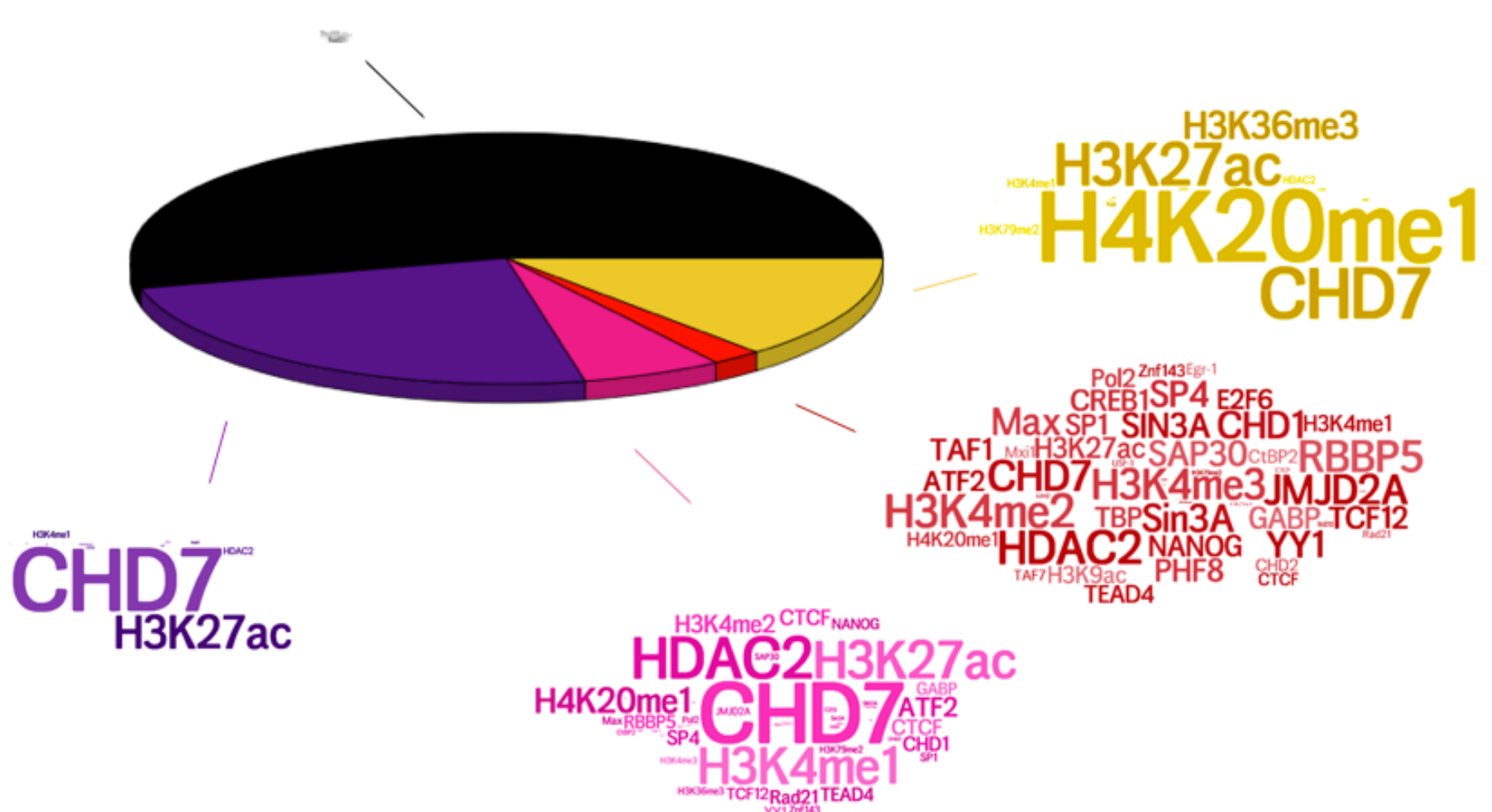


Figure 4: Chromatin Marks Enriched in Color. The word's size reflects the degree of enrichment. The percentage represents the coverage of each color in our genome.

GENOMIC FEATURES

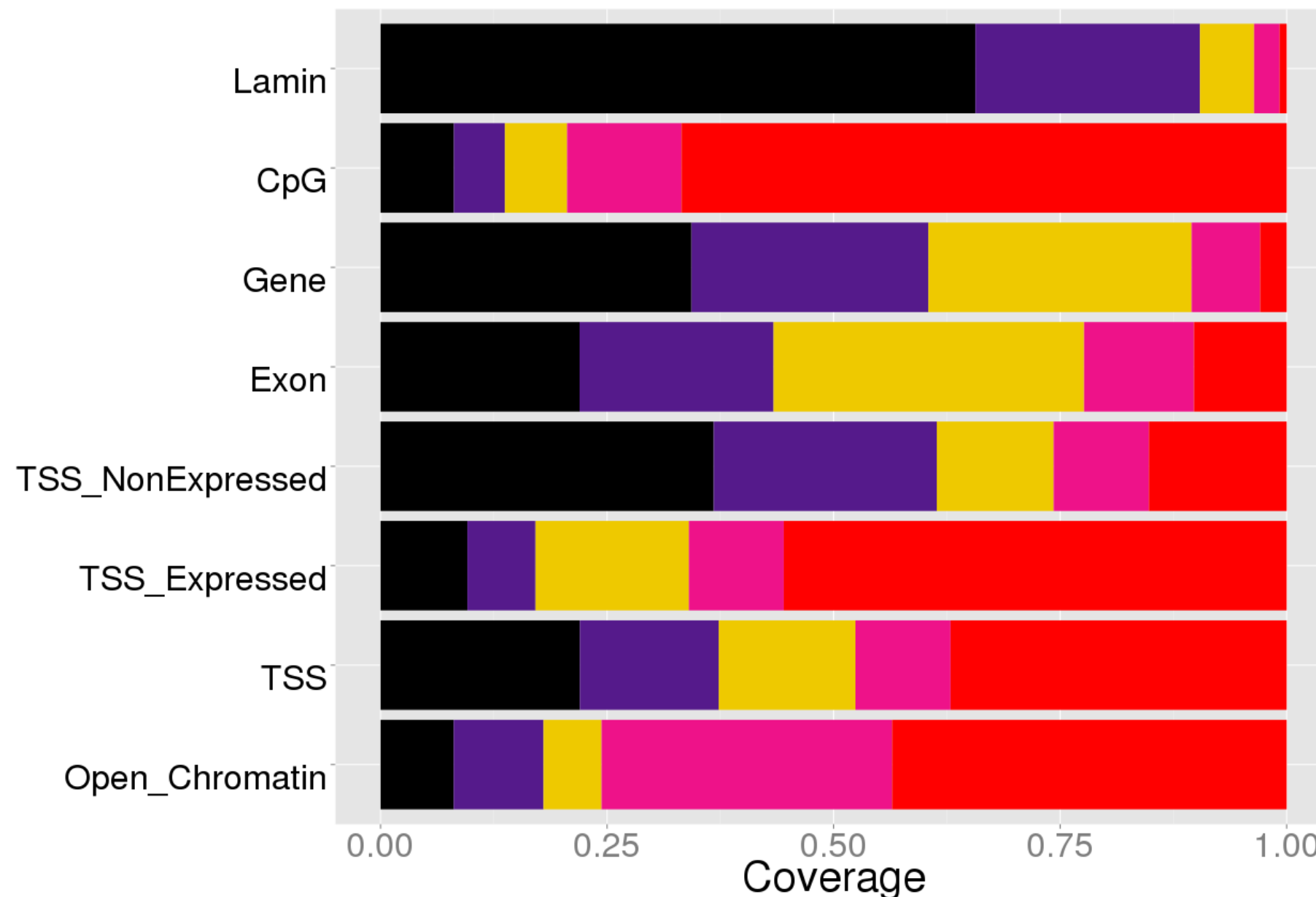


Figure 5: Genomic Features over Color Chromatin. The width of the bar indicates the proportion of the given feature that lies in the chromatin type. TSS: transcription start site

OUR ANSWER: TAKE-HOME MESSAGE

¡YES! WE HAVE BLACK IN OUR CHROMATIN.

CHARACTERISTICS of our black chromatin:

- Wide-spread, sheltering about half of our genome
- Uncharted epigenetics markers, hardly no enrichment of the known histone marks or transcription factors
- Rich in LADs (Lamina-associated Domains) but CpG-poor
- Genic regions, covering about 35% of our genes
- Repressive genic regions, genes in black are not expressed, or expressed at low level
- Low proportion of open-chromatin

“The thing that doesn't fit is the most interesting -Richard Feynman

¿CAN WE TRUST ENCODE?

CHALLENGES in the H1-hESC's CHIPseq dataset (downloaded in 2012) include:

- Genome release artifact. Lift-over from hg18 to hg19 clusters profiles based on the original release they were mapped. The profiles had to be mapped again using the raw data.

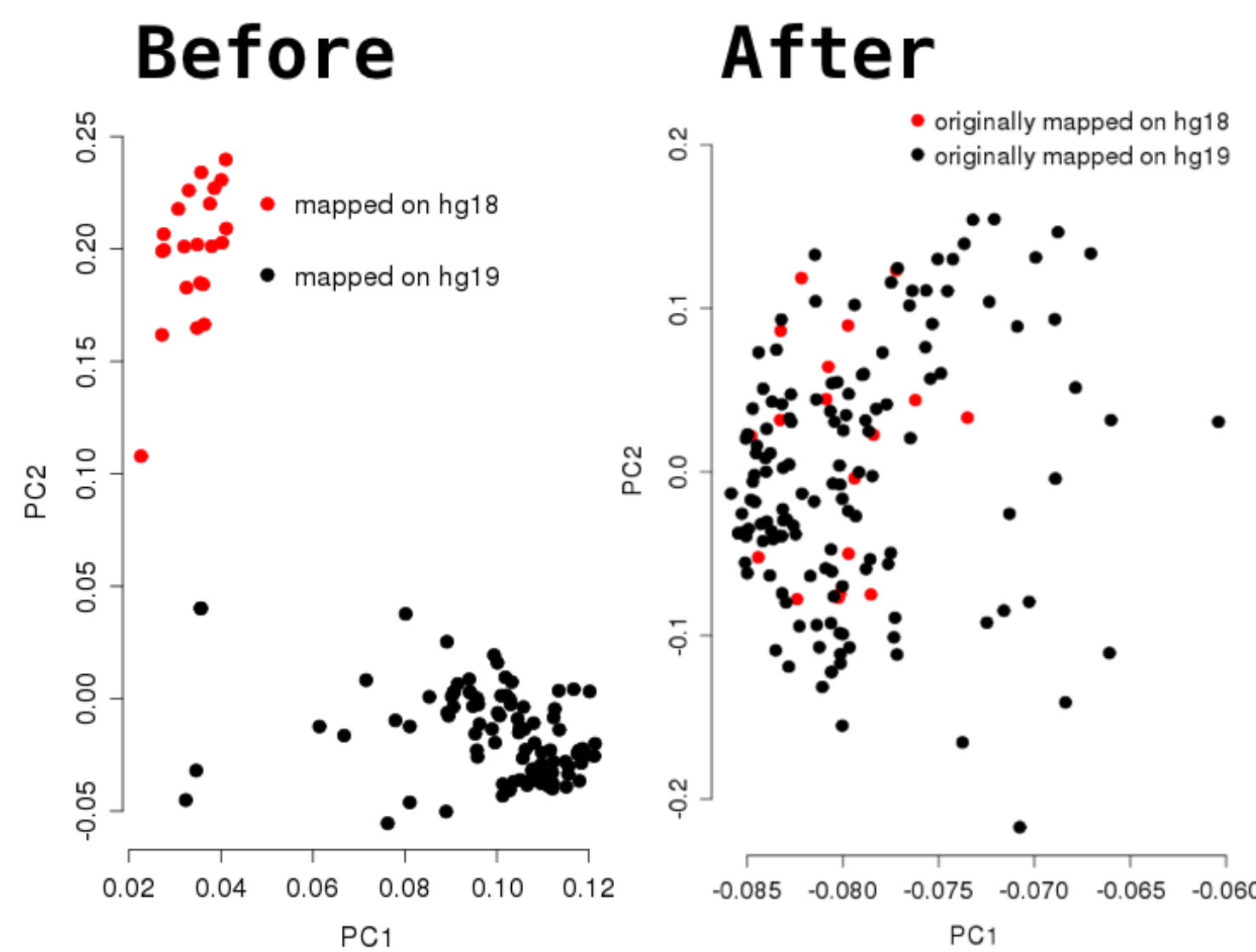


Figure 6: PCA of CHIPseq Profiles. Before (lift-over hg18-hg19): profiles cluster based on the release they were mapped. After (remapping FASTQ files, profiles no longer cluster based on the release)

- The integrity of three CHIPseq profiles could not be confirmed, as they failed the md5sum check verification.
- Out of 158 CHIPseq profiles, 65 profiles do not pass the FASTQC tests.

REFERENCES & ACKNOWLEDGMENT

- 1 Filion, G. J. et al. Systematic Protein Location Mapping Reveals Five Principal Chromatin Types in *Drosophila* Cells. *Cell*, 2010.
- 2 ENCODE Project Consortium, et al. A user's guide to the encyclopedia of DNA elements (ENCODE). *PLoS Biol*, 2011.

“Special thanks to you for reading our poster. We do hope you enjoy reading it. If you feel like giving some comments, questions, or (thoughtful) gifts maybe :) , please feel free to contact us.