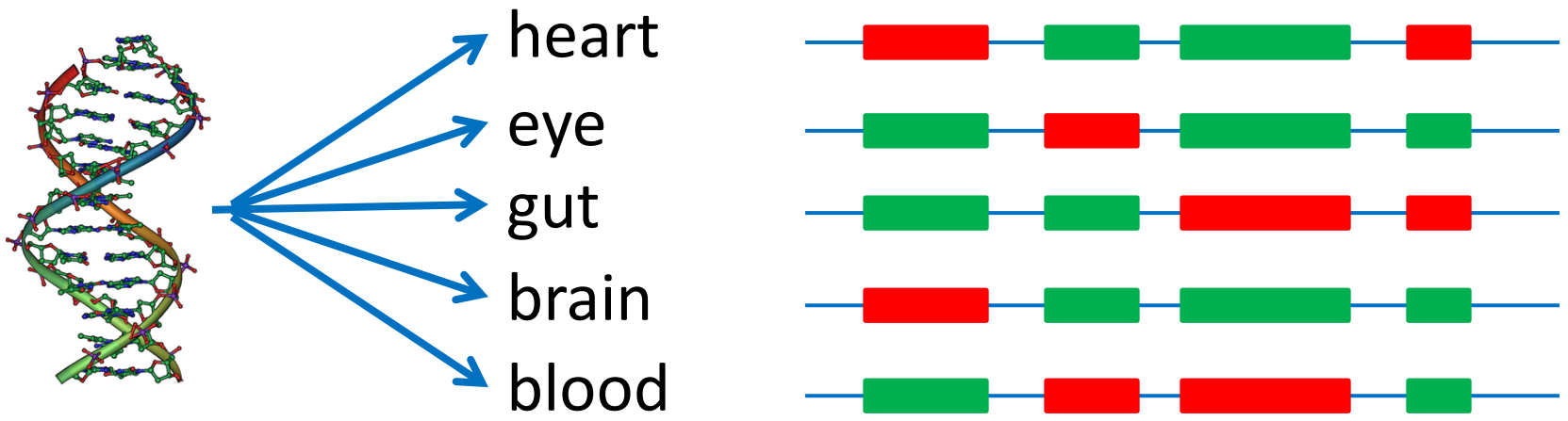
The NIH Roadmap Epigenomics Program: A Community Epigenomics Resource

Lisa Helbling Chadwick, Ph.D.
(chadwickL@niehs.nih.gov)

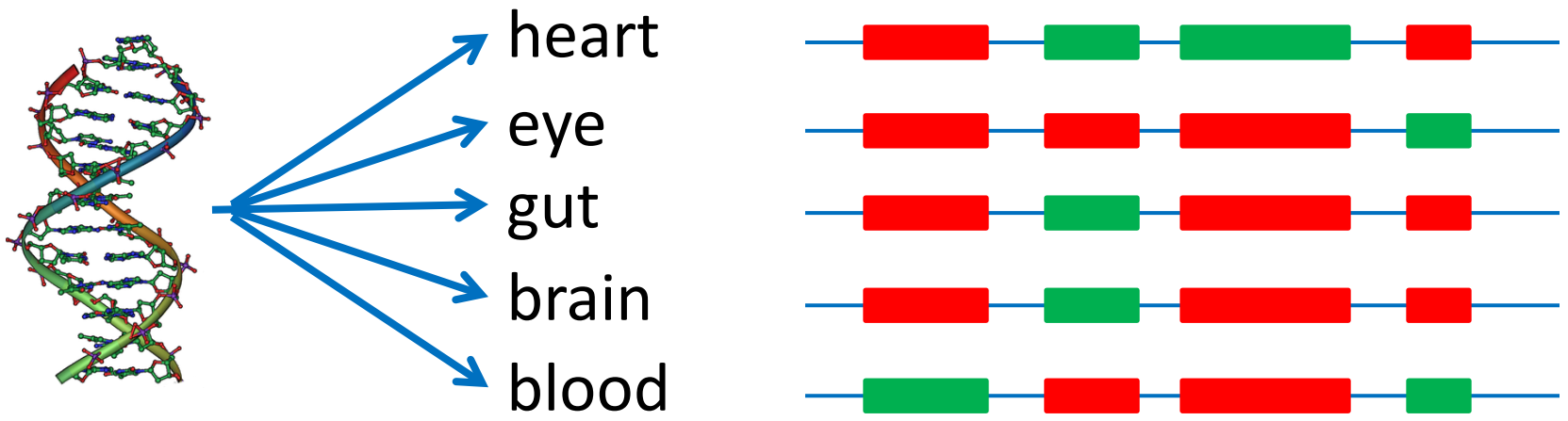
Program Director, NIH Roadmap Epigenomics Program
National Institute of Environmental Health Sciences

NIH
NIEHS

One genome, many cell types, many epigenetic programs



Epigenetic changes may be associated with disease



What is the NIH Roadmap Epigenomics Program?

Research to transform our understanding of how epigenetics contributes to disease

(http://commonfund.nih.gov/epigenomics)

- Epigenomics of Human Health and Disease
- Technology Development in Epigenetics
- Discovery of Novel Epigenetic Marks
- Computational analyses of Reference Epigenomic data
- Functional Epigenomics (epigenomic manipulation)
- Technology Development - *in vivo* epigenetic imaging

The Reference Epigenome Mapping Consortium:

- Reference Epigenome Mapping Centers

  Brad Bernstein & Alex Meissner (Broad)

  Joe Costello (UCSF)

  Bing Ren (UCSD)

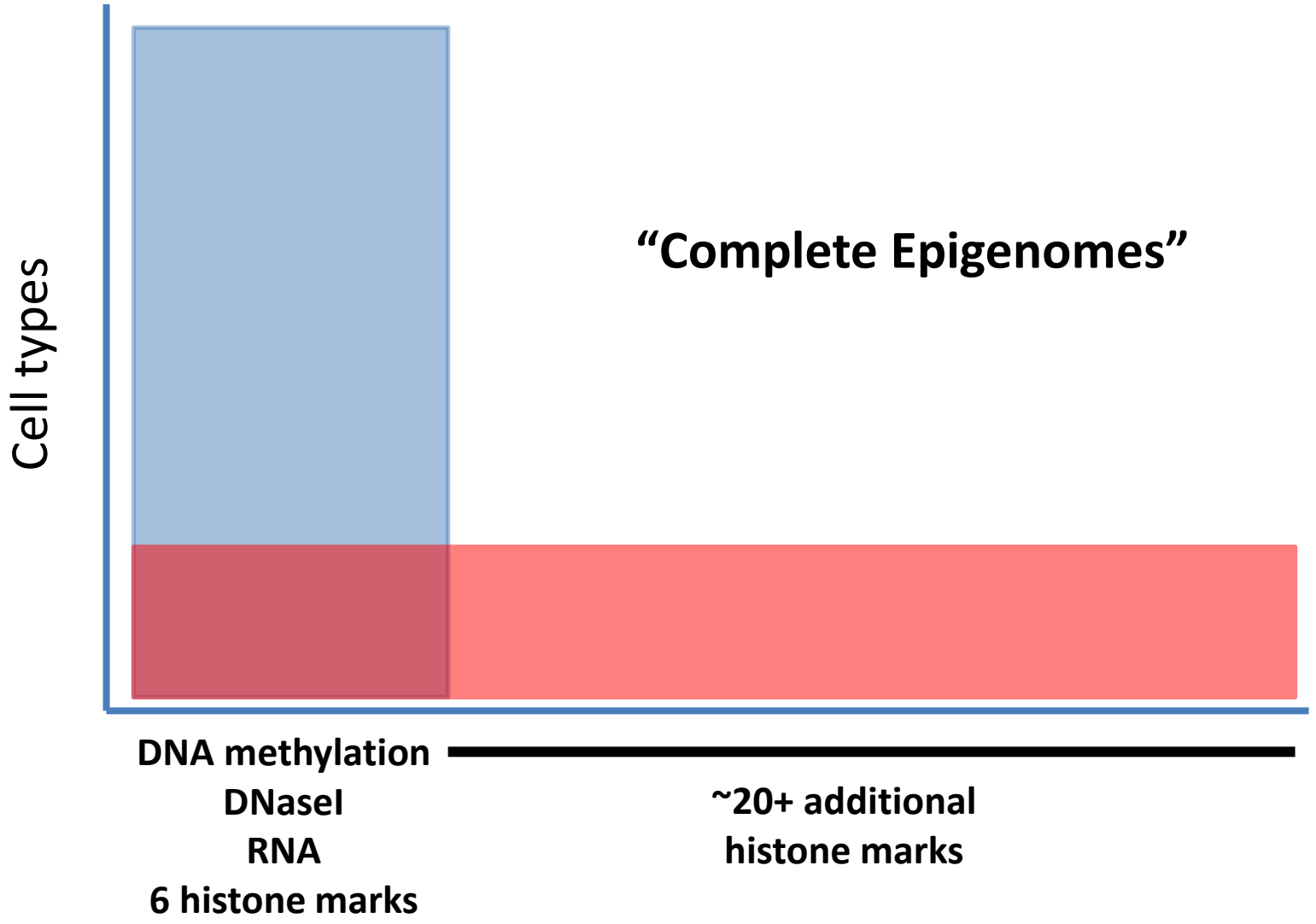
  John Stamatoyannopoulous (Washington)

- Epigenomics Data Analysis and Coordination Center

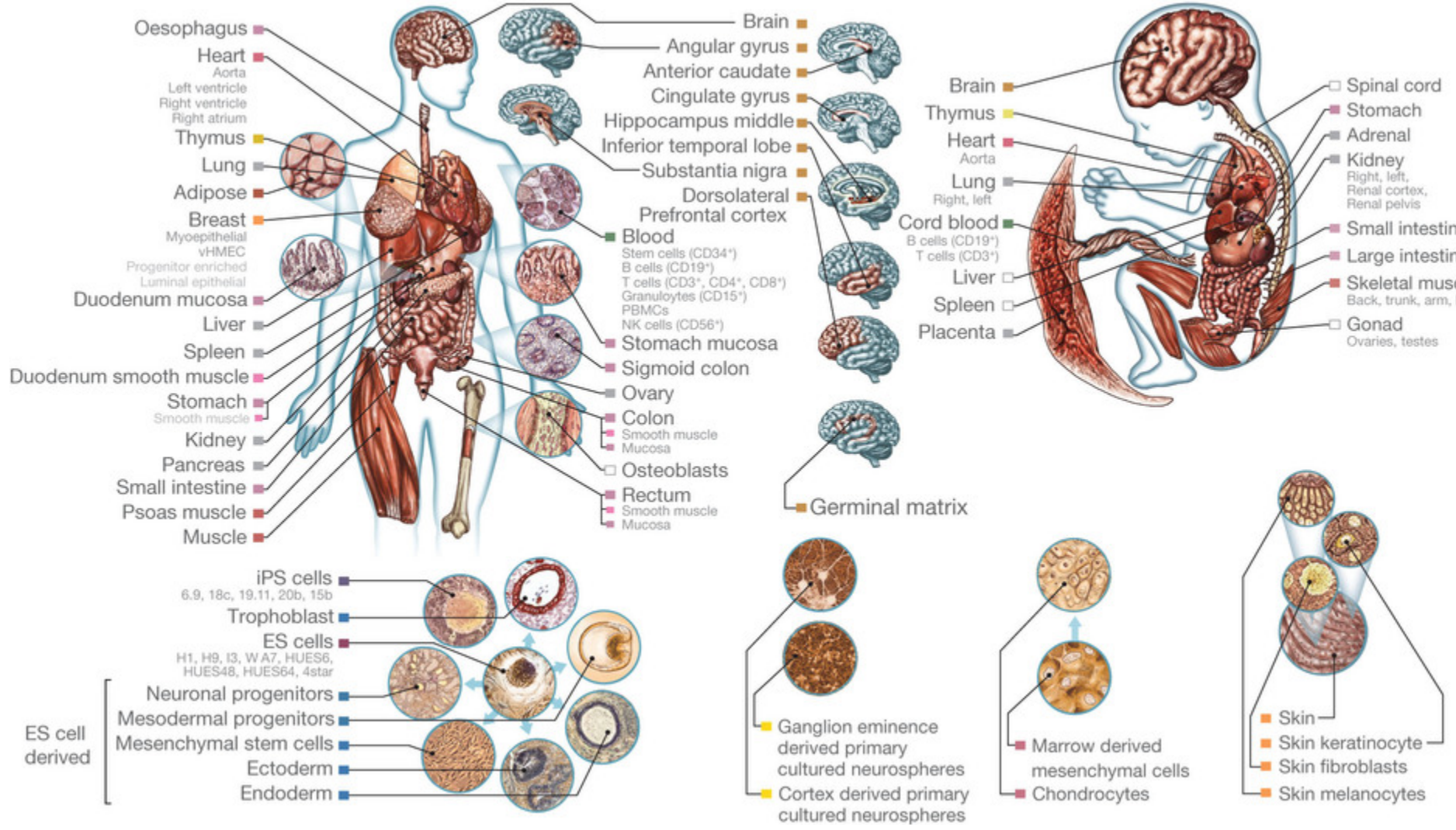
  Aleks Milosavljevic (Baylor)

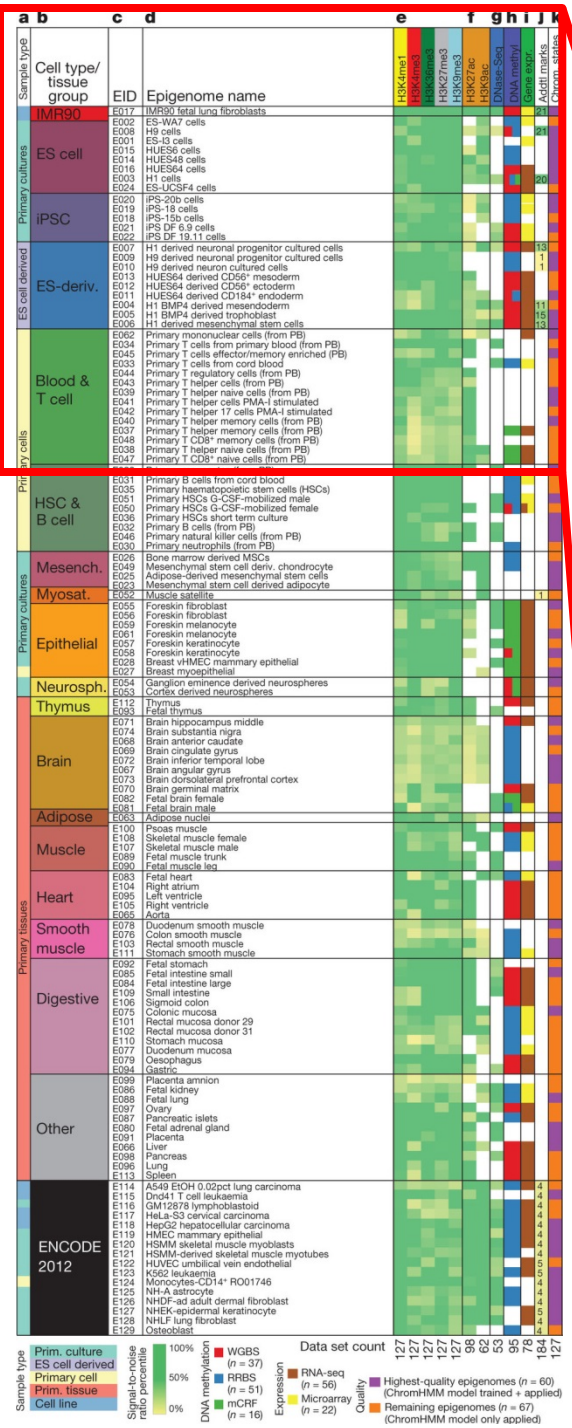
A *community resource* of epigenetic data in primary human cells/tissues

Broad and deep mapping of epigenetic profiles in human cells and tissues

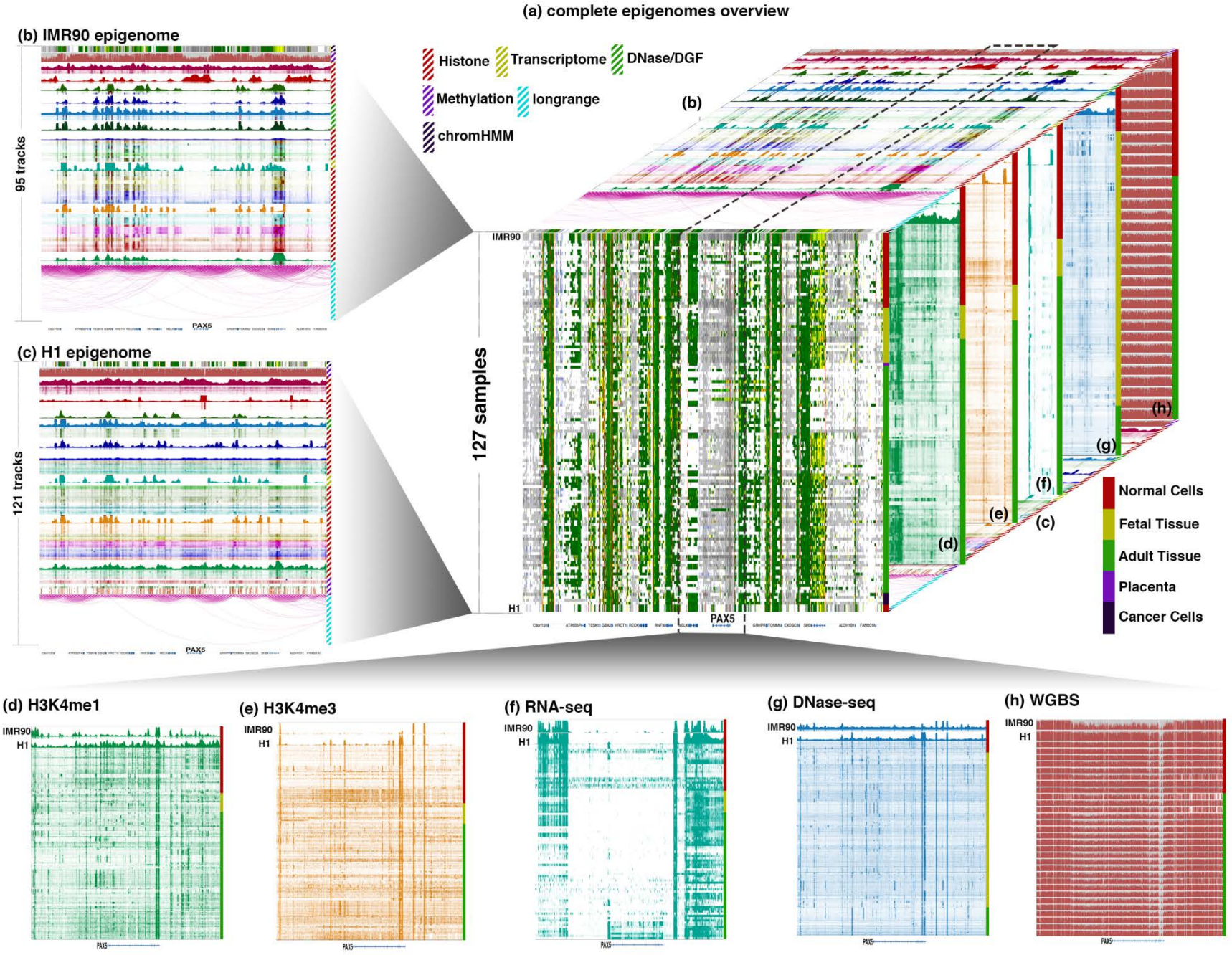


Broad and deep mapping of epigenetic profiles in over 100 human primary cells and tissues

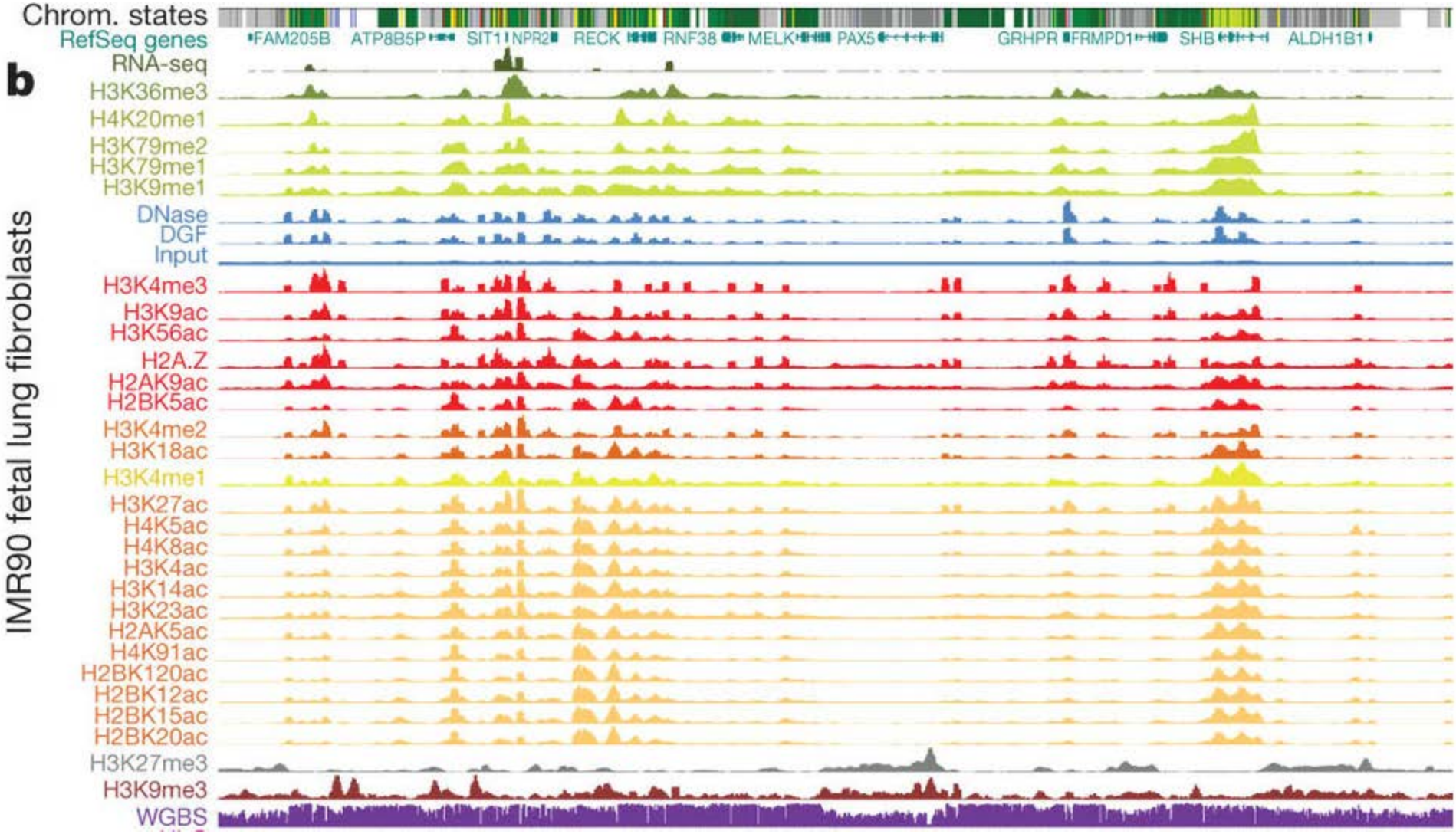




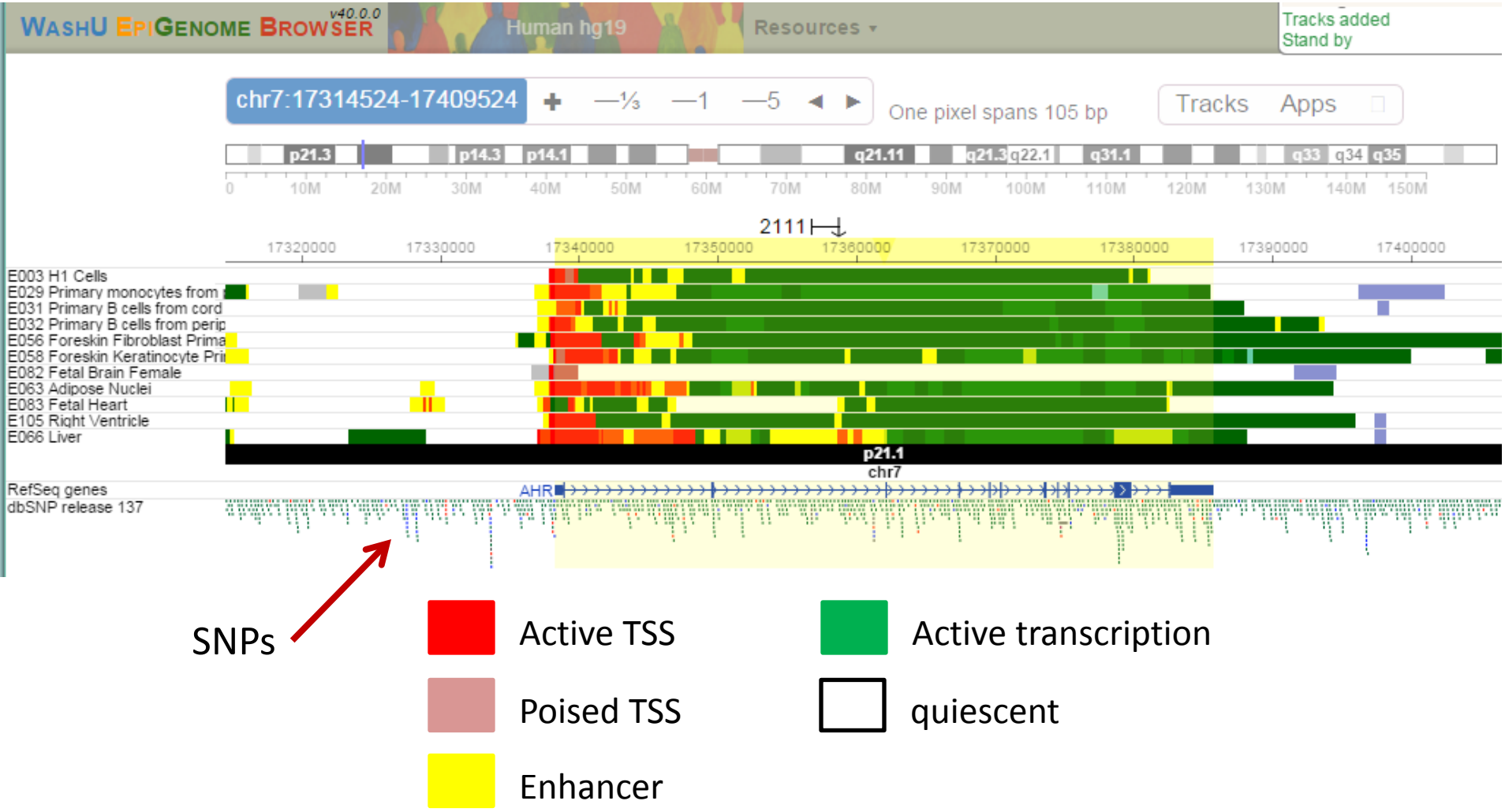
a b c d e f g h i j k
Sample type
Cell type/ tissue group
EID
Epigenome name
H3K4me1
H3K4me3
H3K36me3
H3K27me3
H3K9me3
H3K27ac
H3K9ac
DNase-Seq
DNA methyl
Gene expr.
Addtl marks
Chrom. states
IMR90
E017 IMR90 fetal lung fibroblasts
ES cell
E002 ES-WA7 cells
E008 H9 cells
E001 ES-I3 cells
E015 HUES6 cells
E014 HUES48 cells
E016 HUES64 cells
E003 H1 cells
E024 ES-UCSF4 cells
iPSC
E020 iPS-20b cells
E019 iPS-18 cells
E018 iPS-15b cells
E021 iPS DF 6.9 cells
E022 iPS DF 19.11 cells
ES-deriv.
E007 H1 derived neuronal progenitor cultured cells
E009 H9 derived neuronal progenitor cultured cells
E010 H9 derived neuron cultured cells
E013 HUES64 derived CD56+ mesoderm
E012 HUES64 derived CD56+ ectoderm
E011 HUES64 derived CD184+ endoderm
E004 H1 BMP4 derived mesendoderm
E005 H1 BMP4 derived trophoblast
E006 H1 derived mesenchymal stem cells
Blood & T cell
E062 Primary mononuclear cells (from PB)
E034 Primary T cells from primary blood (from PB)
E045 Primary T cells effector/memory enriched (PB)
E033 Primary T cells from cord blood
E044 Primary T regulatory cells (from PB)
E043 Primary T helper cells (from PB)
E039 Primary T helper naive cells (from PB)
E041 Primary T helper cells PMA-I stimulated
E042 Primary T helper 17 cells PMA-I stimulated
E040 Primary T helper memory cells (from PB)
E037 Primary T helper memory cells (from PB)
E048 Primary T CD8+ memory cells (from PB)
E038 Primary T helper naive cells (from PB)
E047 Primary T CD8+ naive cells (from PB)
Primary cultures
ES cell derived
Primary cells


(a) complete epigenomes overview
(b) IMR90 epigenome
95 tracks
PAX5
(c) H1 epigenome
121 tracks
PAX5
Histone
Transcriptome
DNase/DGF
Methylation
longrange
chromHMM
(b)
IMR90
127 samples
H1
PAX5
(h)
(g)
(f)
(e)
(c)
(d)
Normal Cells
Fetal Tissue
Adult Tissue
Placenta
Cancer Cells
(d) H3K4me1
IMR90
H1
PAX5
(e) H3K4me3
IMR90
H1
PAX5
(f) RNA-seq
IMR90
H1
PAX5
(g) DNase-seq
IMR90
H1
PAX5
(h) WGBS
IMR90
H1
PAX5

Chromatin state tracks summarize information from epigenomic maps



Chromatin state tracks summarize information from epigenomic maps

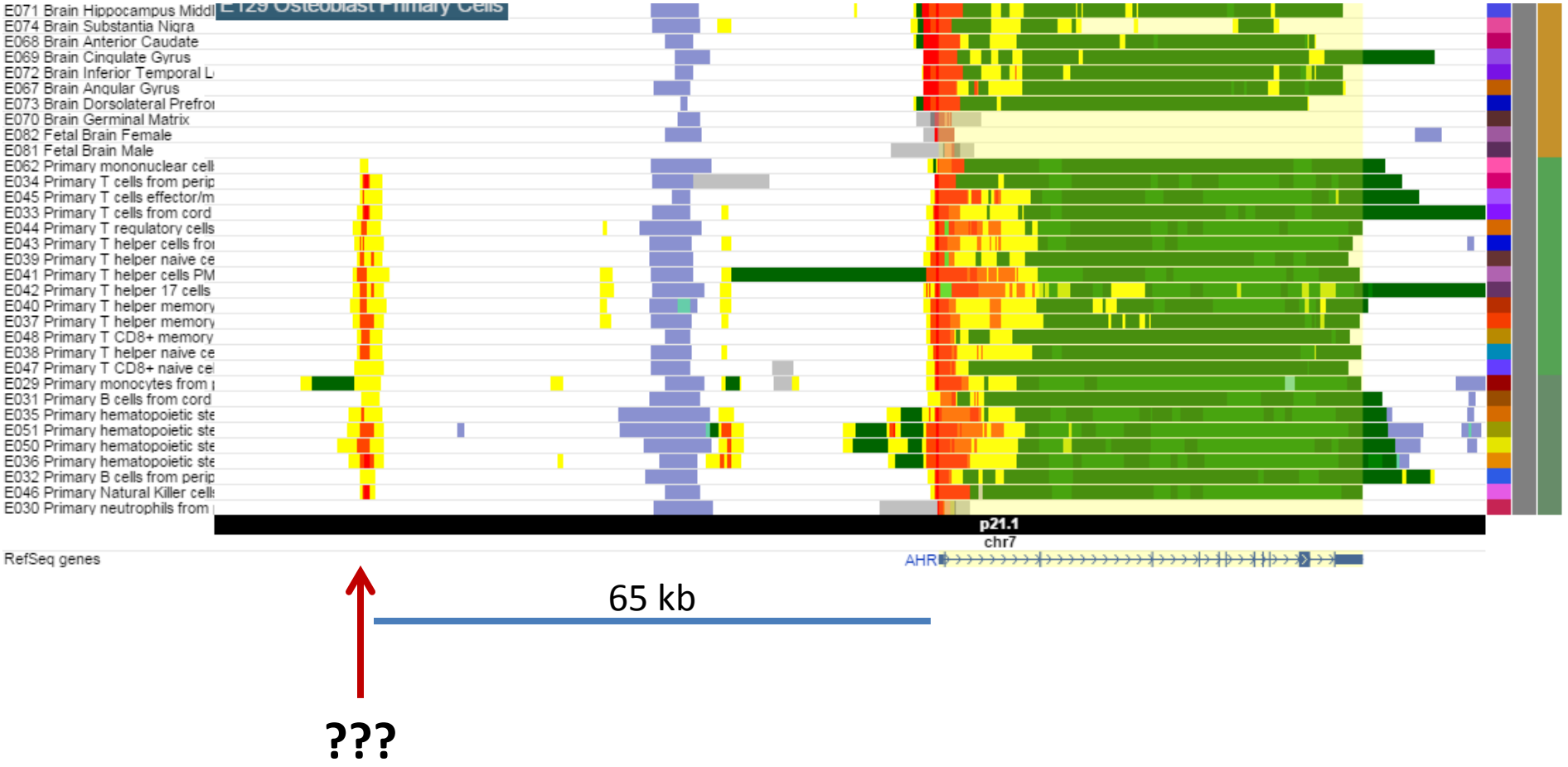


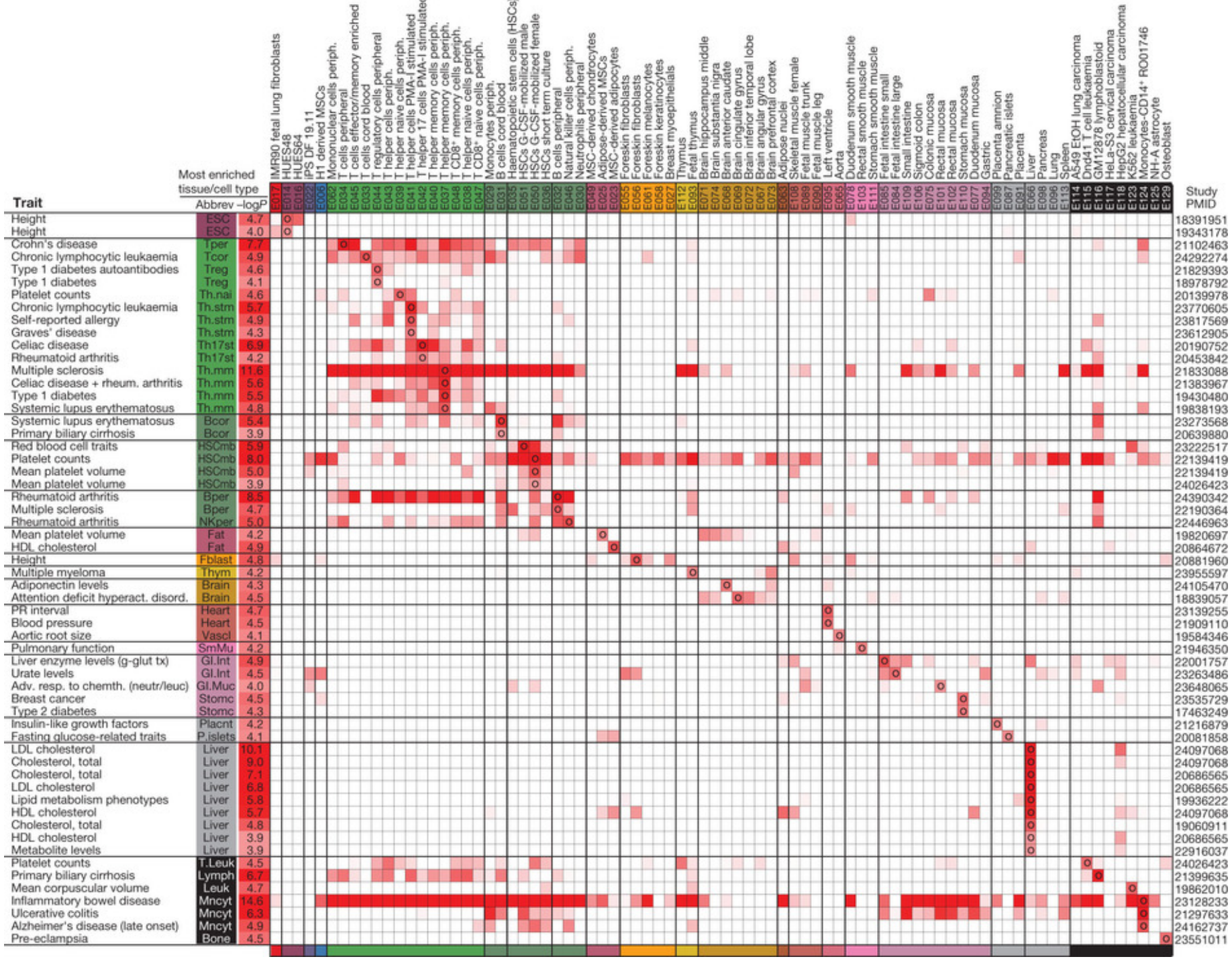
A lot of data, a lot of papers published

Find out:

- What data are there?
- What did we learn from these data about how the epigenome varies across normal tissues, and across differentiation?
- How can we use the data to identify regulatory modules?
- What are some things you do with these data?

I got a highly significant SNP in my GWAS…. in the middle of nowhere!




IMR90 fetal lung fibroblasts
HUES48
HUES64
iPS DF 19.11
H1 derived MSCs
Mononuclear cells periph.
T cells peripheral
T cells effector/memory enriched
T cells cord blood
T regulatory cells peripheral
T helper cells periph.
T helper naive cells periph.
T helper cells PMA-I stimulated
T helper 17 cells PMA-I stimulated
T helper memory cells periph.
T helper memory cells periph.
T CD8+ memory cells periph.
T helper naive cells periph.
T CD8+ naive cells periph.
Monocytes periph.
B cells cord blood
Haematopoietic stem cells (HSCs)
HSCs G-CSF-mobilized male
HSCs G-CSF-mobilized female
HSCs short term culture
B cells peripheral
Natural killer cells periph.
Neutrophils peripheral
MSC-derived chondrocytes
Adipose-derived MSCs
MSC-derived adipocytes
Foreskin fibroblasts
Foreskin fibroblasts
Foreskin melanocytes
Foreskin keratinocytes
Breast myoepithelials
Thymus
Fetal thymus
Brain hippocampus middle
Brain substantia nigra
Brain anterior caudate
Brain cingulate gyrus
Brain inferior temporal lobe
Brain angular gyrus
Brain prefrontal cortex
Adipose nuclei
Skeletal muscle female
Fetal muscle trunk
Fetal muscle leg
Left ventricle
Aorta
Duodenum smooth muscle
Rectal smooth muscle
Stomach smooth muscle
Fetal intestine small
Fetal intestine large
Small intestine
Sigmoid colon
Colonic mucosa
Rectal mucosa
Rectal mucosa
Stomach mucosa
Duodenum mucosa
Gastric
Placenta amnion
Pancreatic islets
Placenta
Liver
Pancreas
Lung
Spleen
A549 EtOH lung carcinoma
Dnd41 T cell leukaemia
GM12878 lymphoblastoid
HeLa-S3 cervical carcinoma
HepG2 hepatocellular carcinoma
K562 leukaemia
Monocytes-CD14+ RO01746
NH-A astrocyte
Osteoblast
Most enriched tissue/cell type
Trait
Abbrev
−logP
Study PMID
Height ESC 4.7 18391951
Height ESC 4.0 19343178
Crohn's disease Tper 7.7 21102463
Chronic lymphocytic leukaemia Tcor 4.9 24292274
Type 1 diabetes autoantibodies Treg 4.6 21829393
Type 1 diabetes Treg 4.1 18978792
Platelet counts Th.nai 4.6 20139978
Chronic lymphocytic leukaemia Th.stm 5.7 23770605
Self-reported allergy Th.stm 4.9 23817569
Graves' disease Th.stm 4.3 23612905
Celiac disease Th17st 6.9 20190752
Rheumatoid arthritis Th17st 4.2 20453842
Multiple sclerosis Th.mm 11.6 21833088
Celiac disease + rheum. arthritis Th.mm 5.6 21383967
Type 1 diabetes Th.mm 5.5 19430480
Systemic lupus erythematosus Th.mm 4.8 19838193
Systemic lupus erythematosus Bcor 5.4 23273568
Primary biliary cirrhosis Bcor 3.9 20639880
Red blood cell traits HSCmb 5.9 23222517
Platelet counts HSCmb 8.0 22139419
Mean platelet volume HSCmb 5.0 22139419
Mean platelet volume HSCmb 3.9 24026423
Rheumatoid arthritis Bper 8.5 24390342
Multiple sclerosis Bper 4.7 22190364
Rheumatoid arthritis NKper 5.0 22446963
Mean platelet volume Fat 4.2 19820697
HDL cholesterol Fat 4.9 20864672
Height Fblast 4.8 20881960
Multiple myeloma Thym 4.2 23955597
Adiponectin levels Brain 4.3 24105470
Attention deficit hyperact. disord. Brain 4.5 18839057
PR interval Heart 4.7 23139255
Blood pressure Heart 4.5 21909110
Aortic root size Vascl 4.1 19584346
Pulmonary function SmMu 4.2 21946350
Liver enzyme levels (g-glut tx) Gl.Int 4.9 22001757
Urate levels Gl.Int 4.5 23263486
Adv. resp. to chemth. (neutr/leuc) Gl.Muc 4.0 23648065
Breast cancer Stomc 4.5 23535729
Type 2 diabetes Stomc 4.3 17463249
Insulin-like growth factors Placnt 4.2 21216879
Fasting glucose-related traits P.islets 4.1 20081858
LDL cholesterol Liver 10.1 24097068
Cholesterol, total Liver 9.0 24097068
Cholesterol, total Liver 7.1 20686565
LDL cholesterol Liver 6.8 20686565
Lipid metabolism phenotypes Liver 5.8 19936222
HDL cholesterol Liver 5.7 24097068
Cholesterol, total Liver 4.8 19060911
HDL cholesterol Liver 3.9 20686565
Metabolite levels Liver 3.9 22916037
Platelet counts T.Leuk 4.5 24026423
Primary biliary cirrhosis Lymph 6.7 21399635
Mean corpuscular volume Leuk 4.7 19862010
Inflammatory bowel disease Mncyt 14.6 23128233
Ulcerative colitis Mncyt 6.3 21297633
Alzheimer's disease (late onset) Mncyt 4.9 24162737
Pre-eclampsia Bone 4.5 23551011

Browse many articles by topical “threads” at nature.com/epigenomeroadmap

I would like to look at this data. Where do I go?

Lots of choices!

http://roadmapepigenomics.org

Just give me the data. That's it.

NCBI

Gene Expression Omnibus

GEO Publications | FAQ | MIAME | Email GEO

NCBI » GEO » NIH Roadmap Epigenomics Logi

NIH Roadmap Epigenomics Project Data Listings

This page summarizes Roadmap Epigenomics project data that are available through the GEO repository. Additional data will be added as it becomes available.

For data usage terms and conditions, please refer to Epigenomics Data Access Policies

More information and resources are available:

- Roadmap Epigenomics Homepage
- Epigenome Browser
- Epigenome Atlas
- NCBI Epigenomics Gateway

FTP download

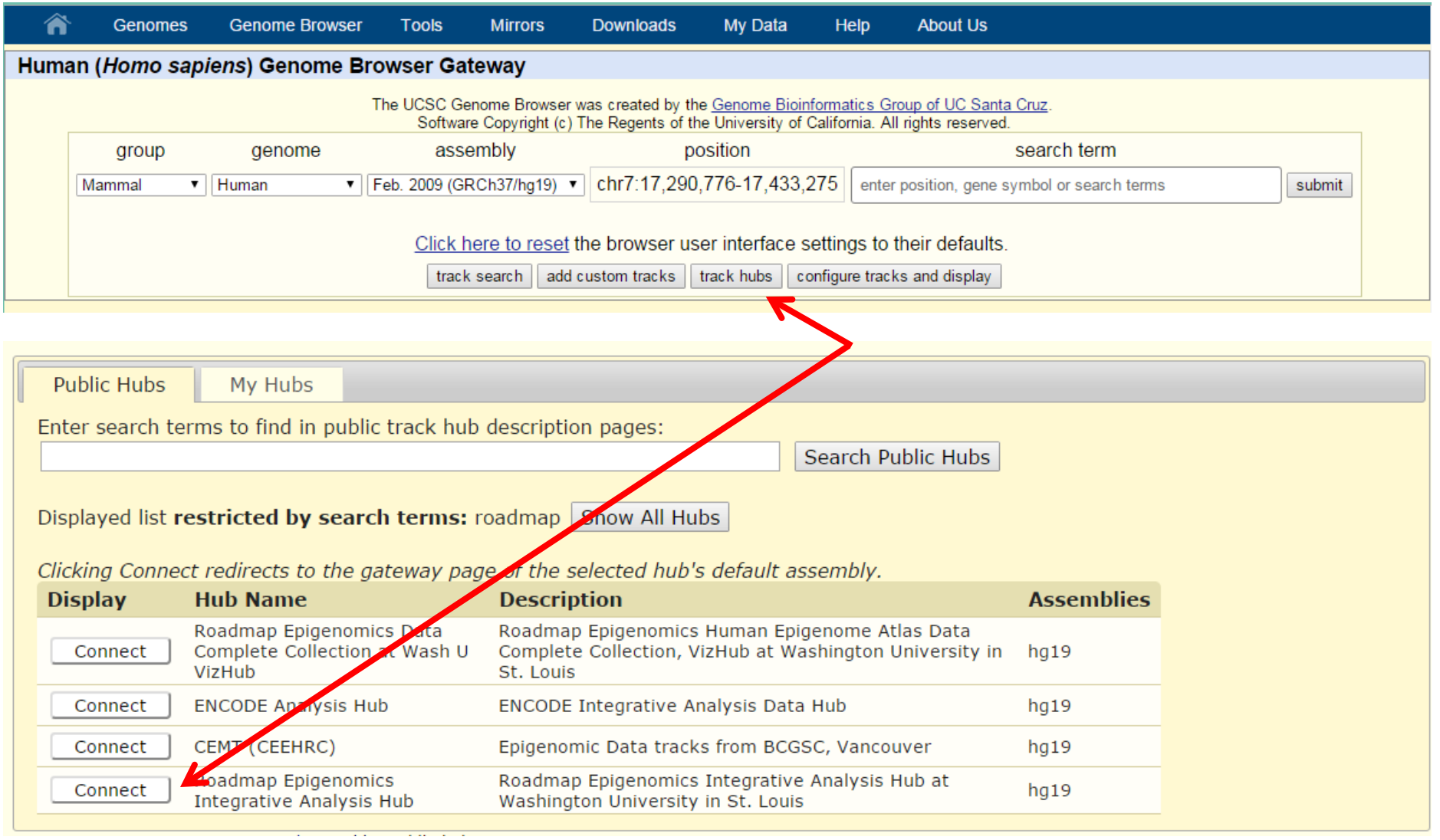
How to use this page

Samples | Studies | Matrix

Search 3135 results View tracks Export Page 1 of 63 > >> Page size 50

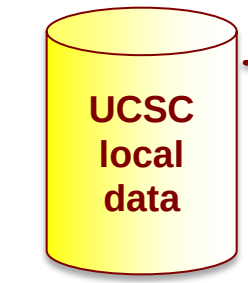
GEO Accession	Sample	Experiment	Track	Center	Download	Embargo end date
GSM409307	H1 cell line	H3K4me1		UCSD	sra bam,bed,wig	2010-05-03
GSM409308	H1 cell line	H3K4me3		UCSD	sra bam,bed,wig	2010-05-03
GSM409312	H1 cell line	H3K36me3		UCSD	sra bam,bed,wig	2010-05-03
GSM410807	H1 cell line	H3K9ac		UCSF-UBC	sra bam,bed,wig	2010-05-03
GSM410808	H1 cell line	H3K4me3		UCSF-UBC	sra bam,bed,wig	2010-05-03
GSM428286	H1 cell line	MRE-Seq		UCSF-UBC	sra bam,bed,wig	2010-10-07
GSM428289	H1 cell line	ChIP-Seq input		UCSF-UBC	sra bam,bed,wig	2010-05-03
GSM428291	H1 cell line	H3K9me3		UCSF-UBC	sra bam,bed,wig	2010-05-03
GSM428295	H1 cell line	H3K27me3		UCSF-UBC	sra bam,bed,wig	2010-05-03
GSM428296	H1 cell line	H3K36me3		UCSF-UBC	sra bam,bed,wig	2010-05-03

I just want to look at the data! (and I have the patience to deal with the UCSC browser)



http://genome.ucsc.edu

Remote hub



cale
hr2:

DNase Clusters

30 _
3K27me3 Solexa-8039
0 _
30 _
BI H1 H3K4me3 Solexa
0 _

ENCODE

BS

MeDIP

MRE

K27me3

K4me3

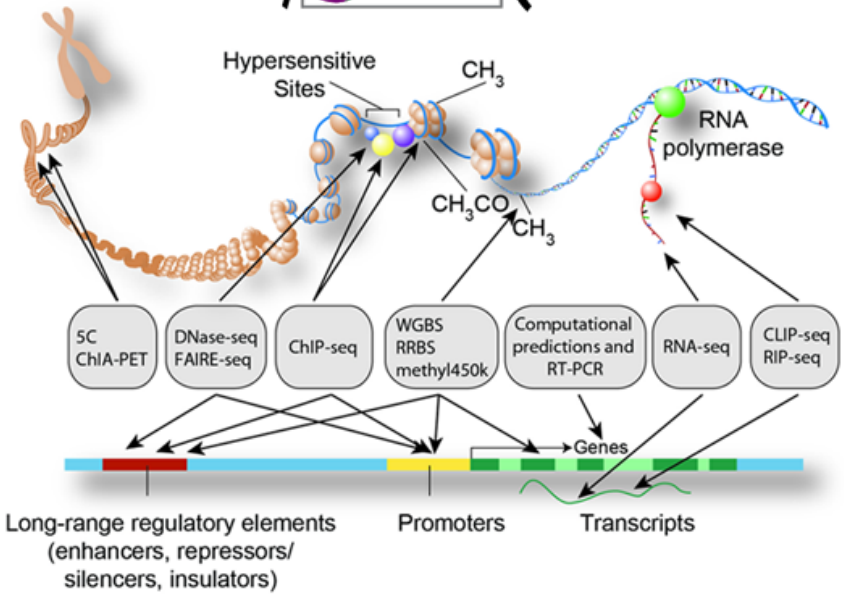
Input

Another option: Next-gen epigenome browser @ WashU

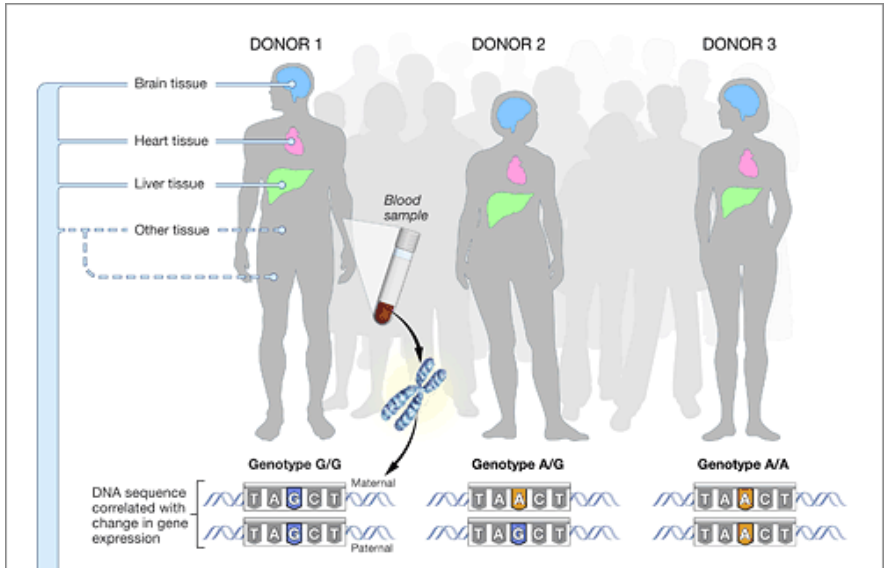
http://epigenomegateway.wustl.edu/

Lots of other large, public data sets

ENCODE



GTEx Portal



IHEC

International Human Epigenome Consortium

4D Nucleome

IHEC
International Human Epigenome Consortium

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Research

By setting quality standards and providing efficient communication structures IHEC fosters continuous exchange among scientists. It promotes rapid data sharing and minimizes redundancy between different individual research projects. Learn more about the research activities of IHEC.

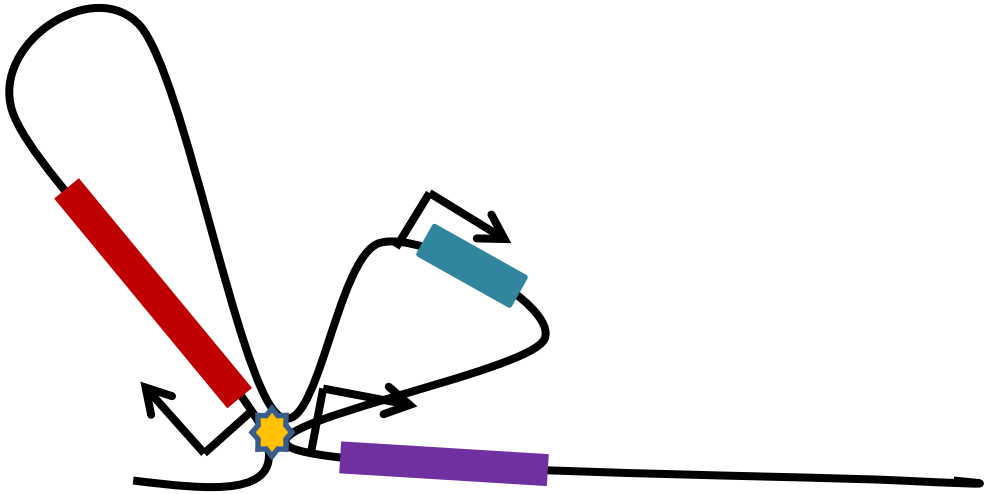
Why Epigenomics?

Epigenomics research and human health are closely linked to each other. Progress in this field of research will thus add to an improved understanding of diseases, and how to better treat and prevent them. Find out what makes epigenomics and the endeavor of IHEC so fascinating.

IHEC Data Portal

IHEC makes available comprehensive sets of reference epigenomes relevant to health and disease. You may view, search and download the data already released by the different IHEC-associated projects via the IHEC Data Portal.

What is 4D Nucleome




Joe Costello, UCSF
John Stamatoyannopoulos, UW
Aleks Milosavljevic, Baylor
Bing Ren, UCSD
Manolis Kellis, MIT
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Fred Tyson, NIEHS
Astrid Haugen, NIEHS
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Martin Hirst, BCGSC