

Workshop:

Engaging 3D Roadmap Epigenomics

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Roadmap Epigenomics Consortium
4DN Consortium
TaRGET Consortium

ASHG 2016
October 18, 2016

Data in the post-genome era



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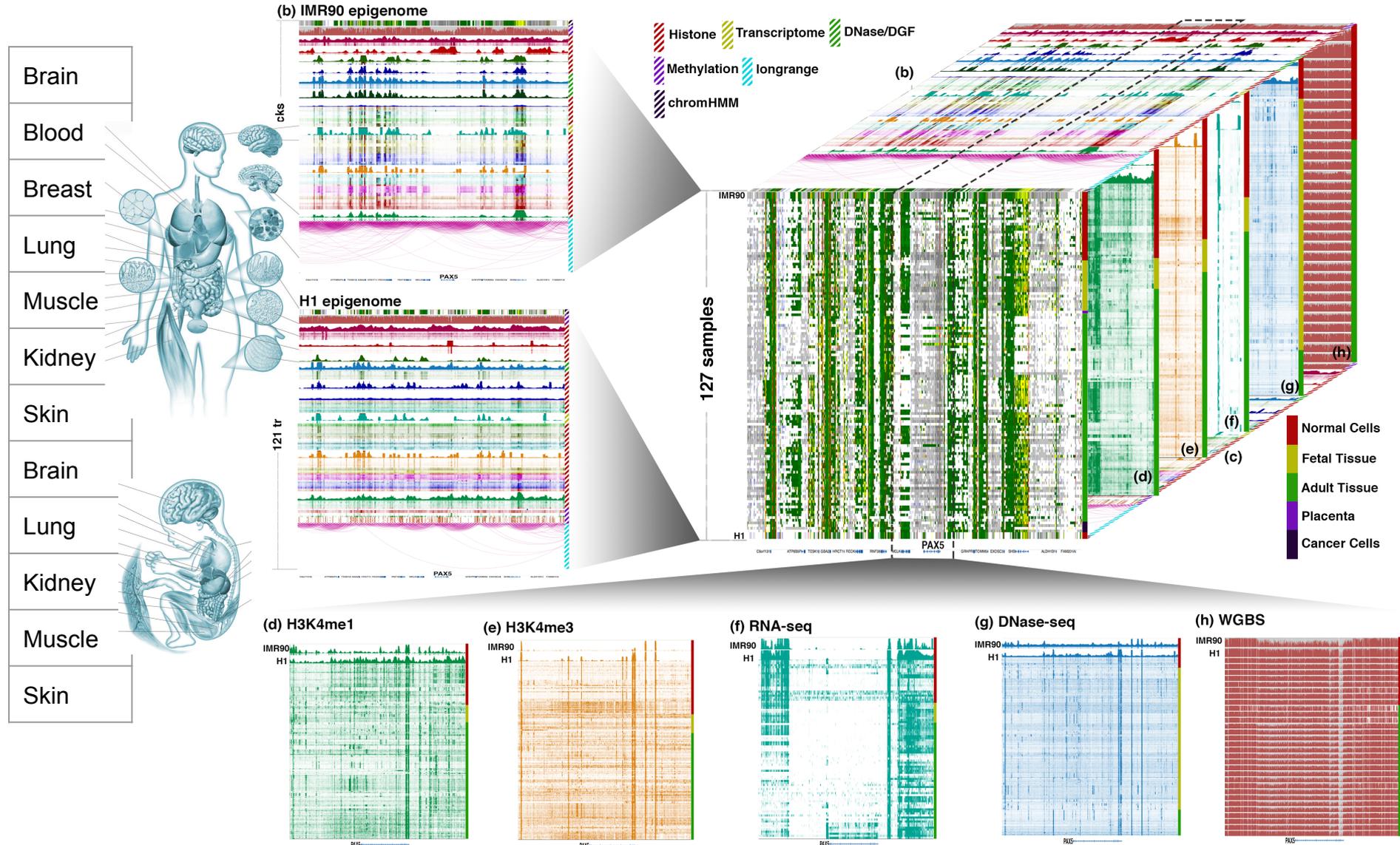
This is what actually happens





The Human Reference Epigenome

(a) complete epigenomes overview



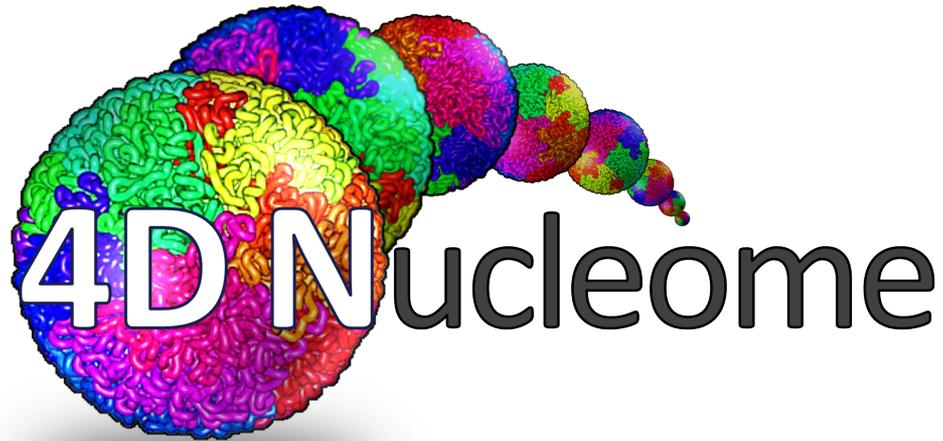
Mechanisms for accessing Roadmap data

- **Current datasets available through Wash U Hub**
 - Roadmap experimental data: ~5,000 tracks
 - Roadmap integrative analysis: ~20,000 tracks
 - ENCODE data: ~9,000 tracks
 - IHEC data (<http://epigenomesportal.ca/ihec/>): 6,000 tracks
- **UCSC Genome Browser Mirror**
 - <http://epigenome.wustl.edu>
 - Fully functional UCSC Mirror for accessing complete set of Roadmap data
- **Remote Data Hub for UCSC Browser**
 - <http://genome.ucsc.edu/cgi-bin/hgTracks?db=hg19&hubUrl=http://vizhub.wustl.edu/VizHub/RoadmapReleaseAll.txt>
 - Data are physically located at remote site (St. Louis), and directly displayed at UCSC Genome Browser
- **Wash U Epigenome Browser**
 - <http://epigenomegateway.wustl.edu>
 - Next generation genome browser for exploring Roadmap, ENCODE, and other data
 - Community outreach and workshops
 - <http://epigenomegateway.wustl.edu/support/workshop.html>

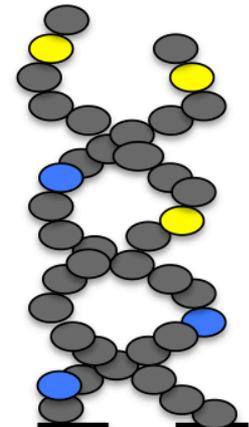
WashU Epigenome Browser:

Innovations in exploring epigenomic data

- **Community resource for multi-dimensional data**
 - Browse hundreds of data tracks in one view
 - Display epigenomic data alongside with their metadata
 - Viewing data on specific genomic features, genesets, or pathways
 - Outreach activities
 - **Google-map style browsing**
 - Heatmap, wiggle map, going from whole genome to single base
 - Zoom and pan, drag and drop, extensive user configuration
 - Sessions, custom track, custom hub, hub cluster
 - **Visualizing non-linear genome**
 - Display chromatin interaction data (HiC, ChIA-PET, etc)
 - **Visual bioinformatics engine**
 - Real time statistical analysis
 - Common genomic data summary graph
 - **Continued development**
 - Novel, more expressive visual format
 - Comparative epigenomics
 - Cancer genome browser
 - Browser of transposable elements
- Nat Methods 2011, 8:989-990
Curr Protoc Bioinformatics. 2012
Nat Methods 2013, 10:375–376
Bioinformatics, 2014, 30(15):2206-7
Nat Biotechnology, 2015, 33, 345–346



4D Nucleome

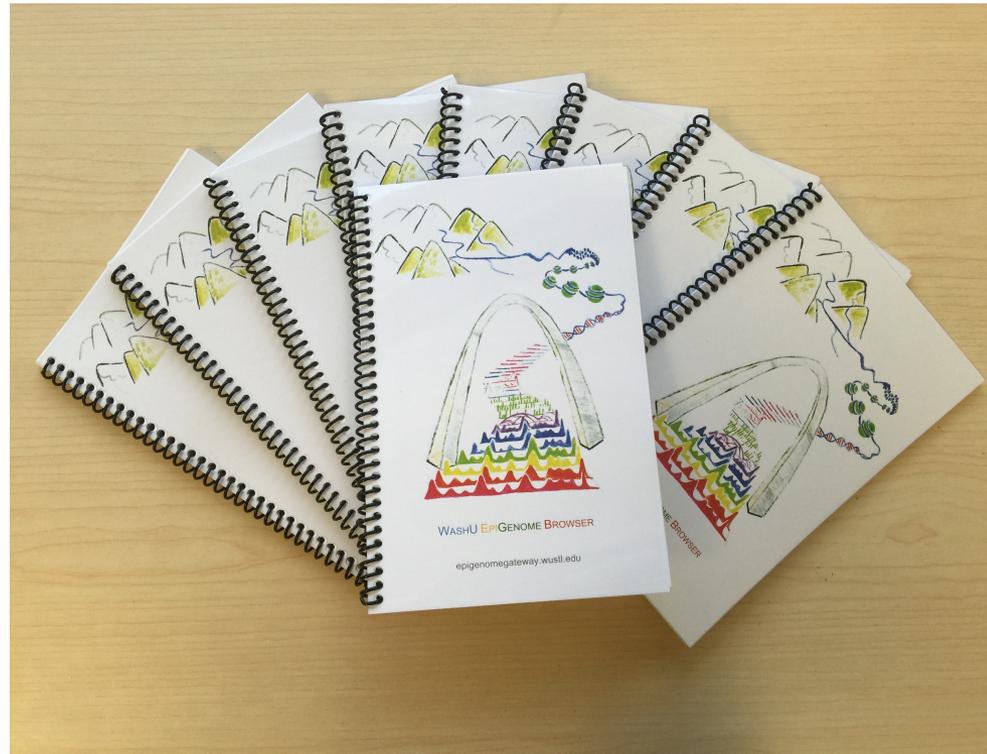


TaRGET

Toxicant Exposure **a**nd **R**esponses by
Genomic and **E**pigenomic Regulators
of **T**ranscription

Outreach and education

- Support websites
 - Wiki, helpdesk, mailing list
 - Documentations, tutorial book, video demo
- User community and social media
 - Facebook
 - Google+
- Workshops
 - CSHL
 - ASHG 2014
 - Keystone 2015
 - Shanghai 2015
 - Puerto Rico 2016
 - SOT 2016
 - Keystone 2016
 - ASHG 2016



<http://epigenomegateway.wustl.edu/support/>

WashU EpiGenome Browser Support

Tutorial Video

Workshops

Tutorial Book

- Download a [PDF](#) version.

Tutorial Video

Please go to the [Video page](#) to view video tutorials.

Workshops

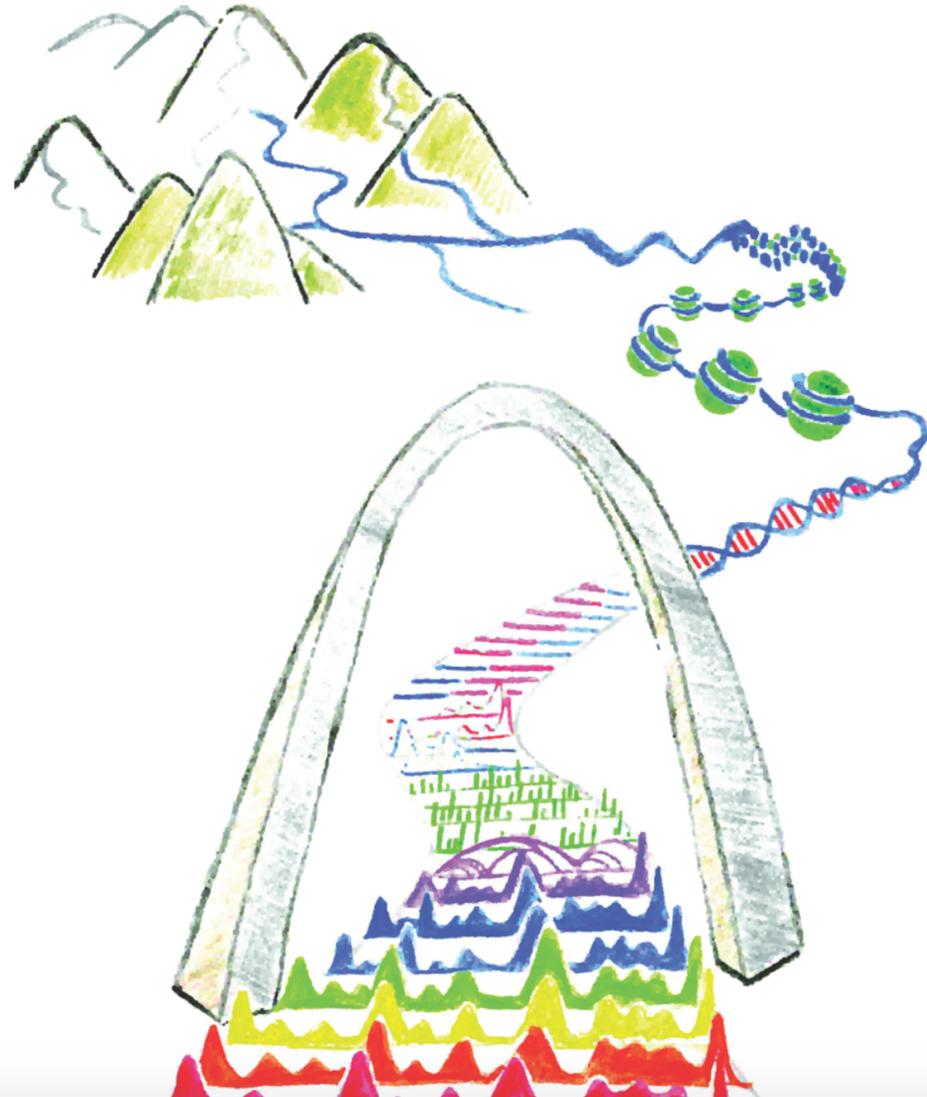
- [Workshop at 2016 Keystone Symposia](#).
- [Workshop at SOT 2016 Satellite Meeting](#).
- [Workshop at EPIGENOMICS 2016 Conference](#).
- [Workshop at The First International Epigenomics Conference 2015](#).
- [Workshop at 2015 Keystone Symposia: Keystone joint meeting on Epigenomics and DNA methylation](#)
- [Workshop at 2014 ASHG: Epigenomic Annotation of Genetic Variants Using The Washington University Epigenome Browser](#).

Please go to the [Workshops page](#) for details.

Resources

- [WashU EpiGenome Browser](#)
- [Roadmap EpiGenome Browser](#)
- [Wiki](#)
- [Publications](#)

1. Xin Zhou, Daofeng Li, Bo Zhang, Rebecca F Lowdon, Nicole B Rockweiler, Renee L Sears, Pamela A F Madden, Ivan Smirnov, Joseph F Costello and Ting Wang, **Epigenomic annotation of genetic variants using the Roadmap Epigenome Browser**, [Nature Biotechnology](#) (2015)



Resources associated with the workshop

- **Booklet (physical and online)**

- Complete tutorial of the WashU EpiGenome Browser
- Supporting websites, publications, and contacts
- Survey

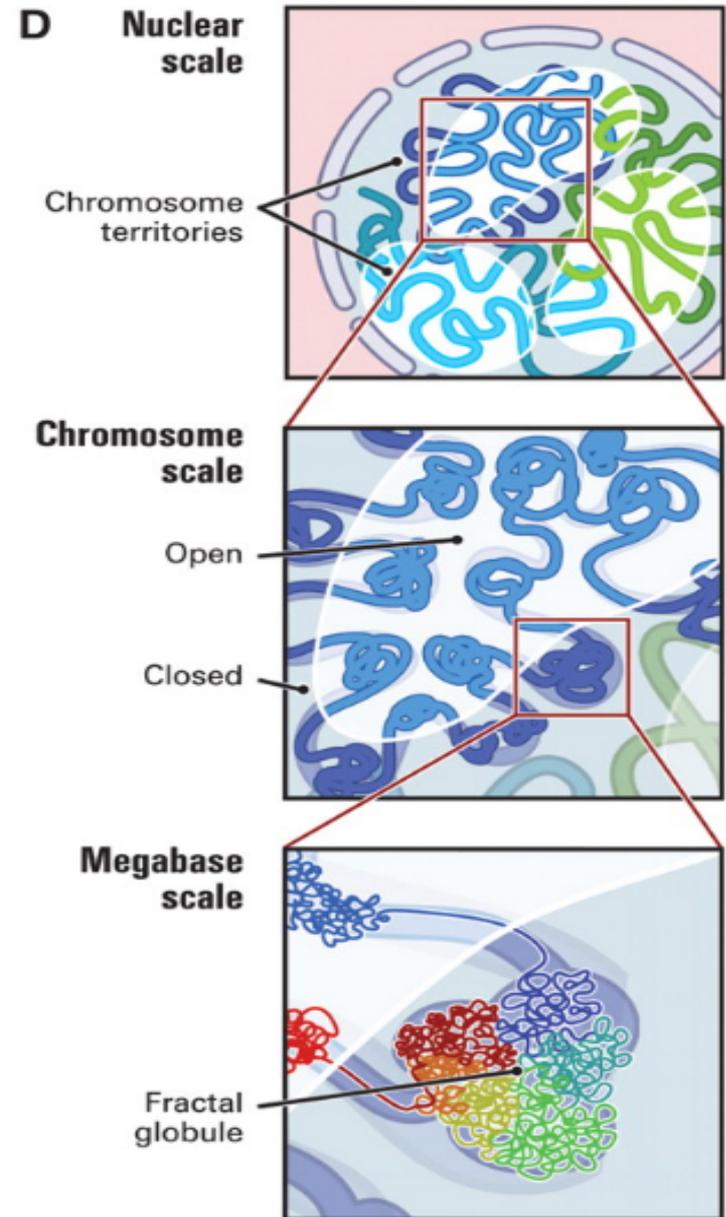
- **Handout (online)**

- Step-by-step instructions of examples in workshop
- Sample genes, SNPs, and datasets
- Multiple re-starting points (saved Browser sessions)

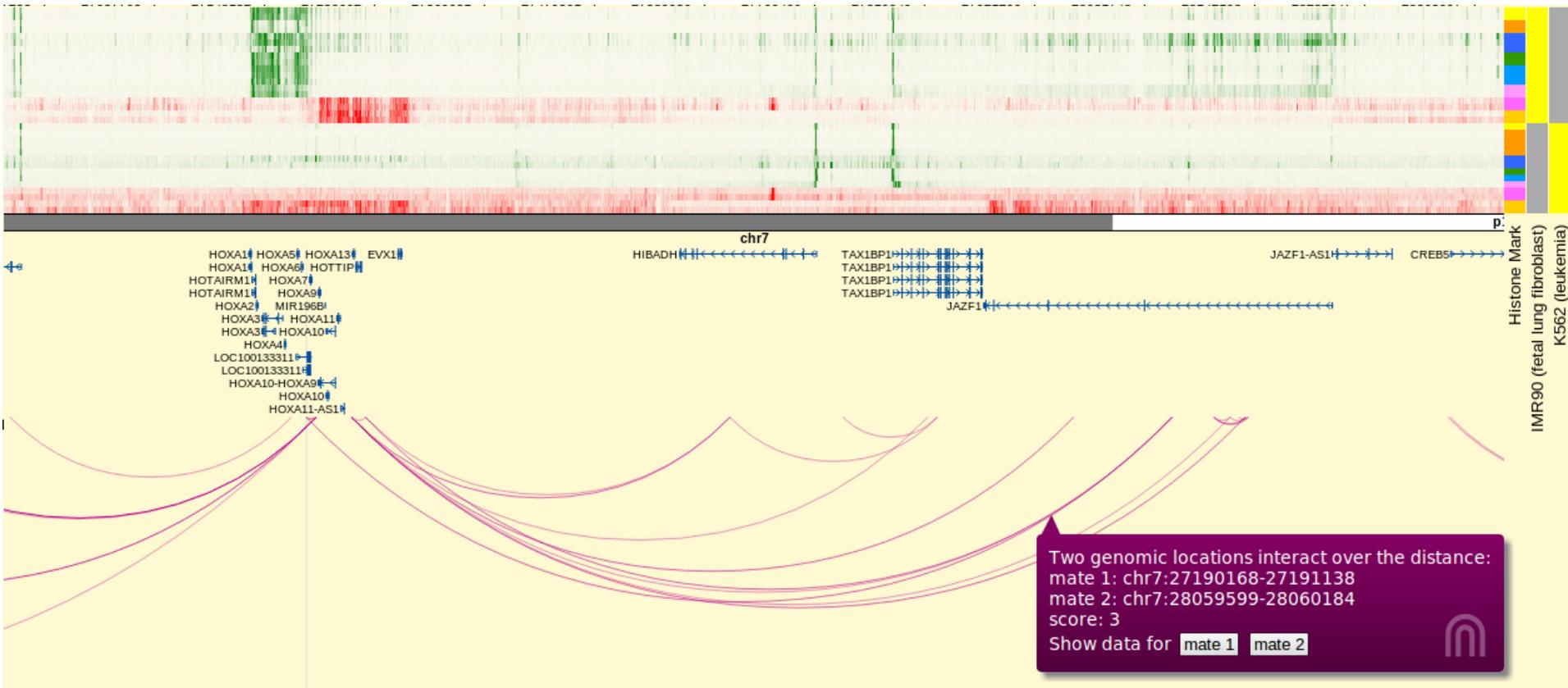
- **Websites**

- <http://epigenomegateway.wustl.edu/browser>
 - The main Browser website
- <http://epigenomegateway.wustl.edu/support/>
 - General support and information
- <http://epigenomegateway.wustl.edu/support/workshop2016keystone.html>
 - Support page for Workshop@Keystone2016

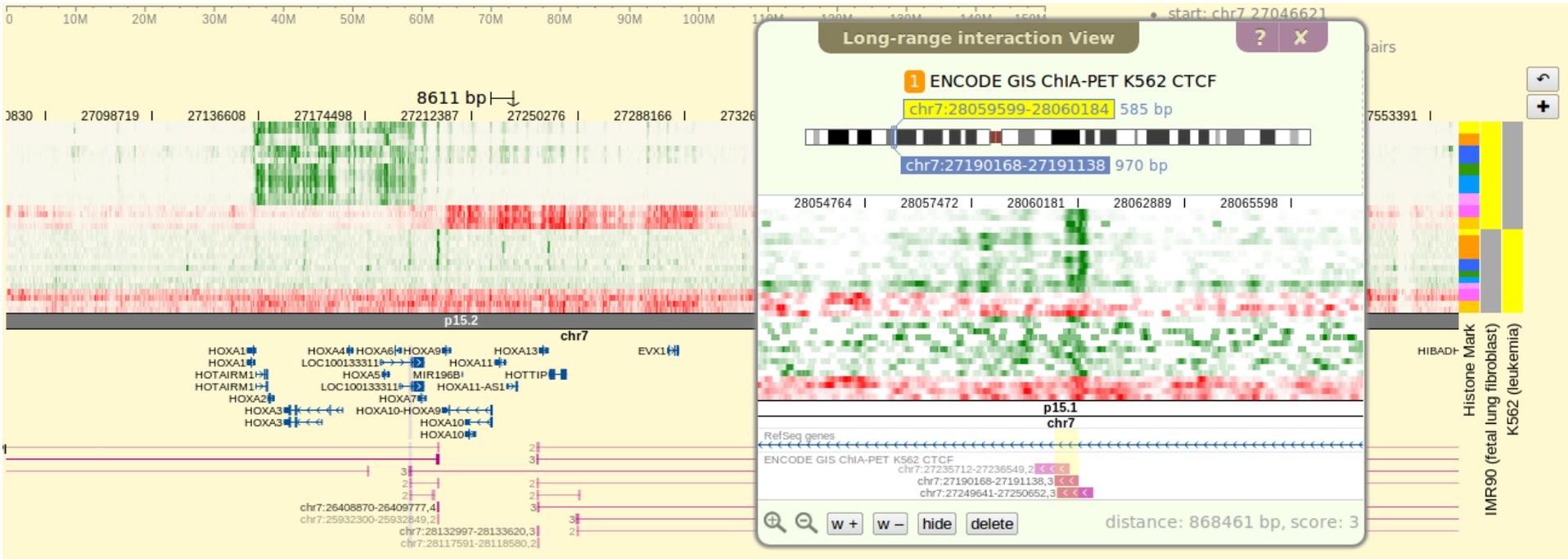
Genome Browsers as a non-linear system: Visualizing chromatin interaction data



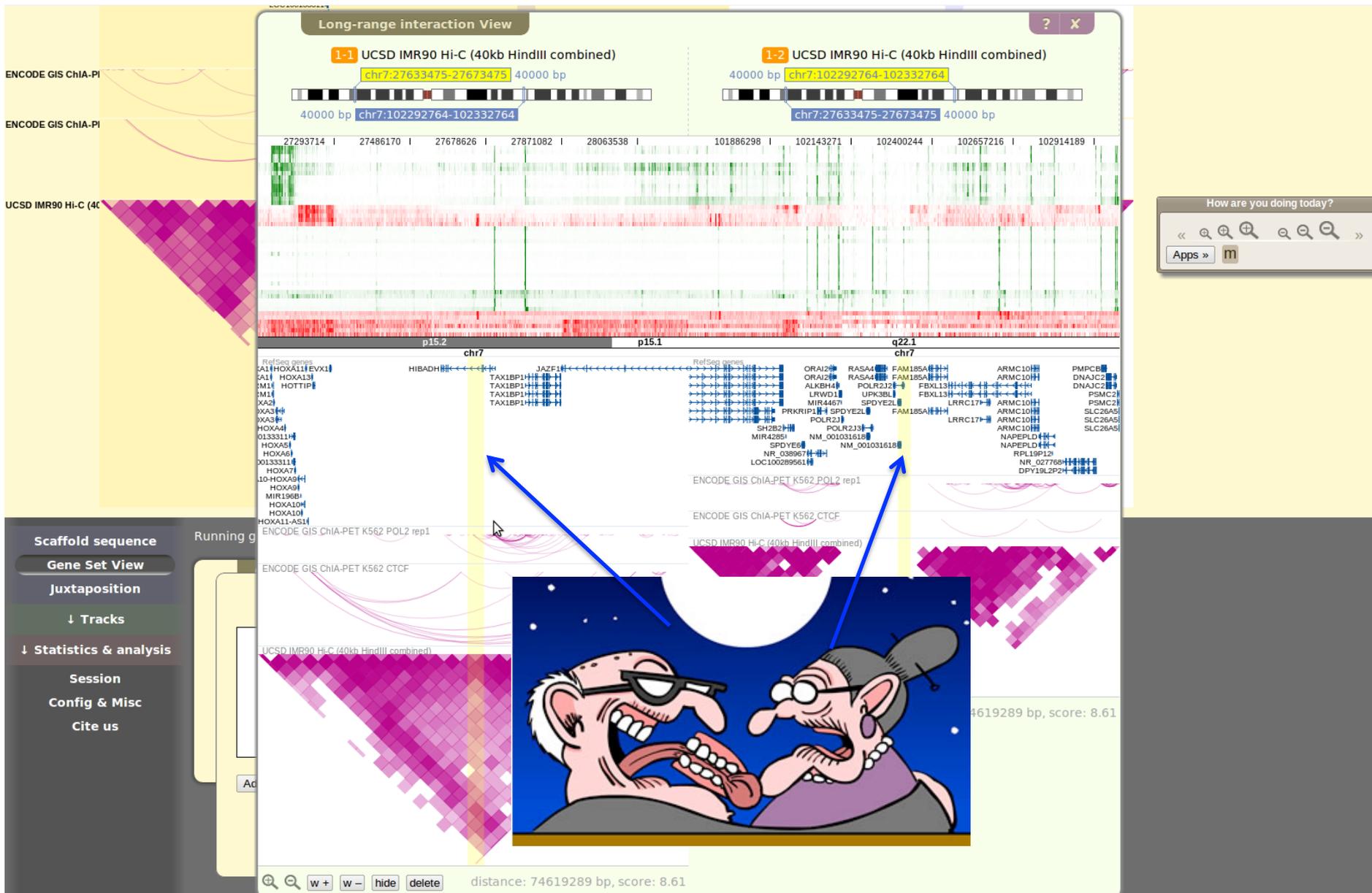
Click on arc/heatmap cell to access two interacting “mates”



Using companion panels to display genomics data over interacting loci



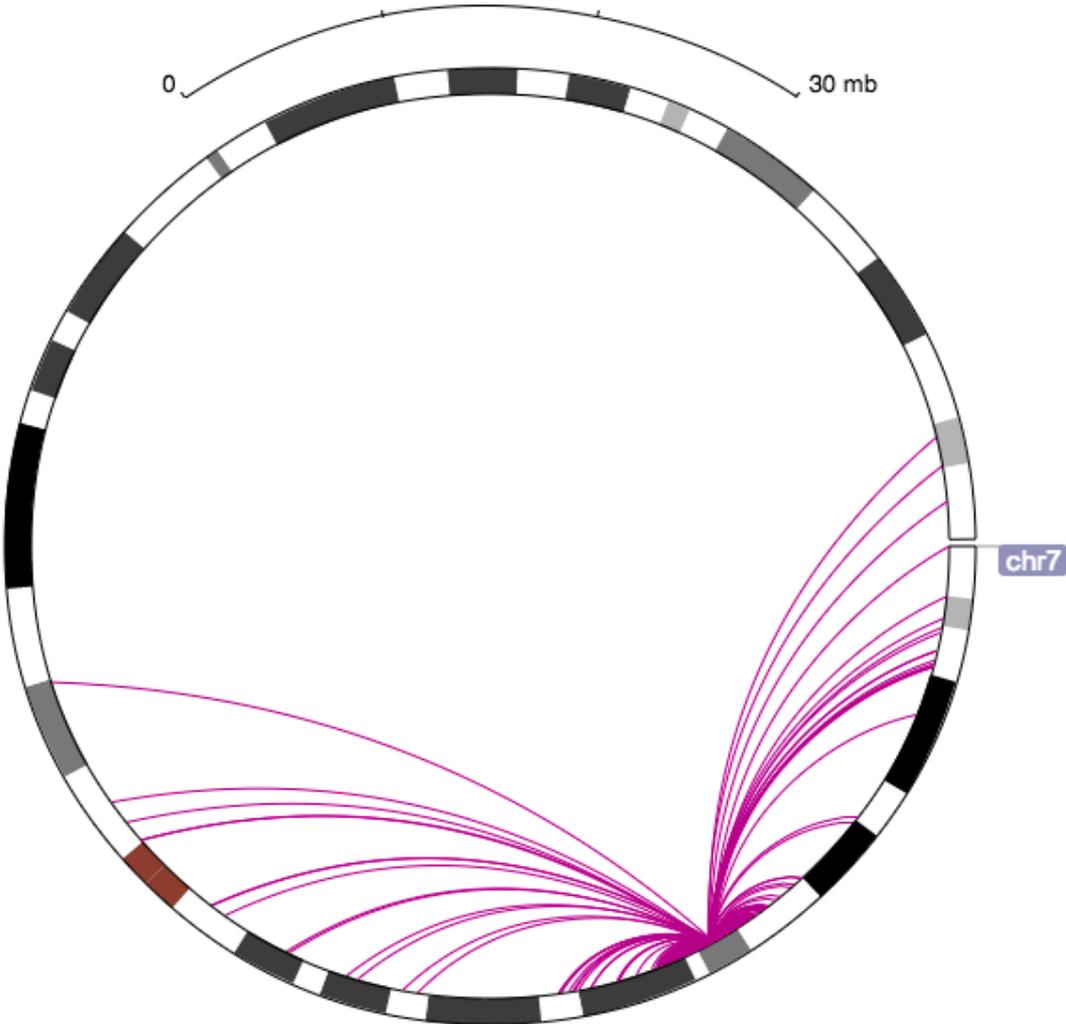
Interaction panel view: Two interaction regions, 70mb apart

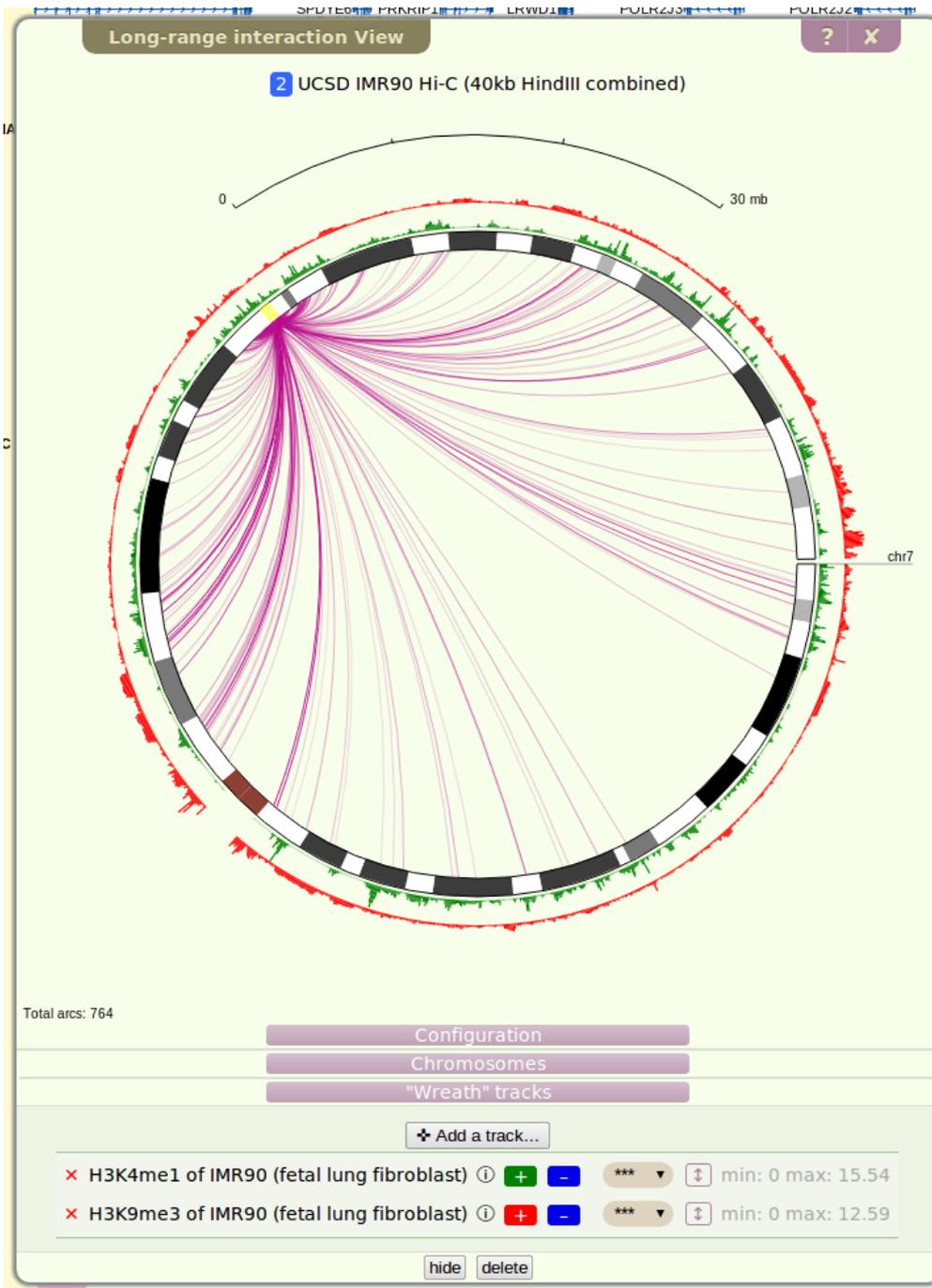


Circlet view on interactions between one locus to the rest of the genome (chromosome)

921 arcs from UCSD IMR90 Hi-C (40k...

Configure add track hide delete





Wreaths on the ring

Quantitative tracks can be added onto the Circlet View.

The red track is H3K9me3 of IMR90

The green track is H3K4me1 of IMR90

- Zoom in/out;
- Whole genome, chromosome, or any select part of the genome (genes, pathways, etc)
- Can generate “one-to-all” and “all-to-all” views
- Visually correlating interaction with other genomic information

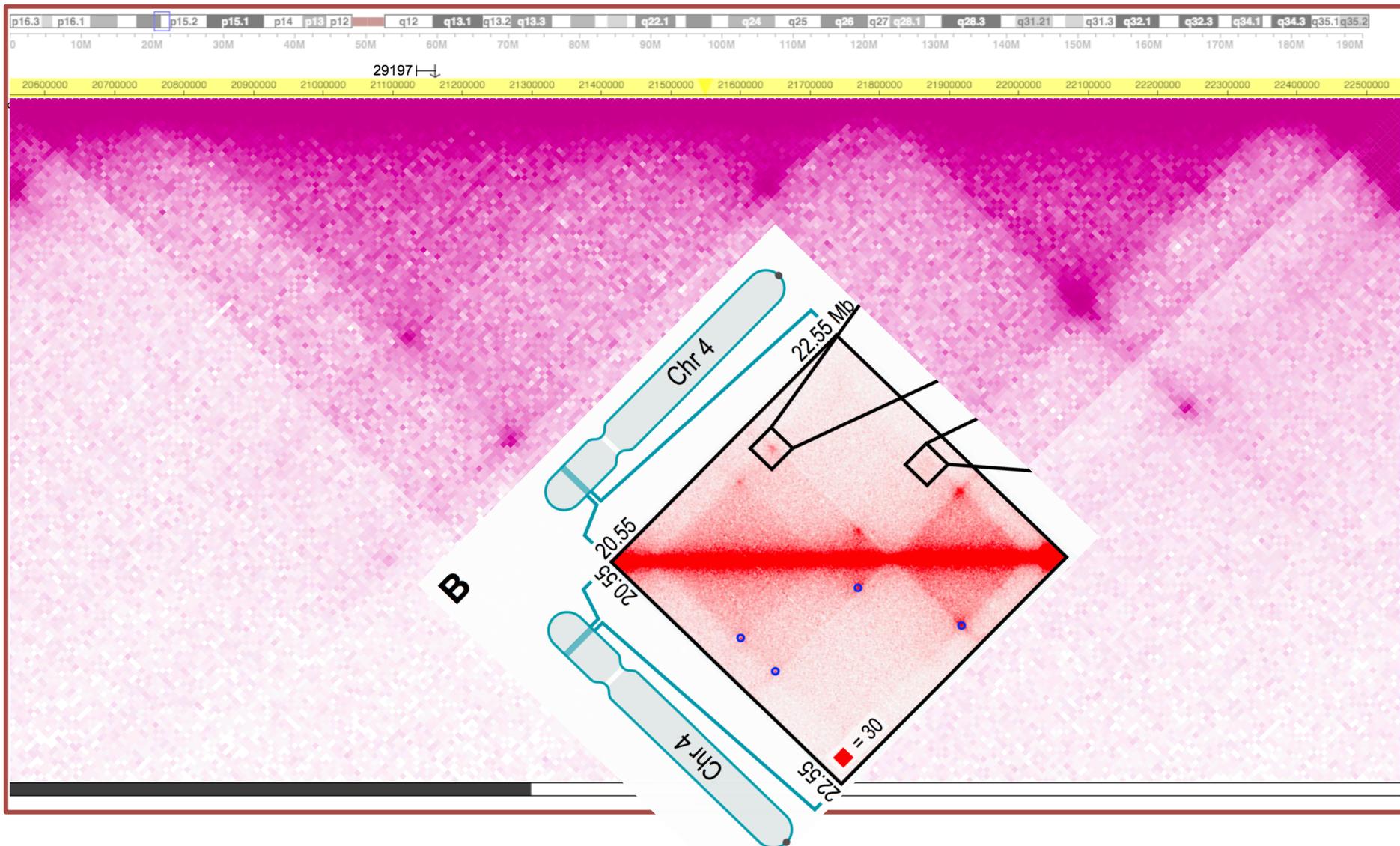
Exploring long-range genome interactions using the WashU Epigenome Browser

Xin Zhou¹, Rebecca F Lowdon¹, Daofeng Li¹, Heather A Lawson¹, Pamela A F Madden², Joseph F Costello^{3,4} & Ting Wang¹

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- **4DN Genomic Data**
 - Integrating JuiceBox into WashU Browser
- **4DN Imaging Data**
 - The new imaging track

Using JuiceBox as a backend engine



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Lab members

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Roadmap Consortium

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NIH U01ES017154,
R01HG007354,
R01HG007175,
R01ES024992,
U01CA200060,
U24ES026699

American Cancer Society
RSG-14-049-01-DMC

March of Dimes

Mallinckrodt Foundation

chr7:27132388-27132983

+ -1/3 -1 -5 < >

One bp spans 2 pixels

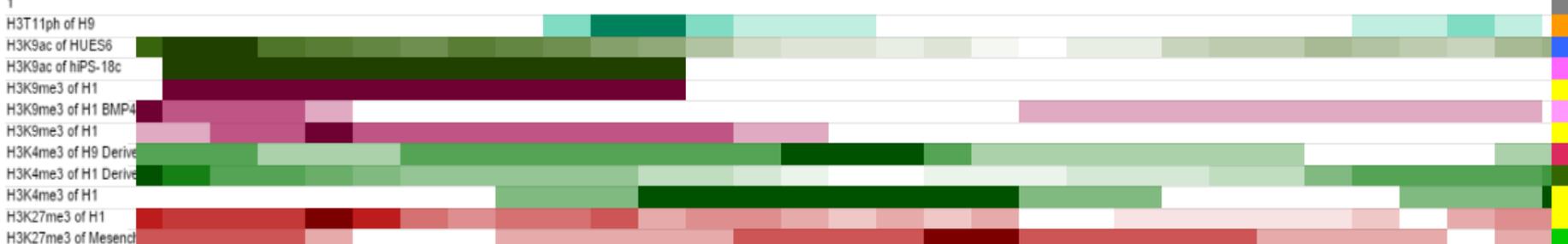
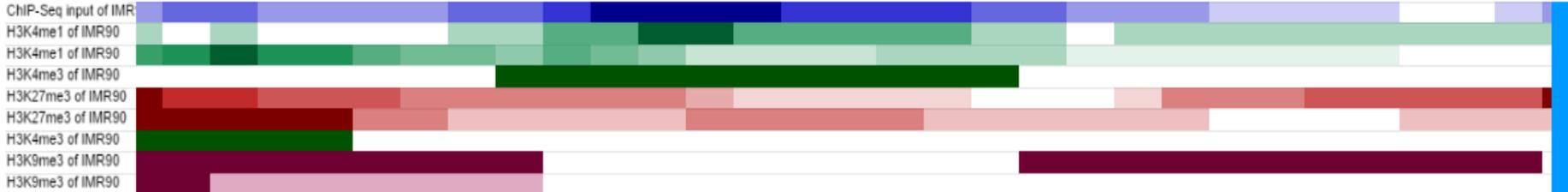
Tracks Apps



10.01



Sample Assay



Switch over to demo!