

Does color have structure?
**Modeling 3D domains of
the fly genome.**

Marc A. Marti-Renom

Genome Biology Group (CNAG)
Structural Genomics Group (CRG)

***iCrea**
INSTITUCIÓ CATALANA DE
RECERCA I ESTUDIS AVANÇATS



Pastene

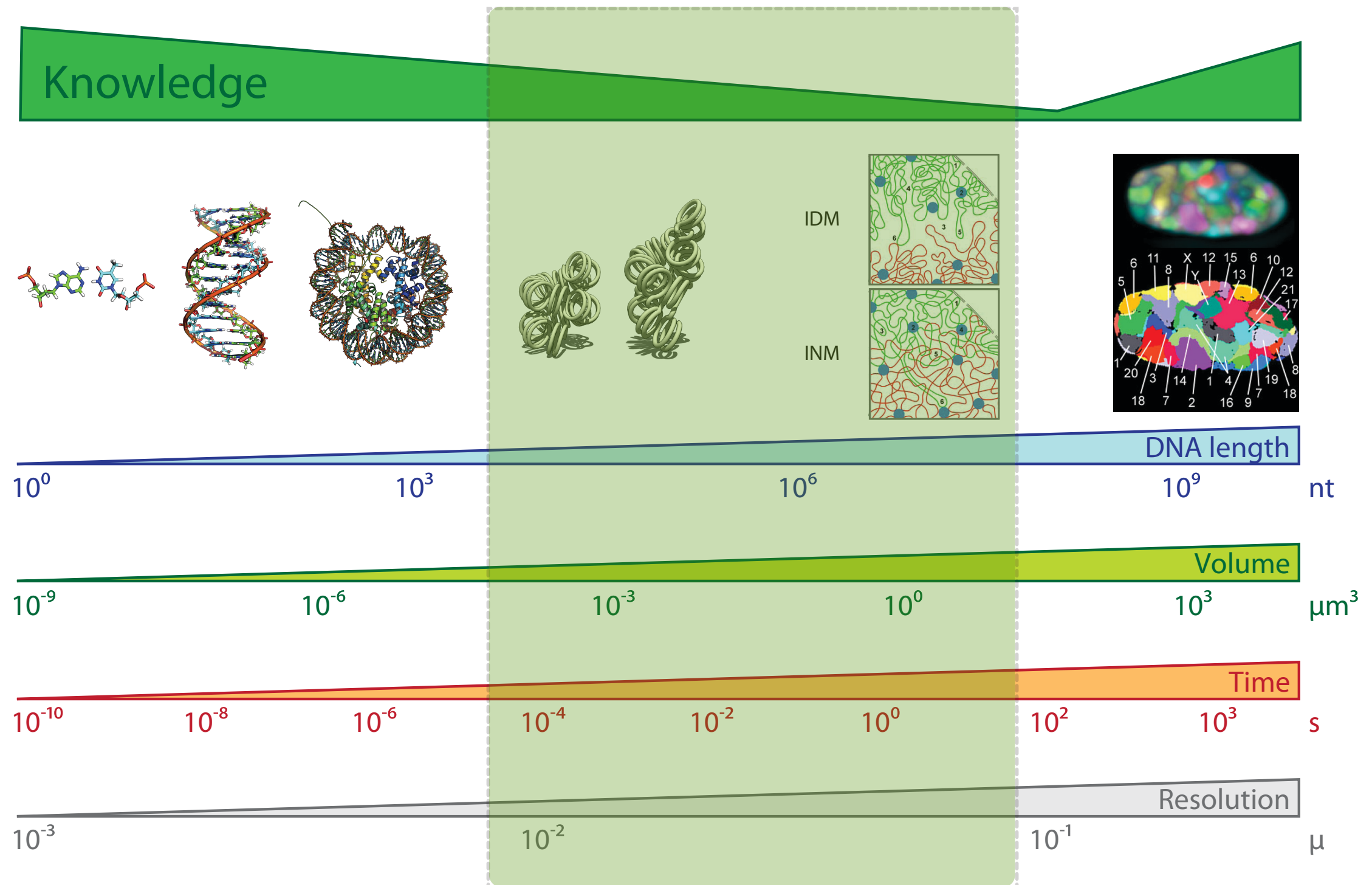
IMPORTED FROM ITALY



CAPPELLI D'ANGELO - 100% SEMOLA DI GRANO DURO

Resolution Gap

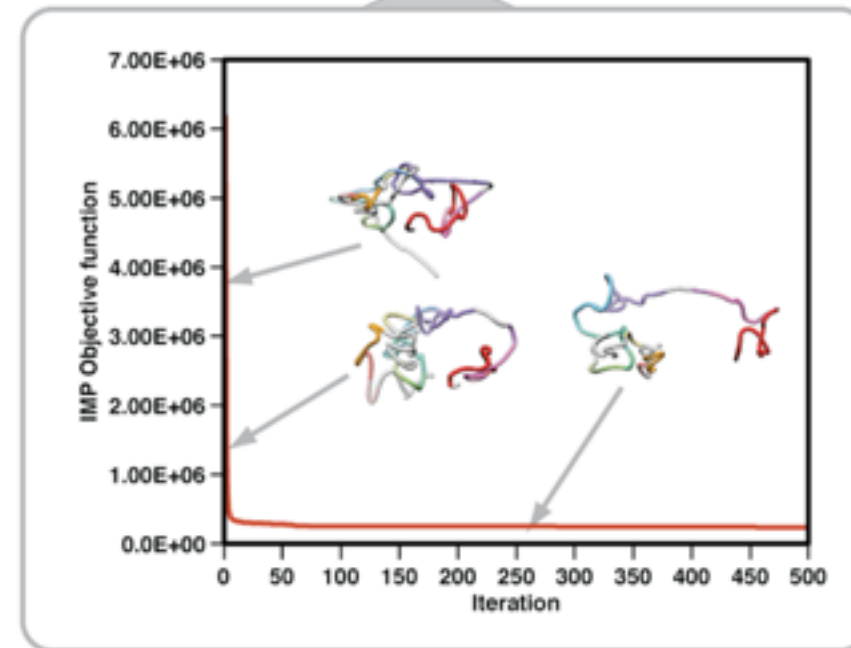
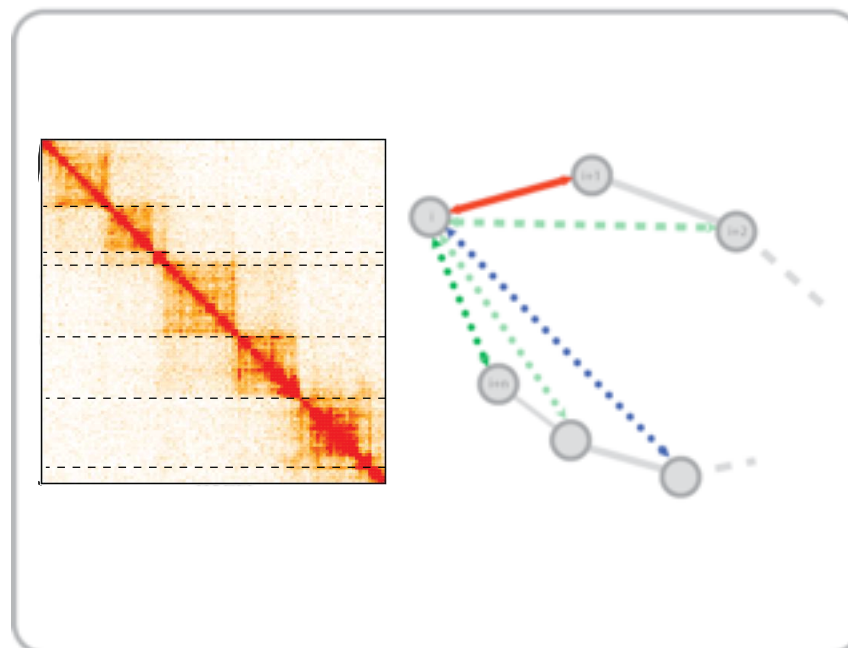
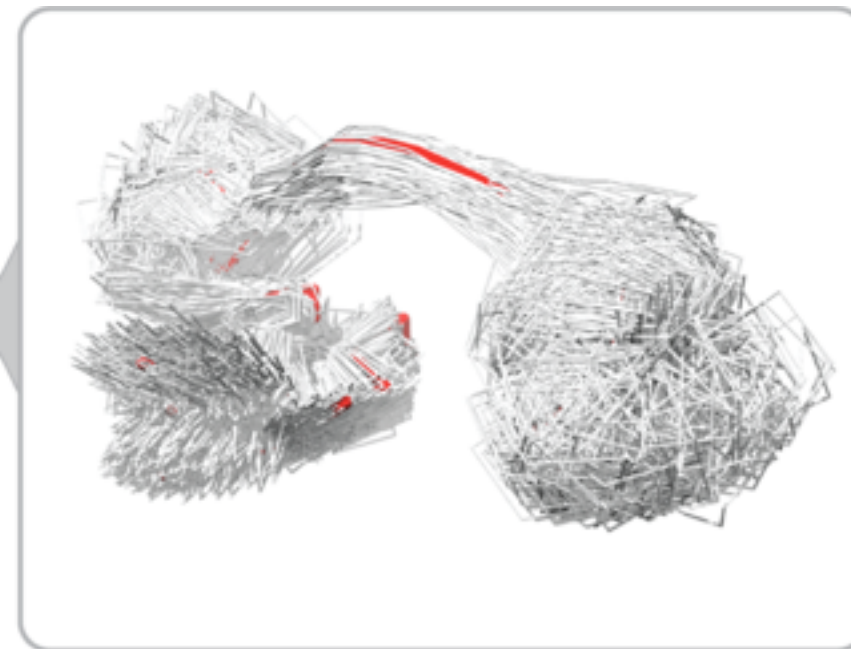
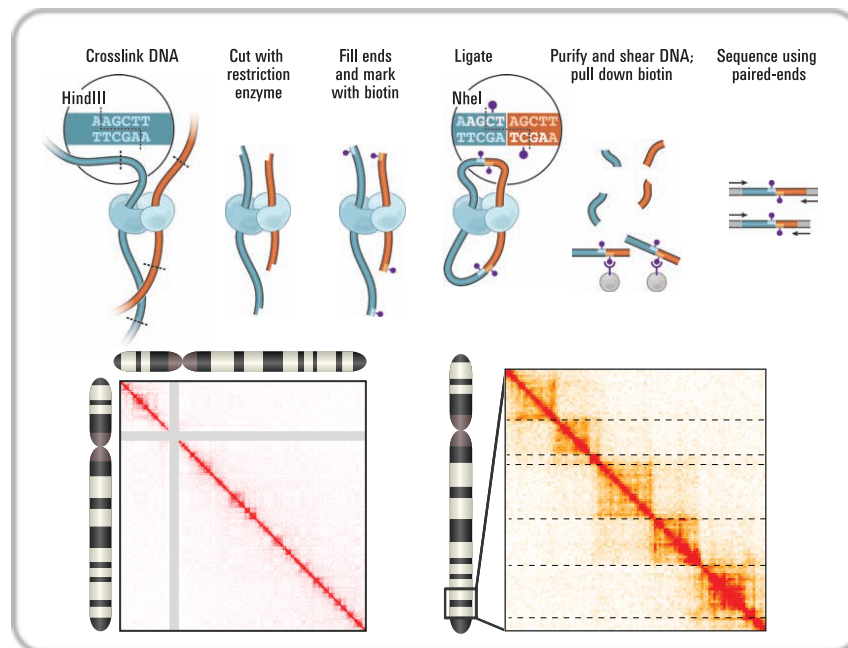
Marti-Renom, M. A. & Mirny, L. A. PLoS Comput Biol 7, e1002125 (2011)



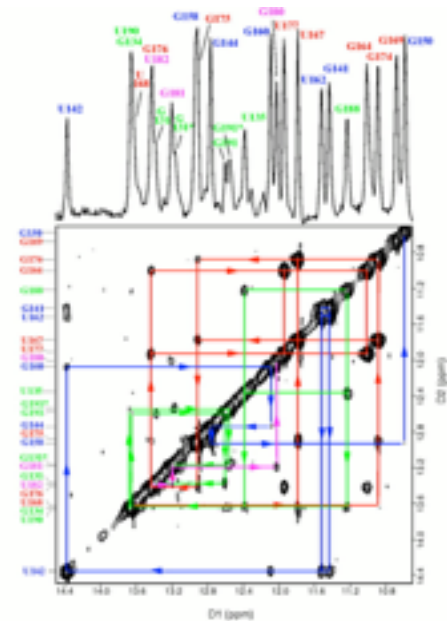
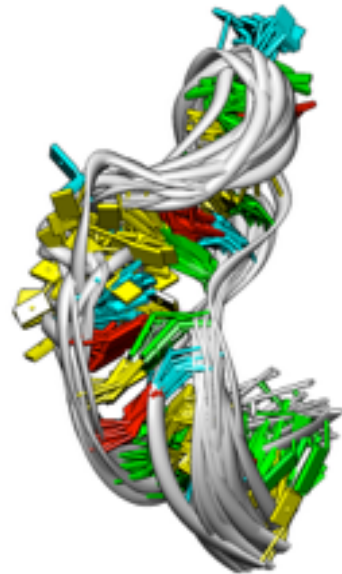
Hybrid Method

Baù, D. & Marti-Renom, M. A. *Methods* 58, 300–306 (2012).

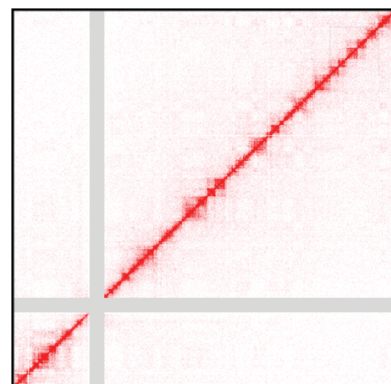
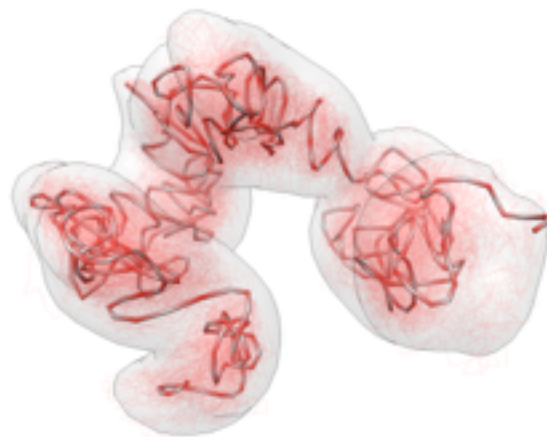
Experiments



Computation



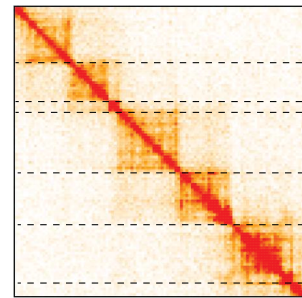
Biomolecular structure determination 2D-NOESY data



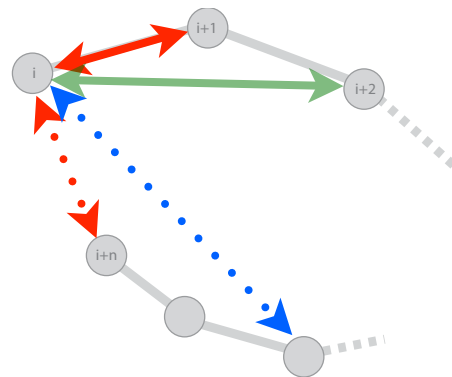
Chromosome structure determination 3C-based data



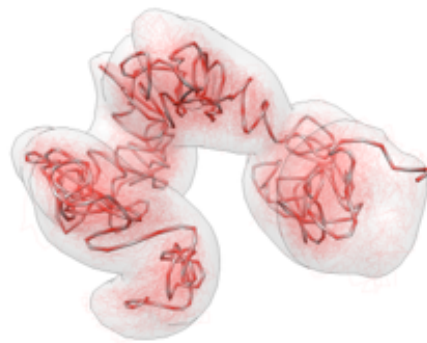
FastQ files to Maps



Map analysis



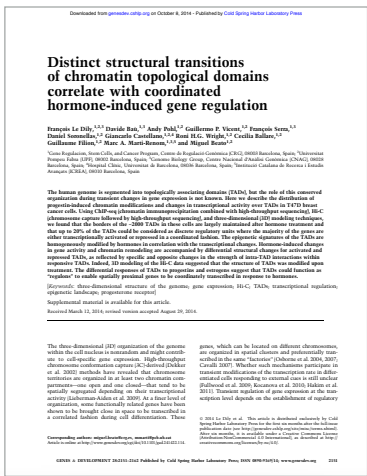
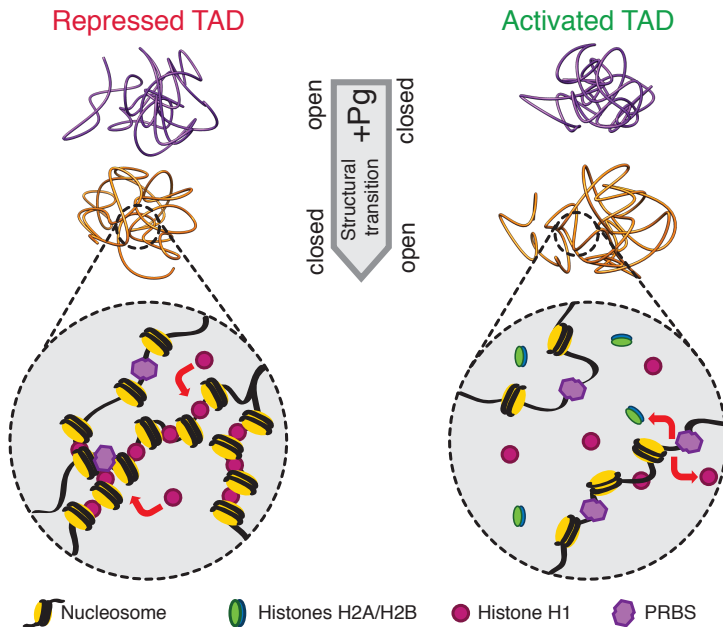
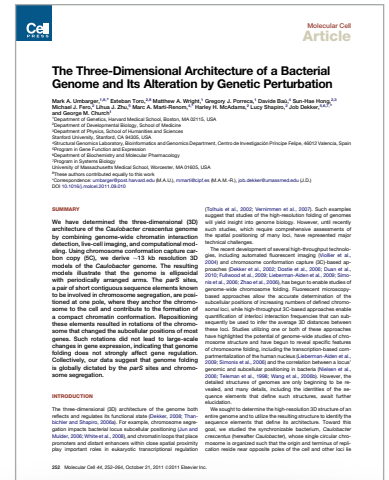
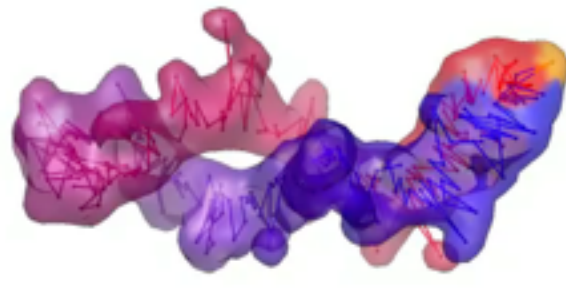
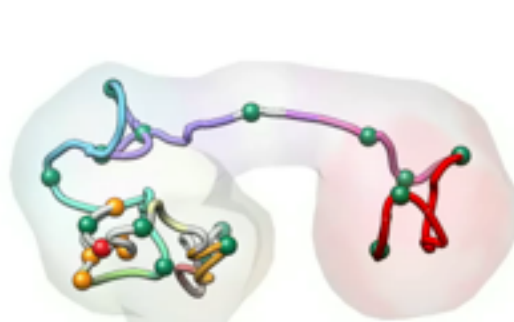
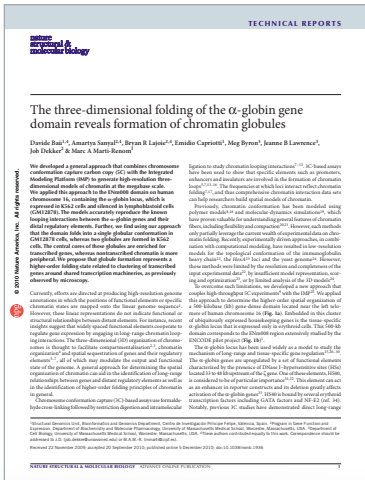
Model building



Model analysis

TADbit previous applications...

Baù, D. et al. Nat Struct Mol Biol (2011).
Umbarger, M. A. et al. Mol Cell (2011).
Le Dily, F. et al. Genes & Dev (2014)

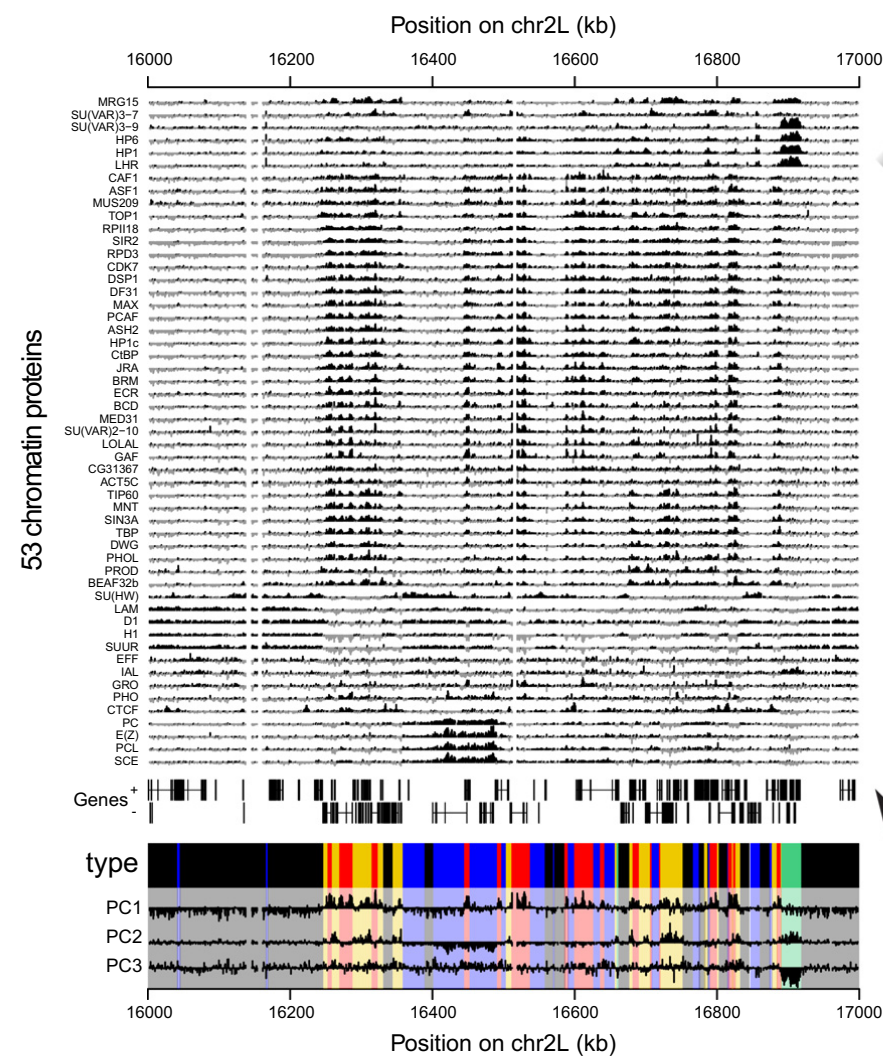
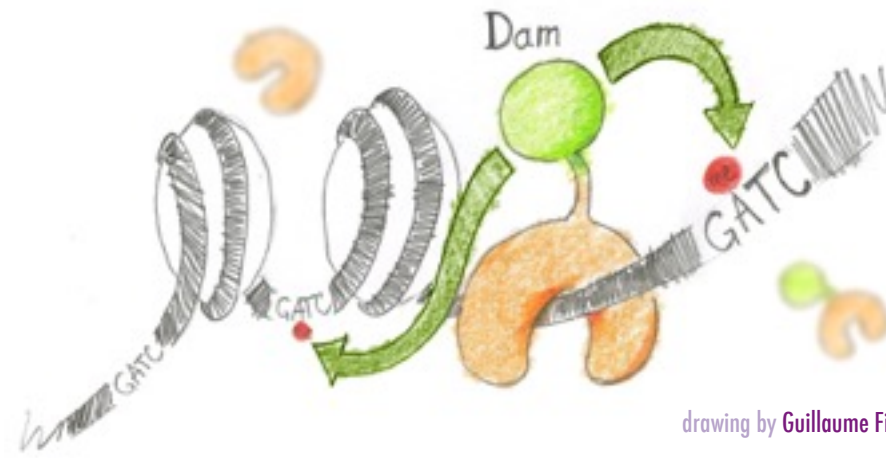


Structuring the **COLORs** of chromatin

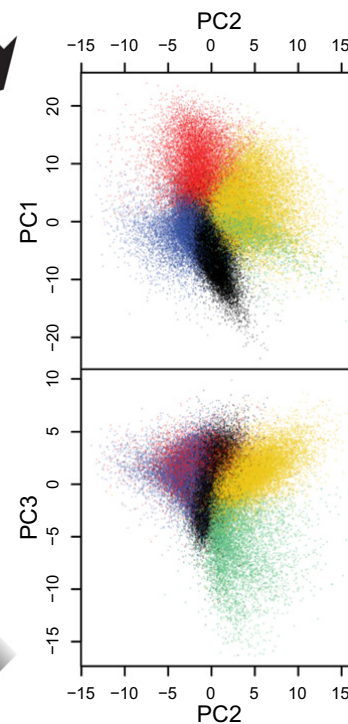


Fly Chromatin COLOrS

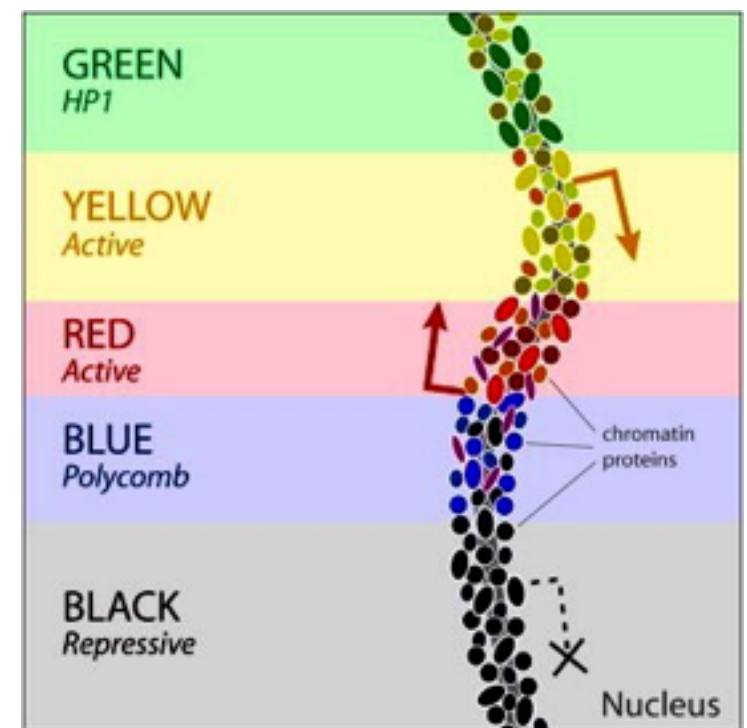
Filion et al. (2010). Cell, 143(2), 212-224.



Principal component analysis

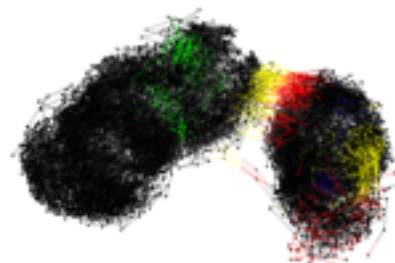
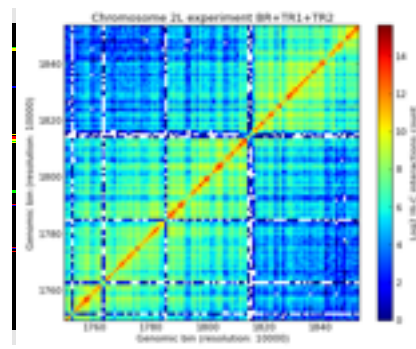
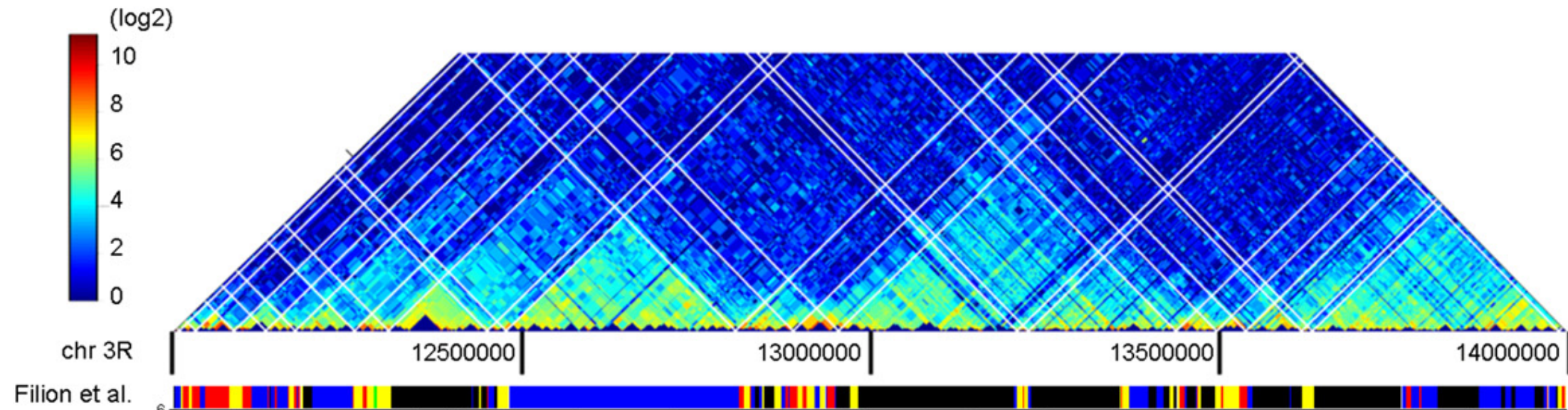


Hidden Markov model



Functional COLOrS

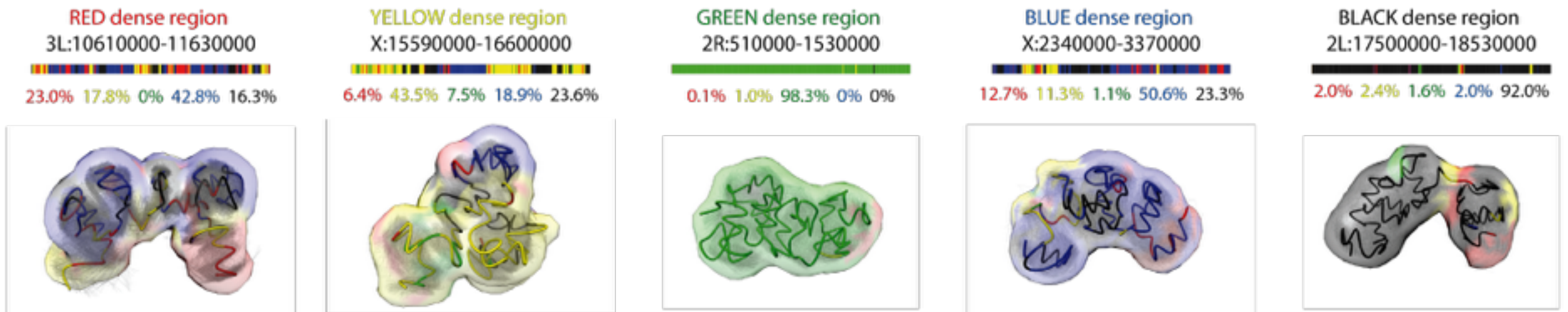
Hou et al. (2012). Molecular Cell, 48(3), 471–484.



50 ~1Mb regions
10 for each color

Structural properties

50 1Mb regions. 10 enriched for each color.

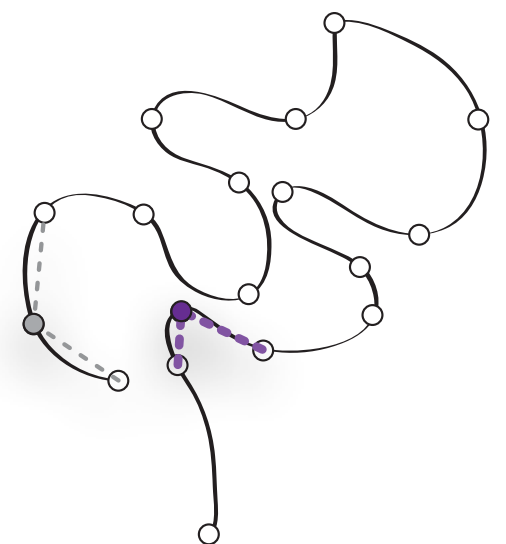
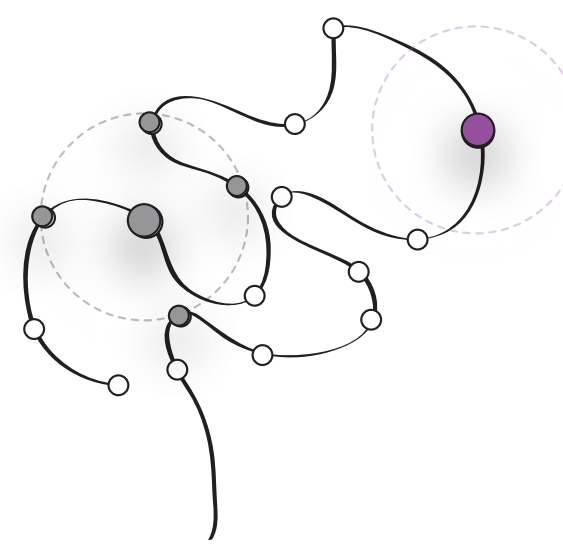
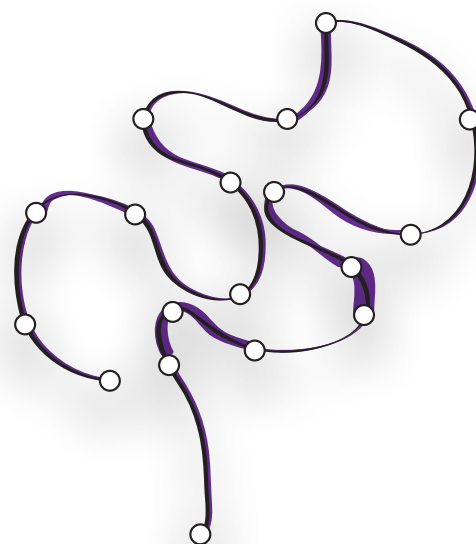
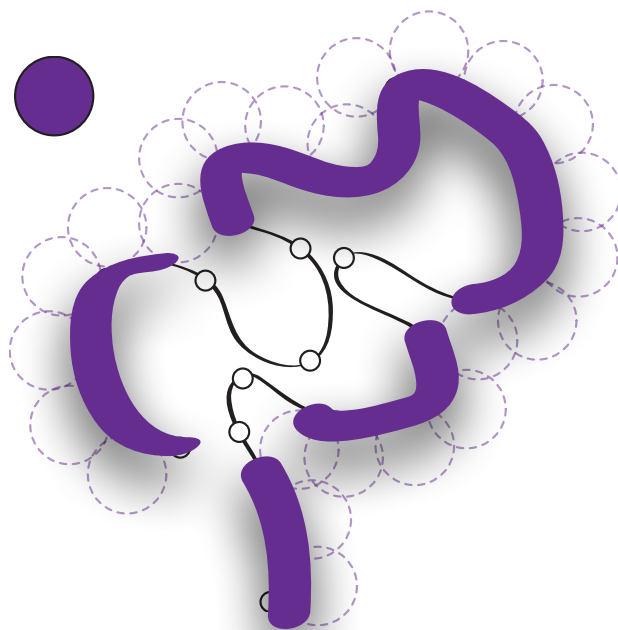


Accessibility (%)

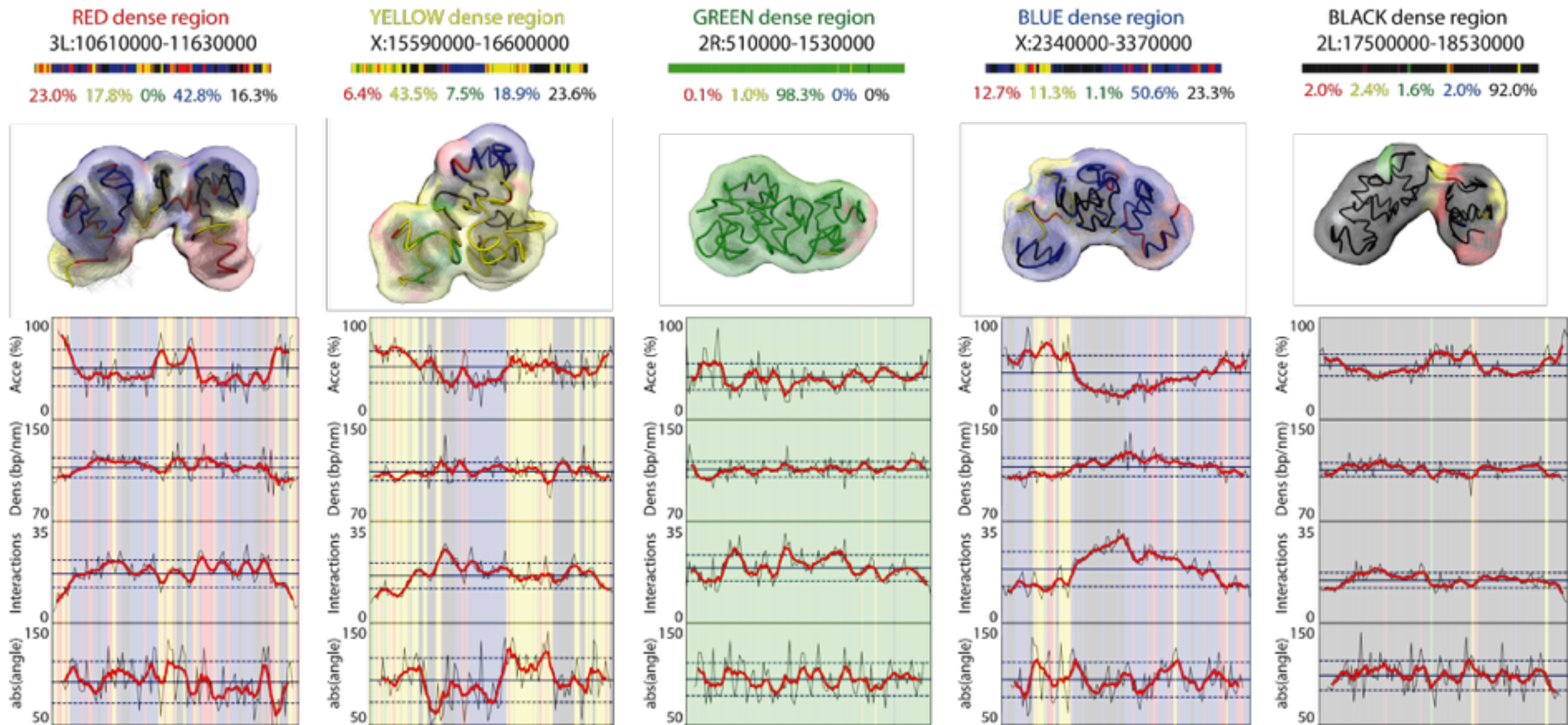
Density (bp/nm)

Interactions

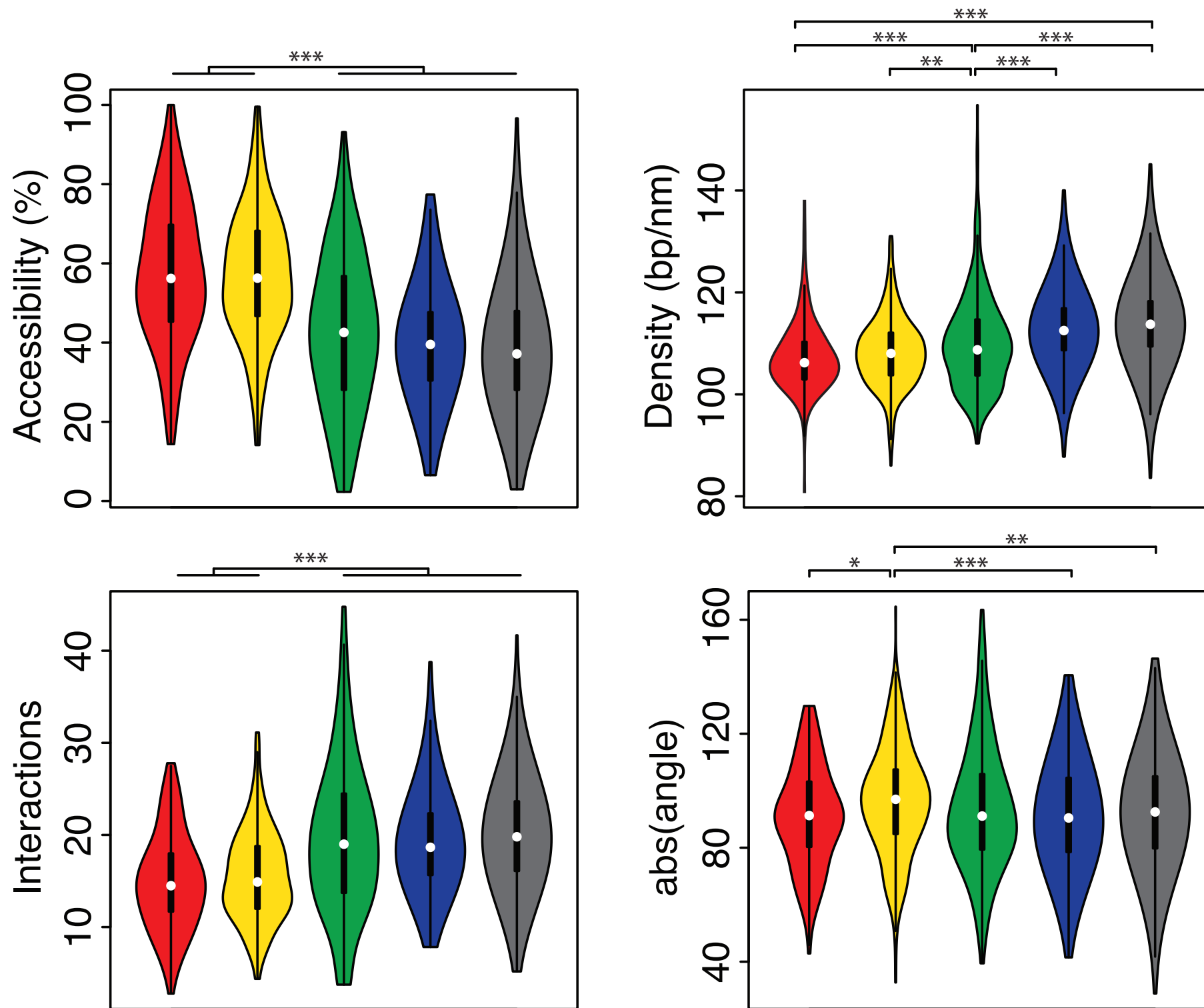
Angle



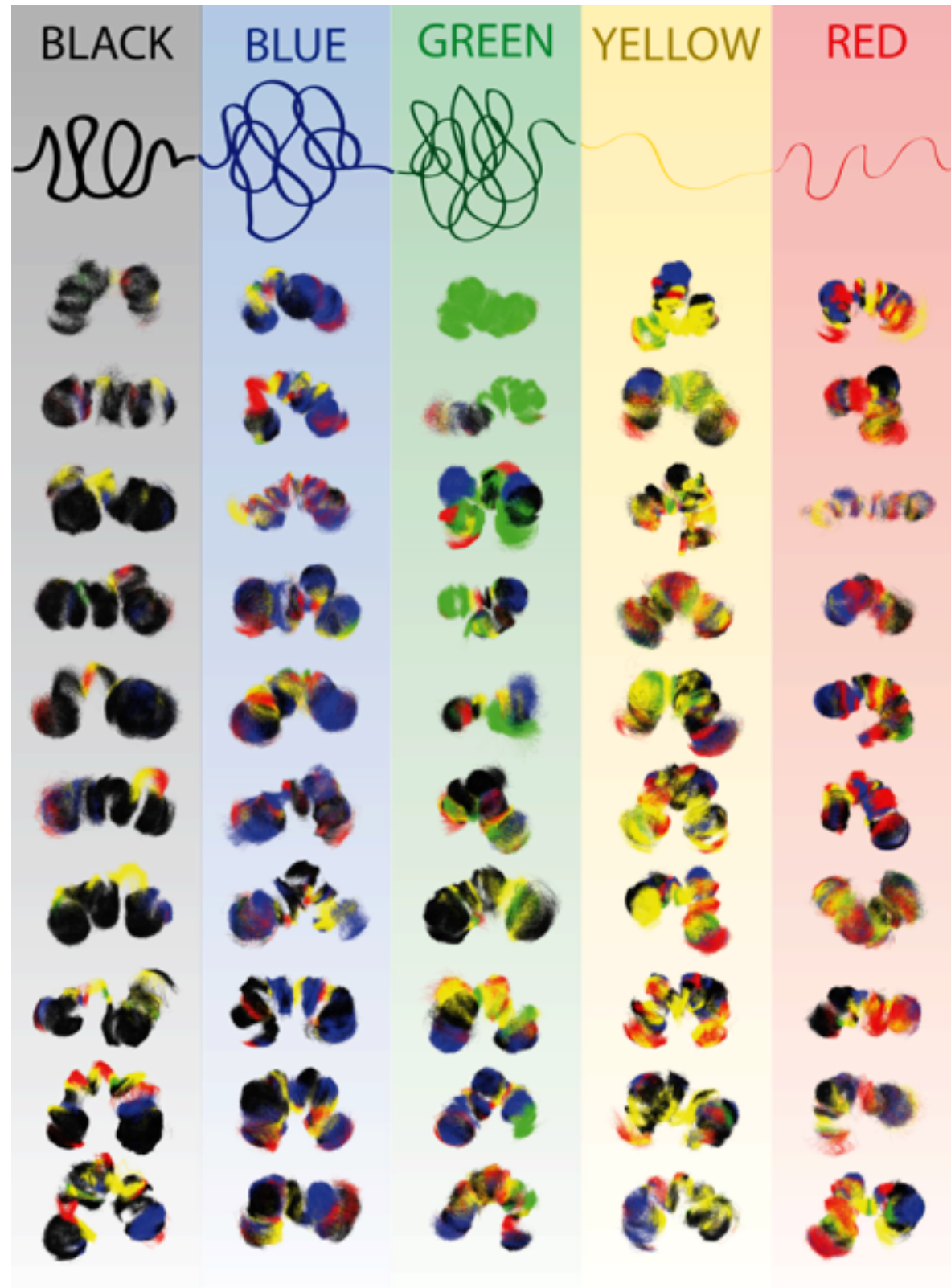
Structural COLOrS



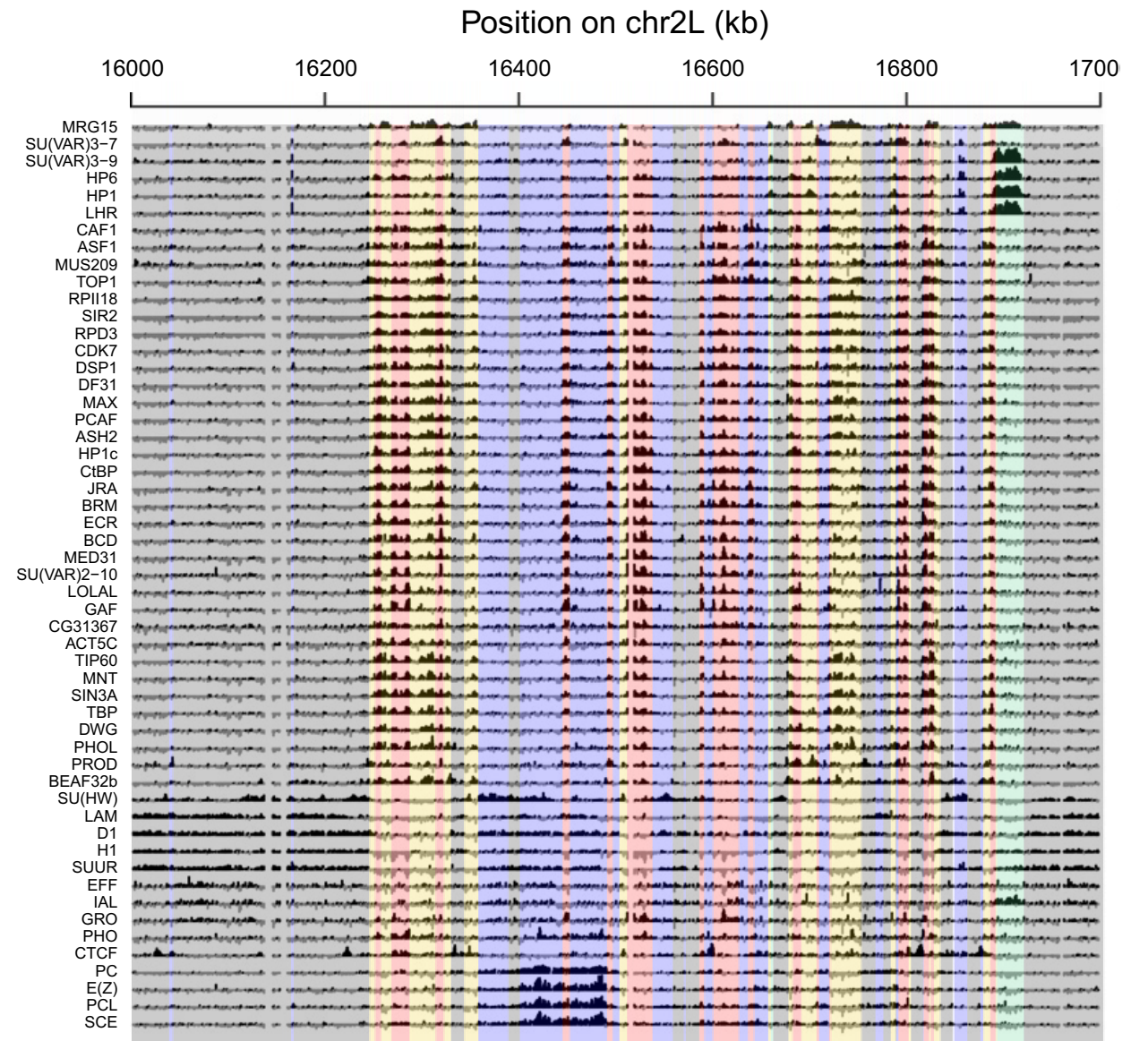
Structural COLOrS



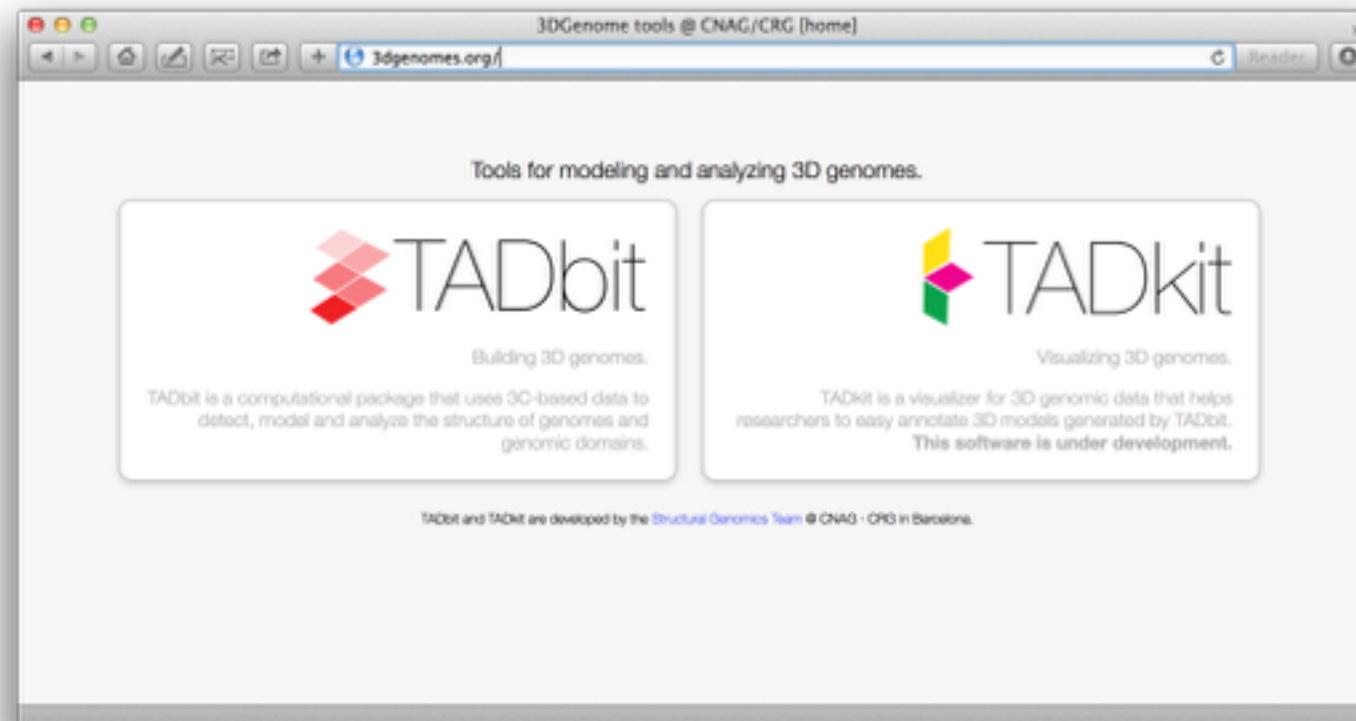
Structural COLOrS



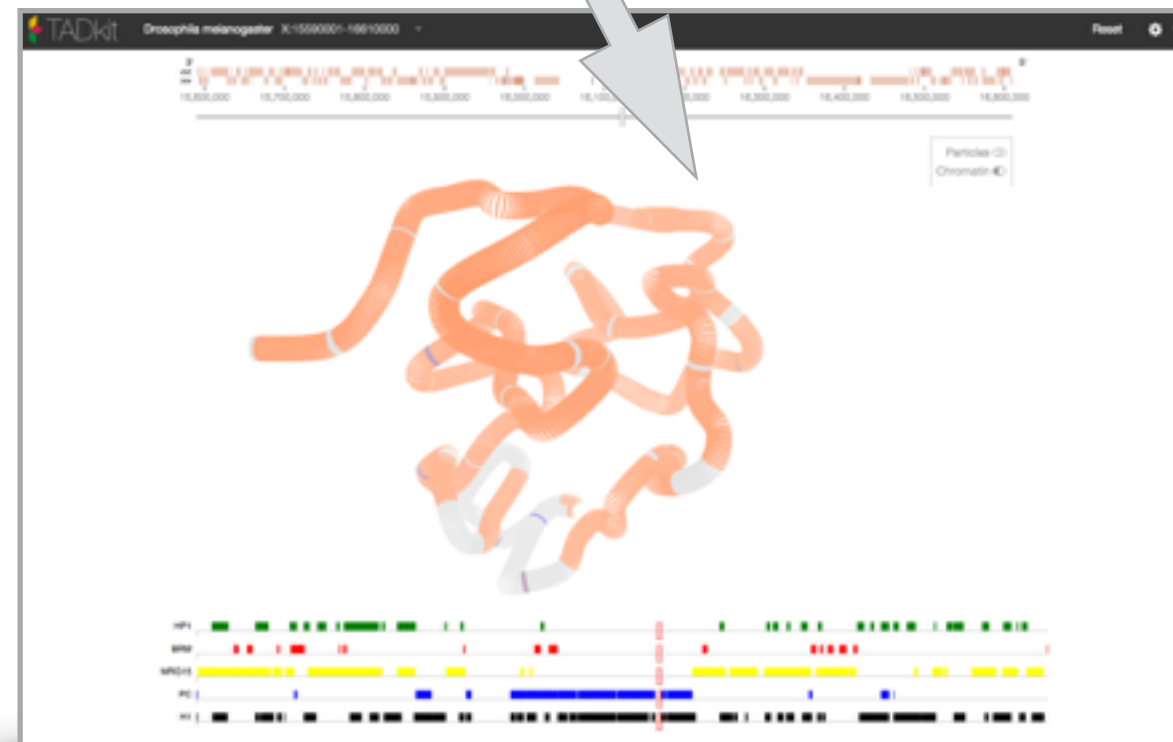
53 chromatin proteins



<http://3DGenomes.org>



```
{
  "metadata": {
    "formatVersion": 3,
    "article": "Hogg et al. (2012) CELL",
    "species": "Drosophila melanogaster",
    "assembly": "BDGP 5",
    "cellType": "Kc167",
    "experimentType": "Hi-C",
    "identifier": "GSE38468",
    "resolution": "10000",
    "chromosome": "X",
    "start": 15190001,
    "end": 16610000
  },
  "materials": [
    {
      "objColor": 15658734,
      "objIndex": 0,
      "objName": "default",
      "vertexColors": false,
      "colorAmbient": [0.8, 0.8, 0.8],
      "colorDiffuse": [0.8, 0.8, 0.8],
      "colorSpecular": [0.8, 0.8, 0.8],
      "illumination": 2,
      "ambientLight": 0.6,
      "transparency": 1.0
    }
  ],
  "vertices": [
    -4997.512, -14445.484, 6862.561,
    -4930.434, -14470.804, 6934.82,
    -4970.555, -14415.34, 7002.625,
    -4935.936, -14318.296, 7005.961,
    -4976.995, -14358.728, 7075.177,
    -4884.587, -14327.883, 7075.655,
    -4930.424, -14392.395, 7137.914,
    -4856.193, -14408.212, 7182.532,
    -4856.193, -14547.263, 7182.532,
    -4776.328, -14389.24, 7156.217,
    -4821.349, -14452.585, 7263.907,
    -4852.323, -14541.284, 7187.383,
    -4907.888, -14583.286, 7219.326,
    -4919.553, -14541.712, 7027.894,
    -4848.228, -14596.95, 7055.235,
    -4769.283, -14539.379, 7055.179,
    -4708.704, -14470.629, 7082.837,
    -4698.692, -14520.434, 7010.915,
    -4750.675, -14588.357, 6928.896,
    -4734.381, -14436.217, 6988.335,
    -4757.711, -14448.468, 6904.803,
    -4748.483, -14357.549, 6958.223,
    -4784.942, -14286.947, 6985.46,
    -4818.842, -14341.789, 6997.86,
    -4751.912, -14241.125, 6986.872,
    -4829.173, -14317.494, 6896.449
  ]
}
```



Shameless promotion...



March 24th, Boston



November 23th-27th, Lisbon



<http://vizbi.org/2015>



<http://gtpb.igc.gulbenkian.pt>

Acknowledgments



François Serra
Davide Baù
Mike Goodstadt

François le Dily
Yasmina Cuartero
Yannick Spill
Marco di Stefano
Francisco Martínez-Jiménez
David Dufour
Gireesh Bogu



Job Dekker

Program in Systems Biology
Department of Biochemistry and Molecular Pharmacology
University of Massachusetts Medical School
Worcester, MA, USA



Kerstin Bystricky

Chromatin and gene expression
Laboratoire de Biologie Moléculaire Eucaryote - CNRS
Toulouse, France



Miguel Beato & Guillaume Filion

Gene Regulation, Stem Cells and Cancer
Centre de Regulació Genòmica
Barcelona, Spain

<http://marciuslab.org>
<http://3DGenomes.org>
<http://cnag.cat> · <http://crg.cat>

