Chromatin is the complex of DNA and proteins that comprise eukaryotic chromosomes.

2 classes of chromatin proteins:
A) Histones and B) Non-histone proteins

1) Chromosome structure

4 core histones found in Nucleosomes: 146 bp of DNA wrapped around an octomer of 2 (H2A, H2A, H3, H4)
TEMs of isolated chromatin
(A) Negatively stained 30 nm helix
(B) Shadowed “string of beads”

Structure of nucleosomes from X-ray diffraction
Face on and Edge on views

Unfolded structure of core histones
(A) H2A
H2B
H3
H4
(B) Folded Histone
(C) H2A/H2B Dimer “handshake”
Assembly of the Histone octomer

Nucleoplasmin catalyzes this process

What determines “beads on the string” vs. 30 nm fiber?
A) Non-histone DNA binding proteins may disrupt 30 nm fiber.
Or prevent binding of a nucleosome.
Creates DNAse I sensitive region

B. Histone H1 is involved in 30 nm fiber formation.
Binds to DNA and surface of nucleosome and helps condense chromatin.

Figure 4-30. Molecular Biology of the Cell, 4th Edition.
So in general, unmodified or methylated histones silence or repress genes, acetylation allows gene expression, and phosphorylation is involved in mitotic chrom. condensation.

D) Remodeling complexes are large ATP-driven machines that move down the DNA and open or restore nucleosomes, and allow other DNA-binding proteins to bind, e.g., DNA and RNA polymerases and Transcription Factors.

3. Global structure of active chromosomes

Two types of chromosomes allow us to view the structure of active vs. inactive regions.

A. Lampbrush chromosomes.

Paired meiotic chromosomes that partially condense and pause during a long meiotic prophase to synthesize RNAs & proteins to be stored in the egg for early development.
B. Polytene chromosomes of *Drosophila*

Have replicated DNA 10X -> 1024 copies of chromosome side by side without separation by mitosis.

Bands are chromatin domains with an ave of 3 genes in them, interbands are probably regions of DNA that assoc. w protein scaffold of the chromosome.

Occasionally a band forms a puff (euchromatin) and becomes active in RNA synthesis.