**Gene expression control:** chromatin structure is crucial!

Gene (nucleus)

- Histone modification
- Chromatin structure
- DNA methylation
- Transcription
- RNA splicing, stability
- Export to cytoplasm
- Translation
- Protein trafficking/Modification/stability

**Cloning conclusion**

*Imprinted Me patterns and reprogramming (reprog.) in cloned embryos*

- **Normal development**
  - Zygote
  - "Competent" state
  - Early genes active
- **Cloned embryos**
  - Adult
  - Genes active

Adult methylation patterns do not normally revert to embryonic patterns.
Future isolation of autologous stem cells?

Oct3/4, Sox2, Klf4, c-Myc

= pluripliant stem cells-form many tissues in embryo (repopulation assay- GFP label)

Takahashi and Yamanaka, 2006

How-to 2

Purves 44.1: Nervous system forms a communication network

Intracellular communication: the action potential

Most cells show a potential difference across the plasma membrane (more negative inside than outside)

M. Levin

Normal Cells

Non-Proliferating

-90
-80
-70
-60
-50
-40
-30
-20
-10
-0

Neuron
Glia, non-dividing
Skeletal muscle
Fat cell
Adrenal Cortex
Kidney tubule
Smooth muscle, uterus

Proliferating

Quail fibrosarcoma QT-6
Thyroid tumour cells (Avg)
HeLa
Human hepatoma HEP-2
Ovarian Tumour
16 cell Embryo
Proliferating fibroblast
Proliferating 3T3
Fertilised Egg
Erythrocyte
Propagating an action potential

H. Sive MIT 2007
Propagating an action potential involves opening and closing of ion channels.

Myelin sheath increases conductance rate by preventing Na+ leakage after action potential.

Ion channels

Looking through an ion channel

Purves 44.4 and 44.12
12 Interaction of ions with water

Interaction of ions with K+ channel

Ion channels are selective when spacing between water molecules and ion = spacing between pore groups and ion

13 Purves 5.9: gated channels

14 Outside cell

K+ diffuses out
3Na+ pumped out

Inside cell

open K+ channel

2K+ pumped in

Na/K ATPase

CHANNELS THAT GENERATE RESTING POTENTIAL
LOW Na+ HIGH K+

15 Outside cell

Na+ in

Inside cell

voltage-gated Na+ channels open

CHANNELS THAT GENERATE ACTION POTENTIAL

HIGH Na+ LOW K+

H. Sive MIT 2007
CHANNELS THAT REPOLARIZE

K+ out
voltage-gated K+ channels

Na+ out and (a few) Na+, Cl- channels

Na/K ATPase

Na+ out

H. Sive MIT 2007

Purves 44.9
Action potential

Threshold
Resting potential

Open K+ channel
Gated Na+ channel
Inactivated Na+ channels

Na channel closed
Na channel open
Na channel closed

Voltage gated Na+ channel: the general idea

See Purves 44.6