

Predavanje GIO 6

## Nomenklatura gena modelnih organizama

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### Bakterije

- geni (lokusi): *uvrA*, *uvrB*;
- opisi lokusa: *lacZp* (promotor), *lacZo* (operator), *lacAt* (terminator)
- aleli (serijski br. izolata): *lacY1 araA1*; nema 4. slova: *lac-23*
- proteini (isti kao gen ili alel): UvrA, UvrB
- fenotip: Ara, divlji tip His<sup>+</sup>, mutant Ara<sup>-</sup>, Str<sup>s</sup>, Str<sup>R</sup>
- tipovi i svojstva mutanata: konstitutivni (Con), temperatura senzitivni (Ts), «cold-sensitive» (Cs)
- supresorski mutanti: amber supresor UAG – *serU67* (AS), ochre supresor UAA – *lysT46*(OS)
- strukturne mutacije: delecija  $\Delta trpE5$ ,  $\Delta(aroP-adeE)419$ ; inverzije IN(*rrnD-rrnE*)1; transpozicije TP(*lacI-purE*)33; fuzije  $\Phi(ara-lac)95$ ; insercije *aroA273::Tn10*
- plazmidi: pBR322 (ColE1, F, R100, SCP1)
- transpozoni: insercijske sekvencije IS3, transpozoni Tn9
- Genetičke zbirke gena («Genetic Stock Center»):
- *E. coli* – <http://cgsc.biology.yale.edu/>
- Salmonela – [kesander@asc.ucalgry.ca](mailto:kesander@asc.ucalgry.ca)
- Bacillus – [dzeigler@magnus.acs.ohio.state.edu](mailto:dzeigler@magnus.acs.ohio.state.edu)

### Kvasac *Saccharomyces cerevisiae*

- geni (lokusi): recesivni – *ade5*, *cdc28*; dominantni - *CUP1*, *SPC105*
- aleli: *act1-606*, *his2-1*
- proteini: Ade5p; Cdc28p; Cup1p; Spc105
- fenotip: divlji tip Arg<sup>+</sup>, mutant Arg<sup>-</sup>
- kreirani aleli: disrupcija (::) *ade6::URA4*; delecija (- $\Delta$ ) *ade6- $\Delta$ 1*; zamjena ( $\Delta::$ »recplacement») *ade6 $\Delta$ ::URA4*

- supresori: dominantni SUP4, recesivni sup35
- genotipovi: haploidi MAT *act1-1 URA3 ADE2* diploid MAT  $\alpha$ /MATa *act1-1/ACT1 ura3/URA3 ADE2/ADE2*
- *S. cerevisiae* was the first eukaryotic genome that was completely sequenced, 1996.
- The genome is composed of about 12,156,677 base pairs and 6,275 genes, about 5,800 of these are believed to be true functional genes.

### **Plijesan *Aspergillus nidulans***

- geni (lokusi): *brlA*, *proA*
- aleli: *proA1*, *proA2*; nema razlike za dominantne i recisivne
- proteini: BRLA, PROA
- genotip: BrIA
- genotipovi: diploidi *proA1/+biA1/+*
- kromosomi: I do VIII
- kromosomske aberacije: translokacija (T) – T1(III; VIII); inverzija (I)
- **Fungal Genetics Stock Center** <http://www.fgsc.net/>
- nitaste gljivice(kvasci i plijesni) u redu Ascomycota
- Sequenced, analysis of the annotated genome was published in *Nature* in December 2005.

### **Biljka *Arabidopsis thaliana***

- geni (lokusi); ime gena divljeg tipa EMBRYO DEFECTIVE 1, simbol gena divljeg tipa EMB1, ime mutiranog gena *de-etiolated 1*, simbol mutiranog gena *det1*
- aleli: *det1-1*, *det1-2*
- proteini: EMB1, DET1
- fenotipovi: Abc+, Abc-
- genotipovi: dvostruki mutant *abc1 def1* double mutant
- kromosomi: 1 do 5 ili I do V
- [http:// genome-www.stanford.edu/Arabidopsis/](http://genome-www.stanford.edu/Arabidopsis/)

- sequencing — with about 157 mega base pairs and five chromosomes, arabidopsis has one of the smallest genomes among plants. It was the first plant genome to be sequenced, completed in 2000 by the Arabidopsis Genome Initiative.
- porodica Cruciferae (krstašice)



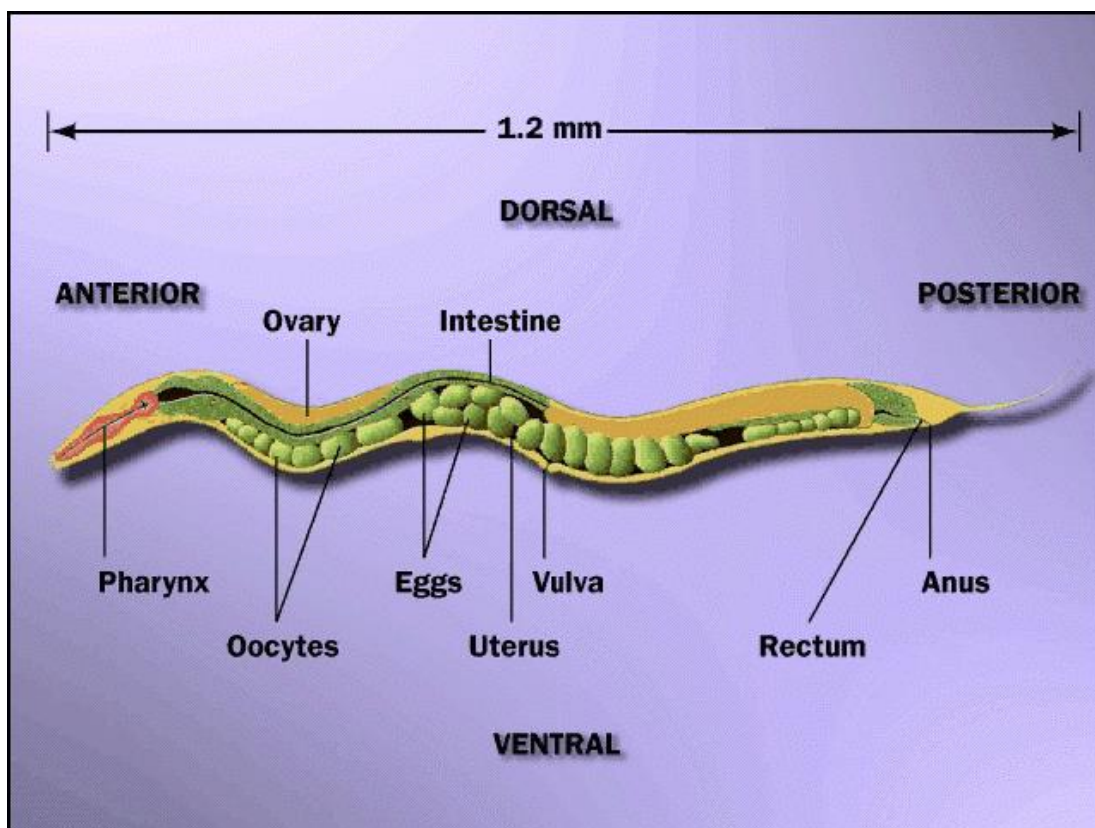
Slika 1. Prikaz svi stadija biljke uročnjak (*Arabidopsis thaliana*)

#### **Oblič *Caenorhabditis elegans***

- 1998. prvi višestanični organizam sa sekvencioniranim genomom; 97 Mb, više od 19 000 gena
- Nematoda-obliči 1 mm dug, proziran, hemafrodit, zemlja,
- geni (lokusi): *dpy-5*

- aleli: divlji tip *dpy-5(+)*, mutant *dpy-5(e61)*
- proteini: DPY-5, UNC-13
- fenotipovi: dumpy ili Dpy
- genotipovi: *dpy-5 +/+ unc-13*
- kromosomi: I do VI i X
- kromosomski rearanžmani: duplikacija (Dp), deficijencija (Df), inverzija (In) i translokacija (T) eDf2(III) (alel i br.)
- transpozoni: Tc1 Tc2 (br. obitelji)

<http://elegans.swmed.edu/Genome/nomen.html> - ne može se otvoriti!!!

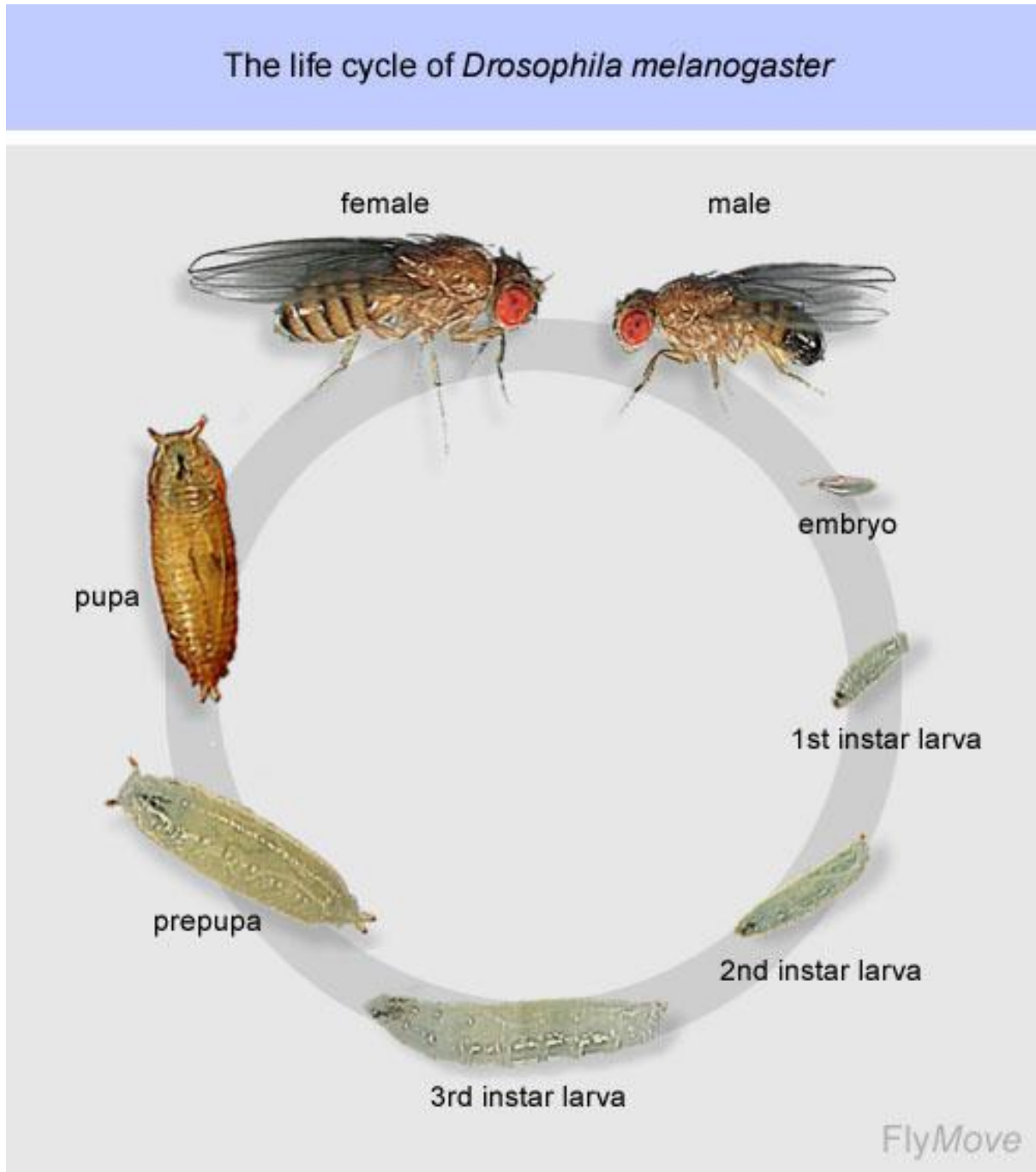


Slika 2. Shematski prikaz nematode *Caenorhabditis elegans*

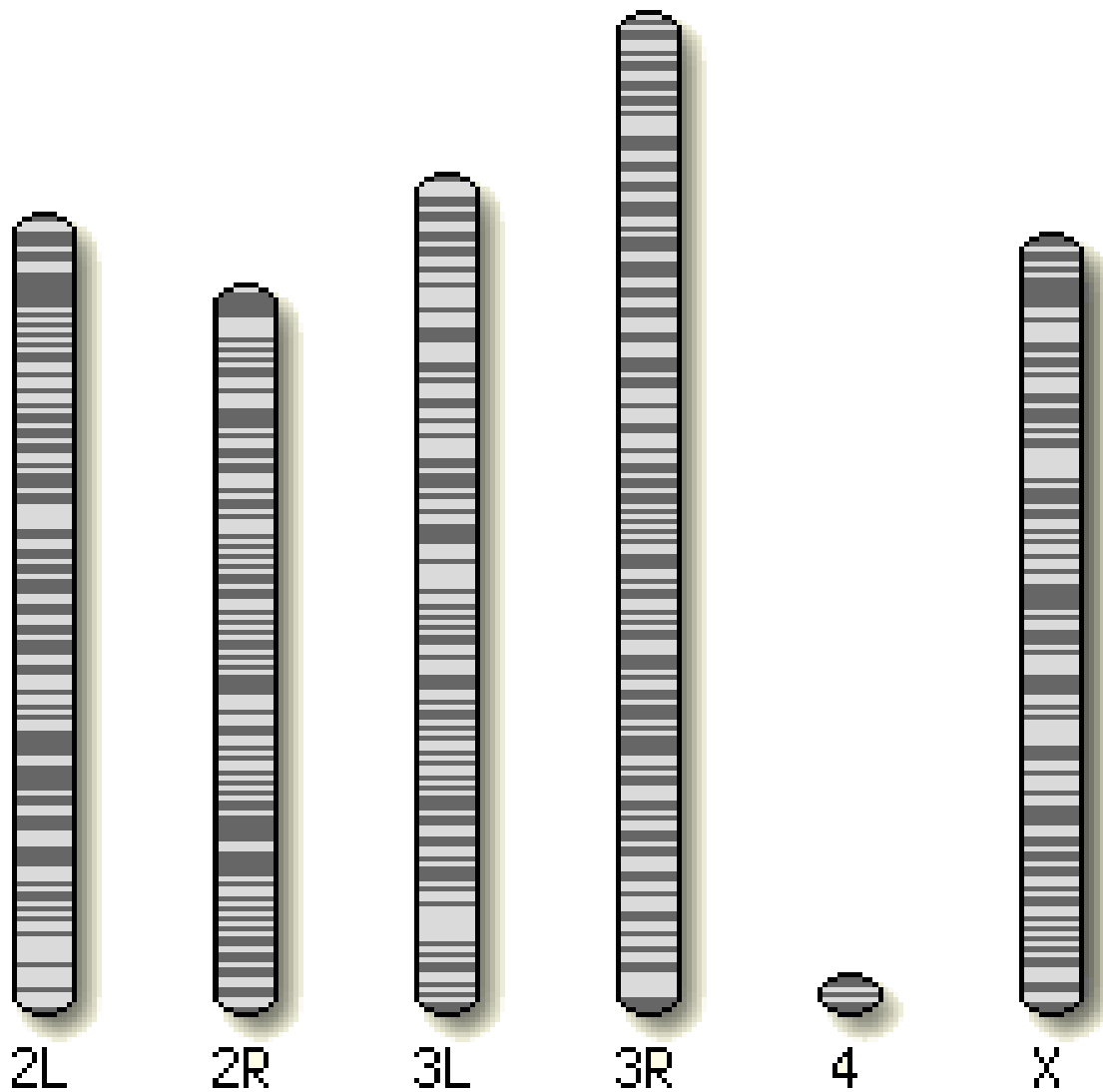
### Vinska mušica *Drosophila melanogaster*

- geni (lokusi): ime gena (a) recesivni mutant *maroon-like*, *fushi tarazu*, (b) dominantni mutant *Deformed*, ili nazvan poslije proteina *Acetylcholine esterase*; simboli gena: *mal*, *ftz*, *Dfd*, *Ace*
- aleli: *nejP*, *mysts1*; recesivni Hnr, dominantni bwD, aleli divljeg tipa b+ ili B+

- proteini: MAL, FTZ, DFD, ACE
- fenotipovi: white, whingless
- kromosomi: X ili 1, 2, 3, 4 i Y; telomere 1Lt (telomera lijevog kraka od X), centromere 1 cen, Ycen
- <http://flybase.bio.indiana.edu/>



Slika 3. Životni ciklus vinske mušice



Slika 4. Shematski prikaz kromosoma vinske mušice

### **Zebrica (zebrafish)**

- geni (lokusi): ime gena *cyclops*, *brass*, *no tail*; simboli gena *cyc*, *brs*, *ntl*
- aleli: aleli divljeg tipa *cyc+*, *brs+* i mutanti *ntl-*, recesivni r, dominantni d
- proteini: Cyc, Brs, Ntl
- fenotipovi: *cyclops*, *cyc*
- kromosomi; LGI do LGXXV (- spolni k.)
- <http://zfish.uoregon.edu>



## Zebrica kao modelni organizam u farmakologiji



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Slika 5. Sedam dana stara ribica u 50  $\mu$ l tekućine u mikrotitarskoj (Eppendorf) kiveti



Slika 6. Fluorescentna i divlji tip zebrice.

#### Miš *Mus musculus*

- geni (lokusi): simboli gena *Esl*, *Mc1r*, *Myc*, *Tyr*
- aleli: *Es1b*, recesivni *Mc1re*, dominantni *MclrE*
- proteini: ES1, MC1R, MYC, TYR
- fenotipovi: grey-lethal
- kromosomi: autosomi 19 parova Chr 1-19; spolni X i Y
- complete mouse reference genome was sequenced in 2002
- <http://www.informatics.jax.org/nomen/>



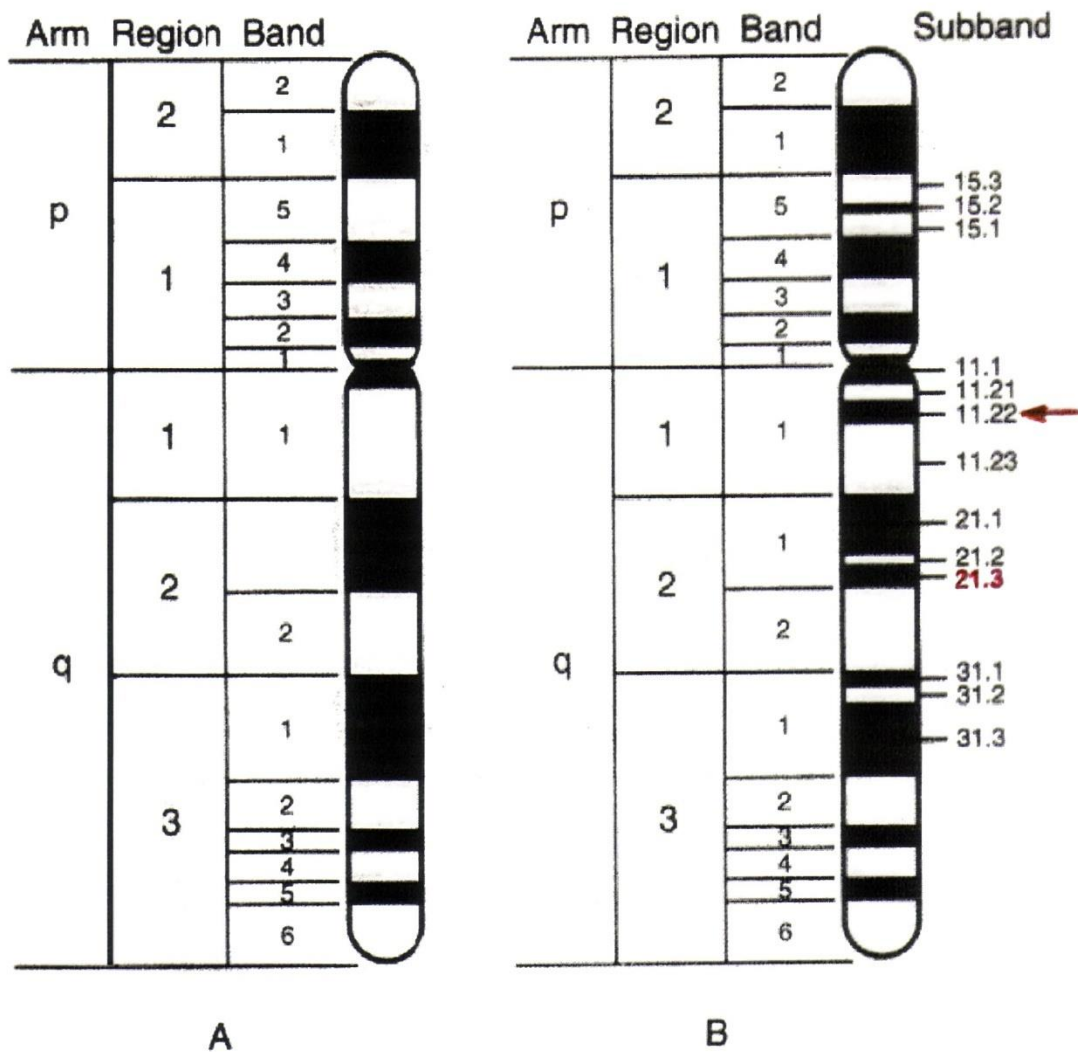


Slika 6. Genetički manipuliran miš s fluorocentnim proteinom (*Mus musculus*. These mice have been genetically manipulated to express a green fluorescent protein from a jellyfish. This allows you to tell where genes are being expressed in a non-invasive manner.)

#### Čovjek *Homo sapiens*

- geni (lokusi): simboli gena *KRT1*, *KRT13*, *TP53*, *RB1*
- aleli: *HBB\*5*, *D3S22\*A1*
- proteini: *KRT1*, *KRT13*, *TP53*, *RB1*
- fenotipovi: HBB SC
- kromosomi: autosomi 22 para; spolni X i Y, kratko rame p, dugo rame q, centromera cen, telomera tel; kromosomske trake – kromosom 1, p, regija 3, traka 3, 1p33, podtraka – 1p33.1; 1p33.13
- kariotip: 46,XY 46,XX

- kromosomski rearanžmani: translokacija t, delecija del, inverzija inv, kružni kromosom r, t(X;3); prekid kromosoma (:), prekid i prespajane (::), od – do (→), pr. Prekid i prespajanje traka 1q21 i 1q31 uz deleciju segmenta između tih traka del(1)(pter→q21::q31→qter)
- <http://www.gene.ucl.ac.uk/nomenclature>



*G bendovi u humanom kromosomu 7*

Slika 7. G trake u humanom kromosomu 7



KARIOTIP MUŠKARCA +6,XY

Slika 8. Kariotip muškarca

Tablica 1. Kromosomska oštećenja u humanih tumora

Tumori s poznatim postojećim kromosomskim oštećenjima <sup>a</sup>		
Bolest	Kromosomski poremećaj	Točno mjesto oštećenja <sup>b</sup>
<b>LEUKEMIJE</b>		
Kronična mijeloična Akutna (nelimfocitna)	t (9; 22)	9q34.1 i 22q11.21
M1	t (9; 22)	9q34.1 i 22q11.21
M2	t (8; 21)	8q22.1 i 21q22.3
M3	t (15; 17)	15q22 i 17q11.2
M4	<i>inv</i> 16	p13.2 i q22
M4, M5	t (9; 11)	9p22 i 11q23
M1, M2, M3, M4, M5, M6	<i>del</i> 5q <i>del</i> 7q	5q22q23 7q33q36
Kronična limfocitna	+8 +12 t (11; 14)	11q13; 14q32
Akutna limfocitna		
L1-L2	t (9; 22)	9q34.1; 22q11.21
L2	t (4; 11)	4q21; 11q23
L3	t (8; 14)	8q24.13; 14q32.33
<b>LIMFOMI</b>		
Burkittov, imunoblastični	t (8; 14)	8q24.13; 14q32.33
Nodularni	t (14; 18)	14q32.3; 18q21.3
Limfocitni, dobro diferenciran	+12	
Limfocitni, slabo diferenciran	t (11; 14)	11q13; 14q32
<b>KARCINOMI</b>		
Neuroblastom, diseminirani	<i>del</i> 1p	1p31p36
Bronhogeni karcinom pluća, anaplastični, mikrocelularni	<i>del</i> 3p	3p14p23
Papilarni cistadenokarcinom ovarija	t (6; 14)	6q21 i 14q24
Retinoblastom	<i>del</i> 13q	13q14
Wilmsov tumor	<i>del</i> 11p	11p13
Aniridija-Wilmsov tumor	<i>del</i> 11p	11p13
<b>DOBROČUDNI SOLIDNI TUMORI</b>		
Meningeom	-22	22
Miješani tumor slinovnica	t (3; 8)	3p25 i 8q21

<sup>a</sup> Prema Yunis, J. J., Science, 221:227, 1983.

<sup>b</sup> Točna mjesta lomova na p i q krakovima kromosoma analiza kojih je omogućena osjetljivim tehnikama pruganja.