



XgWgYg'5: D'WbbchWYi gYXZf gWYbjb['jb.dU]Yhg g f Yfib['k]h
\YdU]hg7 cf Wff cgdg O Sz %Q

Cancer antigen 125 (CA 125)

75!%& 'UbH] Yb]lg _bck b h' Vy h Ydf]a UfnigYfi a 'hi a ci f'a U_f
i gX]b c]Uf]b 'WbWf' Zf' dfc[bcgglg fYg lcgbgY h' Vy ch YfUdmUBX
XlgYgY dfc[fYggc]b" T Y 75 %& 'UbH] Yb]lg Zi bX ci hi h' Vy U
a Ya VfUbY [nwdsfch]b XY]j YYX VmHgj Yg Xf]j YX Zca 'WYca JW
Ydjh Y]j a 'Y dfYggYX Vma cgh Ydjh Y]U c]Uf]b 'WbWf' T Y A Ucf
XfUk VUW]b i gbl 'h Y 75%& 'hgi Ug UgmWb]b['hcc' lg lg 'UW'cZ
gbbglh]j hmLbX]lg]bU]jhmle XYHmWYUfng]U YWbWf' fia UhUgC' Vy
YY UhX]b ch Yf'a U]l bUhWbWf g]bW X]b['hcgYcf]l jhUh]b['j b'h Y
i b[gZUcd]b h' Vy gVfUgYbXca Yf]j a zUbX [Ugfc]bhg]bU hfUW
Q&, +Q

T_g yroglobulin (Tg)

T mfc[cVi ib fH]gUb cf[Ub glYW Wh a ci f'a U_ Yf/Ug₂W₁Hx
k jh dUH₂bldgcYgjbl Xif YfYbhUH₂Xhmfic]XWbWfHUhYa Yf YZca
h Y Z `` JW W`g k \ JW]bWUgYg h Y Yg cZ hmfic[cVi]b` j b` h Y
VccX``hjg WbgjXfYXh VyUu[Y| nWdfchMbj gfcfYX]b h YZ `` JW Uf
W`c]X cZ hmfic]X [UbX k \ JW UWg Ug dfc! cfa cbY]b` h Y jbfU
hmfic]Xgjh YggcZ hmfic]b YfH(LbUbXfH) cXhmfic]b YfH EQ, ! - SQ

Heat shock protein (Hsp)

< gl\ \Ug [UbYX]a dcfIUbW X Y hc\]lg ja d'JWjcB\]b\ hi a ci f
dcfI YgjcB UbXfYgjcBgYlc\ h\ YfUhrik\ JW\ \Ug\ YXhc\ h\ YXYj Ycda Ybh
cZhf\ YhXh\ YfUdnMrh\ Yi g[YCz< gdgUg]a i bc\ c[JW\ UXi j Ubh]b
Ubh]WbWf\ j UWbYg< Yhig\ cW dcfch]bgfk\ gdg\ UYcj YfY dfYgjY\]b
j Ufcj g\ i a Ub WbWf gUbXfY]b c j YX]b W\ WnfYUHXdcfcWgjY
-hia\]\ hVW X Y hc\ hY g]a i UjcB\ cZh\ Y < gd\]bXi\ WjcB\ Vmd\ ngc!
dUhc\ c[JW\ ZUi fYgcZh\ Yhi a ci f'a JM\ C Ybj Jfcba YbhQ%-) Q

Human chorionic gonadotrophin (hCG)

< i a Ub \7\cf{cb}JW cbUXclfcdf\jb fl 7; L\lg U\cfa cbYbcfa Um
dcf\X W\X Vm\nd'Ub\h\k\|W UF\Zi bX h\W\|\`jb h\Y VccX cZ
dU\h\y\blg k\jh\ Wf\h\jb\ hndYg cZ c\j Uf\jb\ WbWfg h\g\JW\U\UbX
Wcf\cW\Wbca U\T Y YY\h\jcb\ cZ g\fi a\ Y\Yg cZ\7; \UbX\lg
a\YU\c\J\h\g\Wbbch\Y\Wbg\X\Y\Z\c d\fc\ bcg\U\jh\lg\Y\h\ja UhX\h\Uh
\7; 'a\|\h\X\j\Y\min\c\X\Z\h\h\Y\fc\h\c\Z\h\Y\WbWZ\Y\X\jb\ h\U
kcfg\Yci\h\w\A\Y\DF\Y\bl\h\h\k\ca\Y\U\Y\h\Y\X\jh\h\Y\df\Y\h\W\c\Z\7;
Y\Yg\Ub\X\h\rbch\Yi\g\Z\U\Ua\U\Yi\bi\X\h\lg\Wb\X\h\c\h\O\!%\\$SQ

Therapeutic biomarkers

7nbccl JWWY_a ch YfUdmUbXfUJch YfUdmfYWbgXYFYXlc VYhY
Vgħha XWħċiġb U U'WYZcf'a U[bUbWa\ck Yjżi hVgħa a UnW għ-
għfci għgħix YWiegħi għb[Xla UY h[bċfa U' W'g Ucb['kjh[h[Y-
h[a cf' W'g" FYWħiġ Ux bWa Ybolg jib[i bxxi għib[b[h[Y[i bxxi njb[
a YWħiġa "7UbWf \Ug YX h[h[YXj Yċda Ybħiċ Zħiġi Yħix h[Yfud] Ygħi-
k[JW[a Unjib[Mjh iħi Y[fċek h[cZħi Yh[a cf' W'g" jħiżi Zf[b[jib[h[Y[
a c "YWU" dUħħek Urġ "YUX[b[h[Uċċedlegġi" : cf "YUa d'Y[-a Ujh[]V UbX-
9f ch[b[JV Xfi [għ Wb[]b[Mjh h[YUwji Jħmici Z Dfċiħ[b[h[fċiġib Y[]b[Ugy-
ħiġi Yħiġi [h[Y[9d]Xxa U[; fċek h[: Uħiġi FYWħiċf[f[; : FL" Ch[Yf-
ħiġi Yħix h[Yfud] Ygħiġi "YUħbi]V Ħxmijj[Uwja a Wk[]" Uħiċi dcib U[fċek h[
ZMif[h[Uħiġiha i] Thieġi a cf' Vċċi X[Ygħiġi f[fċek h[C8%] Q

Glycolysis

A cgb i CZ hY a U] [blbh li a ci fg XxdYbX cb` i VgY Zf` hYf
XjY Ycda Ybh` K \b` \i a Ub` li a ci f` W` jbyg k YFy gi XjYX k Jh
j Ufnjb[`XjY YfYg cZ] \nWngg] Jh` \Ug VYb` cVgYfj YX hUh h YFy lg Ub
lb] YgYfYU]cbg] dWlk Yb` h YfU]cZ] \nWnggUbXXl\ U]Y]bx] WX
VnWl\ ch YfU]m HwXi [gUbXfU]U]cb` Gi XjYg \Ug ck b` h Uh &
8; gYYmj YmgYbgjhng h a ci f` Wg h` jcb]njb[fU]U]cbz k Jh aci h
W gbj` Xla U]Y]c`bcfa UWg`T i gZ` jbjW hf]Ug]b VFUb` li a ci f`
dU]Y]bglj gbj` U]ndcZU]cbh]XfU]ch YfU]ndfch]W` Wa Vb]YXk Jh
&; dfcj YX h` VY g Wg] 7ca Vb]U]cb` h YfU]nd] U]g fYg h]X]b
a jbj]a U]WYh]cl]W]h]bX` U]YfU]U]cb` Yf Wg]bX h` YfYlgg] bi Whb
j]bW]MgY]b` g]fj j]U` fU]Y]bX]a dfcj Ya Ybh]b` ei U]hmcZ] Z` \Ug VYb
fYdcf]h]X]C*!%&Q

Mammalian target of rapamycin (mTOR)

A U a U]b' Hf[Yi cZ fUdUa nWb' fa HCFL lg U g]bYhYc]b]bY
dfch]b'_jbUgYk \JW lg]b k Jh h YD? ? Q\cg\c]b]c]b]hXX' !_jbUgY
fd? !UfYhX]b]b]gQ]a]mUg a YgUbch]kcfh]nUf]h]b f]i 'Uh]b
W' XjYcda Yb]hUbX dFc 'ZfU]hcb' K 'Yb' a HCF 'lg Umj Uh]e hY
d\cg\c]fcm]hcb 'Y Yg cZ]lg]Xck b]g]fYUa 'Hf[Yg d+SG? 'UbX (96D%
UYdfca ch]Xe]k \JW YUg]c]b]WMg]X 'Y Yg cZf]Vcga YV]c [Yb]g]g
h]b]Ug]h]cb]b] M]hcb' cZU hcd U mUbX f]c]f[U]h]h]cb' cZh YUmj
W]rg YY]cb" Ch X]Yg 'Y Y g]ckb' h]U h]Y fd-f]l? L D]h]B a HCF
g]b]U]b]b' dU]h]k U]h]g]Wff]Ub]h]n]W]b]h]cb]b'a Ub]h]a ci fg]fYg 'h]b]b
Xng]f]i 'h]cb]cZ]W' f]ck h]b]Xdfc 'ZfU]hcb' @cg]cZD]h]B a FB5 'cf
dfch]b'_dfc]X W]cb]b]h]a ci f]h]g]Y]b]b]V]W]b]g]X]Y]X]U]6]ca U_f]g
h]c 'Y U]i U]h]h]Y]U]b]h]cb]cZh Y]dU]h]k U]h]Dfc 'ZfU]h]j Ya U_f]Y? !]*+lg
i g]X h]c 'Y U]i U]h]h]Y]b] M]hcb' cZa HCF 'Vm]f]Ud]n]W]b]k \JW W]b
a Y]b]f]Yh]Ydf]g]b]W]c]Zd]cg]c]f]m]h]X]Z]fa 'cZh Y]f]Vcga U_dfc]h]b
G]z]UbX]h]g]Y]d]M]H]W]c]b]h]a ci f]W]g]O]S]!%]Q]

Telomerase

H'ca YfUgY lg Ub 'Ybrna Y_bckb_Ug_fy Yfg lfUbglWldUgYgk \ JW
i gYFB5 Ughlha d'UhZf dfcXl Wb[8B5 UbX]hWblhJbg Vch FB5
UbXdfchJb Wa dcbyblg'T YYbrna Ylgc YfYgclcbgVYZf dcfchWb[
h YW' Zca 'Xy fUXhcb UbXXhVh Ya UbhblubWcZYca YfY
T i gjhWb WlfYUhxUgcbYcZh YWgjxJUbcgjWb Uf_YfgZf'\i a Ub
UbWfzF YUhXlc'a U] [bUbhli a ci fgzhli ga U_jb[jhUb]XXUhf[YhZf
Wya ch YfUdmQ8% !%Q

p53

Tyrosine kinase

Hf₁g₂b₃g₄b₅Y₆g₇W₈c₉b₁₀Y₁₁U₁₂U₁₃f₁₄[fc₁₅d₁₆c₁₇Z₁₈y₁₉b₂₀m₂₁a₂₂]g₂₃Y₂₄h₂₅U₂₆f₂₇[i₂₈U₂₉Y₃₀]U₃₁g₃₂W₃₃i₃₄U₃₅f₃₆U₃₇Y₃₈g₃₉Y₄₀Y₄₁W₄₂U₄₃U₄₄U₄₅U₄₆U₄₇U₄₈U₄₉U₅₀U₅₁U₅₂U₅₃U₅₄U₅₅U₅₆U₅₇U₅₈U₅₉U₆₀U₆₁U₆₂U₆₃U₆₄U₆₅U₆₆U₆₇U₆₈U₆₉U₇₀U₇₁U₇₂U₇₃U₇₄U₇₅U₇₆U₇₇U₇₈U₇₉U₈₀U₈₁U₈₂U₈₃U₈₄U₈₅U₈₆U₈₇U₈₈U₈₉U₉₀U₉₁U₉₂U₉₃U₉₄U₉₅U₉₆U₉₇U₉₈U₉₉U₁₀₀U₁₀₁U₁₀₂U₁₀₃U₁₀₄U₁₀₅U₁₀₆U₁₀₇U₁₀₈U₁₀₉U₁₁₀U₁₁₁U₁₁₂U₁₁₃U₁₁₄U₁₁₅U₁₁₆U₁₁₇U₁₁₈U₁₁₉U₁₂₀U₁₂₁U₁₂₂U₁₂₃U₁₂₄U₁₂₅U₁₂₆U₁₂₇U₁₂₈U₁₂₉U₁₃₀U₁₃₁U₁₃₂U₁₃₃U₁₃₄U₁₃₅U₁₃₆U₁₃₇U₁₃₈U₁₃₉U₁₄₀U₁₄₁U₁₄₂U₁₄₃U₁₄₄U₁₄₅U₁₄₆U₁₄₇U₁₄₈U₁₄₉U₁₅₀U₁₅₁U₁₅₂U₁₅₃U₁₅₄U₁₅₅U₁₅₆U₁₅₇U₁₅₈U₁₅₉U₁₆₀U₁₆₁U₁₆₂U₁₆₃U₁₆₄U₁₆₅U₁₆₆U₁₆₇U₁₆₈U₁₆₉U₁₇₀U₁₇₁U₁₇₂U₁₇₃U₁₇₄U₁₇₅U₁₇₆U₁₇₇U₁₇₈U₁₇₉U₁₈₀U₁₈₁U₁₈₂U₁₈₃U₁₈₄U₁₈₅U₁₈₆U₁₈₇U₁₈₈U₁₈₉U₁₉₀U₁₉₁U₁₉₂U₁₉₃U₁₉₄U₁₉₅U₁₉₆U₁₉₇U₁₉₈U₁₉₉U₂₀₀U₂₀₁U₂₀₂U₂₀₃U₂₀₄U₂₀₅U₂₀₆U₂₀₇U₂₀₈U₂₀₉U₂₁₀U₂₁₁U₂₁₂U₂₁₃U₂₁₄U₂₁₅U₂₁₆U₂₁₇U₂₁₈U₂₁₉U₂₂₀U₂₂₁U₂₂₂U₂₂₃U₂₂₄U₂₂₅U₂₂₆U₂₂₇U₂₂₈U₂₂₉U₂₃₀U₂₃₁U₂₃₂U₂₃₃U₂₃₄U₂₃₅U₂₃₆U₂₃₇U₂₃₈U₂₃₉U₂₄₀U₂₄₁U₂₄₂U₂₄₃U₂₄₄U₂₄₅U₂₄₆U₂₄₇U₂₄₈U₂₄₉U₂₅₀U₂₅₁U₂₅₂U₂₅₃U₂₅₄U₂₅₅U₂₅₆U₂₅₇U₂₅₈U₂₅₉U₂₆₀U₂₆₁U₂₆₂U₂₆₃U₂₆₄U₂₆₅U₂₆₆U₂₆₇U₂₆₈U₂₆₉U₂₇₀U₂₇₁U₂₇₂U₂₇₃U₂₇₄U₂₇₅U₂₇₆U₂₇₇U₂₇₈U₂₇₉U₂₈₀U₂₈₁U₂₈₂U₂₈₃U₂₈₄U₂₈₅U₂₈₆U₂₈₇U₂₈₈U₂₈₉U₂₉₀U₂₉₁U₂₉₂U₂₉₃U₂₉₄U₂₉₅U₂₉₆U₂₉₇U₂₉₈U₂₉₉U₃₀₀U₃₀₁U₃₀₂U₃₀₃U₃₀₄U₃₀₅U₃₀₆U₃₀₇U₃₀₈U₃₀₉U₃₁₀U₃₁₁U₃₁₂U₃₁₃U₃₁₄U₃₁₅U₃₁₆U₃₁₇U₃₁₈U₃₁₉U₃₂₀U₃₂₁U₃₂₂U₃₂₃U₃₂₄U₃₂₅U₃₂₆U₃₂₇U₃₂₈U₃₂₉U₃₃₀U₃₃₁U₃₃₂U₃₃₃U₃₃₄U₃₃₅U₃₃₆U₃₃₇U₃₃₈U₃₃₉U₃₄₀U₃₄₁U₃₄₂U₃₄₃U₃₄₄U₃₄₅U₃₄₆U₃₄₇U₃₄₈U₃₄₉U₃₅₀U₃₅₁U₃₅₂U₃₅₃U₃₅₄U₃₅₅U₃₅₆U₃₅₇U₃₅₈U₃₅₉U₃₆₀U₃₆₁U₃₆₂U₃₆₃U₃₆₄U₃₆₅U₃₆₆U₃₆₇U₃₆₈U₃₆₉U₃₇₀U₃₇₁U₃₇₂U₃₇₃U₃₇₄U₃₇₅U₃₇₆U₃₇₇U₃₇₈U₃₇₉U₃₈₀U₃₈₁U₃₈₂U₃₈₃U₃₈₄U₃₈₅U₃₈₆U₃₈₇U₃₈₈U₃₈₉U₃₉₀U₃₉₁U₃₉₂U₃₉₃U₃₉₄U₃₉₅U₃₉₆U₃₉₇U₃₉₈U₃₉₉U₄₀₀U₄₀₁U₄₀₂U₄₀₃U₄₀₄U₄₀₅U₄₀₆U₄₀₇U₄₀₈U₄₀₉U₄₁₀U₄₁₁U₄₁₂U₄₁₃U₄₁₄U₄₁₅U₄₁₆U₄₁₇U₄₁₈U₄₁₉U₄₂₀U₄₂₁U₄₂₂U₄₂₃U₄₂₄U₄₂₅U₄₂₆U₄₂₇U₄₂₈U₄₂₉U₄₃₀U₄₃₁U₄₃₂U₄₃₃U₄₃₄U₄₃₅U₄₃₆U₄₃₇U₄₃₈U₄₃₉U₄₄₀U₄₄₁U₄₄₂U₄₄₃U₄₄₄U₄₄₅U₄₄₆U₄₄₇U₄₄₈U₄₄₉U₄₅₀U₄₅₁U₄₅₂U₄₅₃U₄₅₄U₄₅₅U₄₅₆U₄₅₇U₄₅₈U₄₅₉U₄₆₀U₄₆₁U₄₆₂U₄₆₃U₄₆₄U₄₆₅U₄₆₆U₄₆₇U₄₆₈U₄₆₉U₄₇₀U₄₇₁U₄₇₂U₄₇₃U₄₇₄U₄₇₅U₄₇₆U₄₇₇U₄₇₈U₄₇₉U₄₈₀U₄₈₁U₄₈₂U₄₈₃U₄₈₄U₄₈₅U₄₈₆U₄₈₇U₄₈₈U₄₈₉U₄₉₀U₄₉₁U₄₉₂U₄₉₃U₄₉₄U₄₉₅U₄₉₆U₄₉₇U₄₉₈U₄₉₉U₅₀₀U₅₀₁U₅₀₂U₅₀₃U₅₀₄U₅₀₅U₅₀₆U₅₀₇U₅₀₈U₅₀₉U₅₁₀U₅₁₁U₅₁₂U₅₁₃U₅₁₄U₅₁₅U₅₁₆U₅₁₇U₅₁₈U₅₁₉U₅₂₀U₅₂₁U₅₂₂U₅₂₃U₅₂₄U₅₂₅U₅₂₆U₅₂₇U₅₂₈U₅₂₉U₅₃₀U₅₃₁U₅₃₂U₅₃₃U₅₃₄U₅₃₅U₅₃₆U₅₃₇U₅₃₈U₅₃₉U₅₄₀U₅₄₁U₅₄₂U₅₄₃U₅₄₄U₅₄₅U₅₄₆U₅₄₇U₅₄₈U₅₄₉U₅₅₀U₅₅₁U₅₅₂U₅₅₃U₅₅₄U₅₅₅U₅₅₆U₅₅₇U₅₅₈U₅₅₉U₅₆₀U₅₆₁U₅₆₂U₅₆₃U₅₆₄U₅₆₅U₅₆₆U₅₆₇U₅₆₈U₅₆₉U₅₇₀U₅₇₁U₅₇₂U₅₇₃U₅₇₄U₅₇₅U₅₇₆U₅₇₇U₅₇₈U₅₇₉U₅₈₀U₅₈₁U₅₈₂U₅₈₃U₅₈₄U₅₈₅U₅₈₆U₅₈₇U₅₈₈U₅₈₉U₅₉₀U₅₉₁U₅₉₂U₅₉₃U₅₉₄U₅₉₅U₅₉₆U₅₉₇U₅₉₈U₅₉₉U₆₀₀U₆₀₁U₆₀₂U₆₀₃U₆₀₄U₆₀₅U₆₀₆U₆₀₇U₆₀₈U₆₀₉U₆₁₀U₆₁₁U₆₁₂U₆₁₃U₆₁₄U₆₁₅U₆₁₆U₆₁₇U₆₁₈U₆₁₉U₆₂₀U₆₂₁U₆₂₂U₆₂₃U₆₂₄U₆₂₅U₆₂₆U₆₂₇U₆₂₈U₆₂₉U₆₃₀U₆₃₁U₆₃₂U₆₃₃U₆₃₄U₆₃₅U₆₃₆U₆₃₇U₆₃₈U₆₃₉U₆₄₀U₆₄₁U₆₄₂U₆₄₃U₆₄₄U₆₄₅U₆₄₆U₆₄₇U₆₄₈U₆₄₉U₆₅₀U₆₅₁U₆₅₂U₆₅₃U₆₅₄U₆₅₅U₆₅₆U₆₅₇U₆₅₈U₆₅₉U₆₆₀U₆₆₁U₆₆₂U₆₆₃U₆₆₄U₆₆₅U₆₆₆U₆₆₇U₆₆₈U₆₆₉U₆₇₀U₆₇₁U₆₇₂U₆₇₃U₆₇₄U₆₇₅U₆₇₆U₆₇₇U₆₇₈U₆₇₉U₆₈₀U₆₈₁U₆₈₂U₆₈₃U₆₈₄U₆₈₅U₆₈₆U₆₈₇U₆₈₈U₆₈₉U₆₉₀U₆₉₁U₆₉₂U₆₉₃U₆₉₄U₆₉₅U₆₉₆U₆₉₇U₆₉₈U₆₉₉U₇₀₀U₇₀₁U₇₀₂U₇₀₃U₇₀₄U₇₀₅U₇₀₆U₇₀₇U₇₀₈U₇₀₉U₇₁₀U₇₁₁U₇₁₂U₇₁₃U₇₁₄U₇₁₅U₇₁₆U₇₁₇U₇₁₈U₇₁₉U₇₂₀U₇₂₁U₇₂₂U₇₂₃U₇₂₄U₇₂₅U₇₂₆U₇₂₇U₇₂₈U₇₂₉U₇₃₀U₇₃₁U₇₃₂U₇₃₃U₇₃₄U₇₃₅U₇₃₆U₇₃₇U₇₃₈U₇₃₉U₇₄₀U₇₄₁U₇₄₂U₇₄₃U₇₄₄U₇₄₅U₇₄₆U₇₄₇U₇₄₈U₇₄₉U₇₅₀U₇₅₁U₇₅₂U₇₅₃U₇₅₄U₇₅₅U₇₅₆U₇₅₇U₇₅₈U₇₅₉U₇₆₀U₇₆₁U₇₆₂U₇₆₃U₇₆₄U₇₆₅U₇₆₆U₇₆₇U₇₆₈U₇₆₉U₇₇₀U₇₇₁U₇₇₂U₇₇₃U₇₇₄U₇₇₅U₇₇₆U₇₇₇U₇₇₈U₇₇₉U₇₈₀U₇₈₁U₇₈₂U₇₈₃U₇₈₄U₇₈₅U₇₈₆U₇₈₇U₇₈₈U₇₈₉U₇₉₀U₇₉₁U₇₉₂U₇₉₃U₇₉₄U₇₉₅U₇₉₆U₇₉₇U₇₉₈U₇₉₉U₈₀₀U₈₀₁U₈₀₂U₈₀₃U₈₀₄U₈₀₅U₈₀₆U₈₀₇U₈₀₈U₈₀₉U₈₁₀U₈₁₁U₈₁₂U₈₁₃U₈₁₄U₈₁₅U₈₁₆U₈₁₇U₈₁₈U₈₁₉U₈₂₀U₈₂₁U₈₂₂U₈₂₃U₈₂₄U₈₂₅U₈₂₆U₈₂₇U₈₂₈U₈₂₉U₈₃₀U₈₃₁U₈₃₂U₈₃₃U₈₃₄U₈₃₅U₈₃₆U₈₃₇U₈₃₈U₈₃₉U₈₄₀U₈₄₁U₈₄₂U₈₄₃U₈₄₄U₈₄₅U₈₄₆U₈₄₇U₈₄₈U₈₄₉U₈₅₀U₈₅₁U₈₅₂U₈₅₃U₈₅₄U₈₅₅U₈₅₆U₈₅₇U₈₅₈U₈₅₉U₈₆₀U₈₆₁U₈₆₂U₈₆₃U₈₆₄U₈₆₅U₈₆₆U₈₆₇U₈₆₈U₈₆₉U₈₇₀U₈₇₁U₈₇₂U₈₇₃U₈₇₄U₈₇₅U₈₇₆U₈₇₇U₈₇₈U₈₇₉U₈₈₀U₈₈₁U₈₈₂U₈₈₃U₈₈₄U₈₈₅U₈₈₆U₈₈₇U₈₈₈U₈₈₉U₈₉₀U₈₉₁U₈₉₂U₈₉₃U₈₉₄U₈₉₅U₈₉₆U₈₉₇U₈₉₈U₈₉₉U₉₀₀U₉₀₁U₉₀₂U₉₀₃U₉₀₄U₉₀₅U₉₀₆U₉₀₇U₉₀₈U₉₀₉U₉₁₀U₉₁₁U₉₁₂U₉₁₃U₉₁₄U₉₁₅U₉₁₆U₉₁₇U₉₁₈U₉₁₉U₉₂₀U₉₂₁U₉₂₂U₉₂₃U₉₂₄U₉₂₅U₉₂₆U₉₂₇U₉₂₈U₉₂₉U₉₃₀U₉₃₁U₉₃₂U₉₃₃U₉₃₄U₉₃₅U₉₃₆U₉₃₇U₉₃₈U₉₃₉U₉₄₀U₉₄₁U₉₄₂U₉₄₃U₉₄₄U₉₄₅U₉₄₆U₉₄₇U₉₄₈U₉₄₉U₉₅₀U₉₅₁U₉₅₂U₉₅₃U₉₅₄U₉₅₅U₉₅₆U₉₅₇U₉₅₈U₉₅₉U₉₆₀U₉₆₁U₉₆₂U₉₆₃U₉₆₄U₉₆₅U₉₆₆U₉₆₇U₉₆₈U₉₆₉U₉₇₀U₉₇₁U₉₇₂U₉₇₃U₉₇₄U₉₇₅U₉₇₆U₉₇₇U₉₇₈U₉₇₉U₉₈₀U₉₈₁U₉₈₂U₉₈₃U₉₈₄U₉₈₅U₉₈₆U₉₈₇U₉₈₈U₉₈₉U₉₉₀U₉₉₁U₉₉₂U₉₉₃U₉₉₄U₉₉₅U₉₉₆U₉₉₇U₉₉₈U₉₉₉U₁₀₀₀U₁₀₀₁U₁₀₀₂U₁₀₀₃U₁₀₀₄U₁₀₀₅U₁₀₀₆U₁₀₀₇U₁₀₀₈U₁₀₀₉U₁₀₁₀U₁₀₁₁U₁₀₁₂U₁₀₁₃U₁₀₁₄U₁₀₁₅U₁₀₁₆U₁₀₁₇U₁₀₁₈U₁₀₁₉U₁₀₂₀U₁₀₂₁U₁₀₂₂U₁₀₂₃U₁₀₂₄U₁₀₂₅U₁₀₂₆U₁₀₂₇U₁₀₂₈U₁₀₂₉U₁₀₃₀U₁₀₃₁U₁₀₃₂U₁₀₃₃U₁₀₃₄U₁₀₃₅U₁₀₃₆U₁₀₃₇U₁₀₃₈U₁₀₃₉U₁₀₄₀U₁₀₄₁U₁₀₄₂U₁₀₄₃U₁₀₄₄U₁₀₄₅U₁₀₄₆U₁₀₄₇U₁₀₄₈U₁₀₄₉U₁₀₅₀U₁₀₅₁U₁₀₅₂U₁₀₅₃U₁₀₅₄U₁₀₅₅U₁₀₅₆U₁₀₅₇U₁₀₅₈U₁₀₅₉U₁₀₆₀U₁₀₆₁U₁₀₆₂U₁₀₆₃U₁₀₆₄U₁₀₆₅U₁₀₆₆U₁₀₆₇U₁₀₆₈U₁₀₆₉U₁₀₇₀U₁₀₇₁U₁₀₇₂U₁₀₇₃U₁₀₇₄U₁₀₇₅U₁₀₇₆U₁₀₇₇U₁₀₇₈U₁₀₇₉U₁₀₈₀U₁₀₈₁U₁₀₈₂U₁₀₈₃U₁₀₈₄U₁₀₈₅U₁₀₈₆U₁₀₈₇U₁₀₈₈U₁₀₈₉U₁₀₉₀U₁₀₉₁U₁₀₉₂U₁₀₉₃U₁₀₉₄U₁₀₉₅U₁₀₉₆U₁₀₉₇U₁₀₉₈U₁₀₉₉U₁₁₀₀U₁₁₀₁U₁₁₀₂U₁₁₀₃U₁₁₀₄U₁₁₀₅U₁₁₀₆U₁₁₀₇U₁₁₀₈U₁₁₀₉U₁₁₁₀U₁₁₁₁U₁₁₁₂U₁₁₁₃U₁₁₁₄U₁₁₁₅U₁₁₁₆U₁₁₁₇U₁₁₁₈U₁₁₁₉U₁₁₂₀U₁₁₂₁U₁₁₂₂U₁₁₂₃U₁₁₂₄U₁₁₂₅U₁₁₂₆U₁₁₂₇U₁₁₂₈U₁₁₂₉U₁₁₃₀U₁₁₃₁U₁₁₃₂U₁₁₃₃U₁₁₃₄U₁₁₃₅U₁₁₃₆U₁₁₃₇U₁₁₃₈U₁₁₃₉U₁₁₄₀U₁₁₄₁U₁₁₄₂U₁₁₄₃U₁₁₄₄U₁₁₄₅U₁₁₄₆U₁₁₄₇U₁₁₄₈U₁₁₄₉U₁₁₅₀U₁₁₅₁U₁₁₅₂U₁₁₅₃U₁₁₅₄U₁₁₅₅U₁₁₅₆U₁₁₅₇U₁₁₅₈U₁₁₅₉U₁₁₆₀U₁₁₆₁U₁₁₆₂U₁₁₆₃U₁₁₆₄U₁₁₆₅U₁₁₆₆U₁₁₆₇U₁₁₆₈U₁₁₆₉U₁₁₇₀U₁₁₇₁U₁₁₇₂U₁₁₇₃U₁₁₇₄U₁₁₇₅U₁₁₇₆U₁₁₇₇U₁₁₇₈U₁₁₇₉U₁₁₈₀U₁₁₈₁U₁₁₈₂U₁₁₈₃U₁₁₈₄U₁₁₈₅U₁₁₈₆U₁₁₈₇U₁₁₈₈U₁₁₈₉U₁₁₉₀U₁₁₉₁U₁₁₉₂U₁₁₉₃U₁₁₉₄U₁₁₉₅U₁₁₉₆U₁₁₉₇U₁₁₉₈U₁₁₉₉U₁₂₀₀U₁₂₀₁U₁₂₀₂U₁₂₀₃U₁₂₀₄U₁₂₀₅U₁₂₀₆U₁₂₀₇U₁₂₀₈U₁₂₀₉U₁₂₁₀U₁₂₁₁U₁₂₁₂U₁₂₁₃U₁₂₁₄U₁₂₁₅U₁₂₁₆U₁₂₁₇U₁₂₁₈U₁₂₁₉U₁₂₂₀U₁₂₂₁U₁₂₂₂U₁₂₂₃U₁₂₂₄U₁₂₂₅U<sub

hfcglbY_]bUgY]b\]Mfcf'GY hbiVUbXHfUj i n a U\Y Ydfcj YXhc VY
Ubj!WbWf U YbglgO&&%&Q

Cells as Biomarker

Circulating tumour cells (CTCs)

7]fWUjb[hi a ci f W'gWb VYWbglXYfYXUgUdck YfZ ` Vjca Uf_Yf
le dfYX]Mh YXgMgYdfc[fYgcb UbXfYgcbgYlc h YfUdm=bWMgY]b
7H7g U i Ubmja X X fjb[h YfUdm]g Ub` jbXWfcb` cZ dfc[fYgcbz
k\YfUg XYWMgYX bi a Wf cZ 7H7g g\ckg h Yf Ym j YbYgg cZ h Y
h YfUdmGi XjYg\Y Yg\ckb h Uih Ym Wb VYWbglXYfYXUgUdck
hi a ci f a Uf_YfgfM["7U&!& L]b dfYX]Mj b[dfc[bcglgO&Q

T-regulatory cells (CD4+, CD25+ and Foxp3+)

H fYi Ucfm W'g fHfYgE UY WbglXYfYX hc` VY ja dcfUbkj jb
jbX Wb[UbX a UbUjb]b[dY]d YfU` gYZlc YfUWb Wbglg ei Ybim
dfY Yb]b[]a a i bY dUhc`c[]Yg`T YmUfY Ugl a YX hc` Wbhfcc` Vch
bu h fU`UbX Wb[fYX ja a i bY fYgcbgYg` HfYg lg k Y` _bck b` Ug U
g ffc[UY ja a i bY a Uf_Yf cZ WbWf dfc[fYgcb/ Ug` Umg Ug U
dfY]Mtf cZfYgcbgYlc h f[YMX h YfU]Yg`T Y dfYgWbWcZ: cl D Z
W'g k]h]b[hi a ci fg\Ugdfcj Yb` hc` dfYX]Mh Ydfc[bcglgza YhUjW
W]hmiUbX]bj Ugl YbYggcZgca Yhi a ci fgVma cX Ujb[h YU]hmcZ
h Y]a a i bYgglY a hc Hf[Yhi a ci f W'gO&!%&Q

Cancer stem cells (CSCs)

7UbWfghY W'gUg Vcdci Ujcb`cZW`ghUh\Y Yh YWdUWjhic
gYZfYbYk` UbX hc` [YbYfUY h Y a cfY Xif YfYbhUXX dfc[Ybmik\JW
a UYi d`h Ym` _cZUh a ci f`Ch XjYg\Y Yg\ckb` WbWfghY` W'g
f7G7gzh a ci f][Yb]WbWf W'gcf h a ci f]b]H]Ujb[W'gWb[l]j Y
fjg` hc` bYk` hi a ci fg k\Yb` hfUbgfUbhX` jbhc` ia a i bc!XY Wbkh
Ub]a Ug`T YfYfUg]hlgj ha cglja dcfUbkWb[XhblZni7G/gZf`Yf Ym
dcgjVY h a ci f` k\JW a Um` YX` hc` bYk` h YfUdY hWU Ybi Yg
O&!%&Q

Epigenetic biomarkers

hi jg k Y` _bck b` h Ubz]b` WbWf` W'g[YbYg UY Yjh Y` UhfYX Vm
a i hUjcbg`cf`hfc[\`Yd][YbYfW a cX` Wicbg`lc` Wfca cga Yg`h`h
Wb[Y` [YbY`Yf dfYgcb` dUHfbg` 9d][YbYfW a cX` Wicbg` UfY
g ddcgYX` hc` cWf` Yjh Yf` hfc[\`8B5` a YhmUjcb`cZ[YbYg cf` Vm
WhmUjcbz a YhmUjcbz cf` d`cg`lcfmUjcb`cZ\`gcbYg UbX ch`Yf
dfch`bg`Ufc[bXk\JW 8B5`lgkci bXlc`Zfa` Wfca Ujb` O&% (Q
FYWbli Uj UbWb Ybi jb` h Y` YX` \Ug` YX` hc` h Y` UfYbYgg cZ h Y
Yd][YbYfWb[Yg`Xf]j jb[bYcd`UgUlc` VYi gXUg`g[bi` WbhWbWf
Vjca Uf_Yg` Gi XjYg` \Y Y` g\ckb` h Uj h Y` Umj` hm` cZ` 8B5`
a YhmUjcbg`fBBA Hjz UfY UhfYX` jb[hi a ci f` W'g` UbX` UfY

&S"

*- " A Uh jj UbUb' G f88%&L E i YgjZf' 7UbWf' 6]ca U_fYg' 5ggHjb['Ai Hbh
DfchY]bg UbX FB5' hUi Dfcj]Xg' hY Ai W' BYXXX CdYW Whi' >
DfchYca]W6]c]bZfa). %!%"
+S"

%& HU]` 5?ž DfYUX G fRS% L Hf[Yhb[`D]` ` DUhkUmVm7i fWa jb` Zf
7UbWFDFj YbHcb UbXHFUa YbH`7Y`8Y`6]c`(. Y% %
% " @JW7z5bXYgjB Jz; Yflgb`6HfRS% L=a dUfYXF]Vcgca Y6]c[YbYdg
UbX D` ` 5Wj UHcb` jb` < Ua Uc`c[JW` 8]gMjY` Bcj Y` T YfUdM hW
GfUM]Yg`>6cbYA Uffck FYg%&%
%(" BUU` 8YdH]` 7<ž JJ@` DJUb` ?ia U` 5ž FLa YgVM ž
-bXfUdf]nXfg]b]`I` fRS%&Fc`YcZH a cf`G ddfYggf`Dfch]b`d` `jb
5dcdegjUbX7UbWF T YfUdm>7UbWF GWT Y`C%`!SS%
%)" ?i fcXUžHbjkU]`A` fRS% L Df]bWd`Yg`UbX7i ffYbhHed]Wg`7cbWfb]b[
A UbU`Ya Ybh cZ HfegjbY ?jbUg` -b\ Mlef` T YfUdm Zf` 7\fcb]W
A nYc`Ybc g@Y`_Ya JUHUb`g`A`YXG`!SS%
%&" 7\Yb`A G@q` 7MKUb`K HE<g` 7HE7\Yb[`7A` fRS%&LdfcV]b[FYU!
Ha Y FyglcbgY hc` A i HUf[YHx HfegjbY ?jbUg` -b\ Mlef` (!B!fl !
6fca c!D`YbrL5a]bcl*ž+!8]a Yhcl nei]bUrc`]bY]b`G]b[`Y@j]b[`7Y`g
I gbl`6]cZ bHcbU]nXXE i Ubh a `8ch`>B`Uca`XXB`UchWbc`&%"
%&" 5\b`A z7\c`>MfRS% L7i ffYbhGfi a `@ b[`7UbWF`6]ca Uf_Yfg`>A c`
6]ca Uf_8]U`b`G`!SS%
%)" : UfWA fRS%&7UbWF`6]ca Uf_Yfg`T Y: i h fY7\U`Yb[YcZ7UbWF`>
A c`6]ca Uf_8]U`b`G`!SS%
%" Hf[YbWF`Y`75zDfYf]a`8` fRS% L8]gMj Yfm`ZBcj Y`6]ca Uf_Yfg`Vm
HM hA]b]b[`5`B`Y`5j`Ybi`Yzf`8fi` `F`Yg`UW3>A c`6]ca Uf_8]U`b
G`!SS"
%&" G`Ufa UA žA c`\Ubhmg fRS% L A c`Ym`U`6]ca Uf_Yfg]b`7nhc`[YbYjW`m
Bcf`U`5W`Y`A`nYc`X@Y`_Ya JU`U`f`Yg`b[`h`YHf`Yg`>A c`6]ca Uf_
8]U`b`G`!SS"
%&" 9`8`Y`W`K`A` fRS% L`5` Bcj Y`6]ca Uf_Yfg`Zf`DbY`a cb]U`jb`7Uj`Yg`>
J`YHf`b`f`G`M`H`W`bc`(. Y% %
%& GUb]` A ž 8`Y`Vg` A ž @W` A ž DUU`f`D` A`JWUU` A ž Yh`U` fRS% L
9`l`cgca`Yg`jb`D`U`a`U`cZ`DU`Y`bg`k`jh` Cj`U`f`U` `7`U`W`b`ca`U`D`h`b`h`U
6]ca Uf_Yfg`cZH`a`cf`D`f`f`Y`g`cb`UbX`F`Y`g`l`cb`Y`h` T`Y`f`U`dm` ;`nb`W`
CV`g`M`f`J`W`G`!SS"
%& " JU`nf`Y`X`U`b`