

# BIOM9027

A YX]WU`-a U[ ]b[

HYfa " z&\$&&



7ci fgY`Cj Yfj ]Yk

GHJZ7cbHJW8YHJ]g

7cbj Ybcfg

BUa Y	9a U]`	5j U]`UV]`]m	@cW]h]cb	D\cbY
FcVYfhBcfXcb	<a href="#">f"bcfXcb4 i bgk "YXi "Ui</a>			Ž *%` ' , ) \$)


7ci fgY'8YHJ`g

I b]hg'cZ7 fYX]h\*`

Gi a a UfmcZ\Y'7ci fgY

: i bXUa YbHJ'g'cZdfcXi W]b[ 'U'a YX]W]'ja U[ Yž]a U[ Y'Wc`YW]cb'h'WXb]ei Ygž]a U[ Y'fYWc'bgf]i W]cb U[ cf]h'a g"8YHJ]YX'Yi Ua ]bU]cb'cZ\Y'Zci f'a U]b'UfYUg'cZa YX]W]'ja U[ ]b[ . 'Bi WYUf'A YX]W]bY'UbX Dcg]fcb'9a ]gg]cb'Hca c[ fUd\mžL!fUm]a U[ ]b[ žA U[ bYh]WF YgcbUbW'UbX]ja U[ Y'UbU'mg]g'a Yh'cXg"

A YX]W]'a U[ ]b[ ]g'ZcfYb[ ]bYYfg'fUH.Yf'h.Ub`]'Z'gW]YbW]'[ fUXi UH'g'UbX'fYei ]fYg'gca Y'\_bck`YX[ Y']b d\mg]W]ž'a Uh'Ya Uh]W]UbX'Wc'a di h'f'gW]YbW]'K \]gh]h]g'bchbYW]ggUfmr'c`Uj Y'fU\_Yb'Ub'i bXYf[ fUXi UH' Wc'i fgY'k ]h'd\mg]W]ž'UXj UbW]X'a Uh'Ya Uh]W]UbX'Wc'a di h'f'gW]YbW]'ž'U'VUW\_[ fci bX]b'g][ bU'UbU'mg]g fB€A - \* &%&cf'fY'UH'X'gi V'YWh]g'\][ \`mXYg]fUV'Y"D'YUgY'Wc'bHJW]i g'hc'XYH'fa ]bY']Zmci f'YXi W]h]cbU' VUW\_[ fci bX]g'Uddfcdf]UH'Zcf'h]g'Wc'i fgY"

7ci fgY'5]a g

Hc'XYj Y'cd'Ub'i bXYfg]UbX]b[ 'cZ\Y'df]bW]d'Yg'cZa YX]W]'ja U[ ]b[ 'h'WXbc'c[ ]Yg'Zfca 'Ub'Yb[ ]bYYf]b[ dYfgdYW]j Y"

7ci fgY'@YUfb]b[ 'Ci hWc'a Yg

5Zhf'gi W]W]ggZ `mWc'a d'Yh]b[ 'h]g'Wc'i fgYžmci 'g\ci 'X'VY'UV'Y'hc.

@YUfb]b[ 'Ci hWc'a Y	95`GHJ[ Y'%7ca dYHbW]Yg

H\Y`Wci fgY`k ]`VY`UggYgg`VmZci f`Ugg][ ba YbhgžcbY`Zcf`YUW`a cXU`]mž`Wca df]g]b[ `) & i `cZHY`  
UggYgga Ybh`H\Y`Z]bU`YI Ua `k ]`Wca df]gY`HY`fYa U]bXYf`cZHY`UggYgga Ybhf( , i `E`H\Y`YI Ua `k ]`]bWl XY`  
a i `hd`Y`Wc]W`ei Ygh]cbgžg\cfh]Ubgk Yf`ei Ygh]cbg`UbX`W`W`U]h]cbg"

### 5XX]h]cbU`7ci fgY`bZcfa U]h]cb

H\]g`Wci fgY`]g`Ub`]b]fcXi W]h]cb`hc`a YX]W]`]a U[ ]b[ `Vml !fUmž`bi WYUf`]gchmdY`UbX`a U[ bYh]WfYgcbUbW`  
]a U[ ]b[ `Ug`k Y`Ug`]a U[ Y`dfcW`gg]b[ "H\Y`Wci fgY`]g`]bh]fX]gW]d`]bUfmXfUk`]b[ `Zca`d\mg]Wgž`a UH`Ya U]h]Vg`  
UbX`Wca di h]f`gW]YbW`"K `]gh]h]g`bchbYW`ggUfm]c`Uj Y`hU`Yb`Ub`i bXYf[ fUXi UH`Wci fgY`]b`d\mg]Vg`UbX`  
Wca di h]f`gW]YbW`ž`U`VUW\_[ fci bX`]b`g][ bU`UbU`mg]g`f`b`€A` - \*`&%`c`f`fY`UH`X`gi V`Y`W`i]g`U`\][ `mXYg]fUV`Y`  
D`YUgY`Wcb]UW`i g`hc`XY`h`fa`]bY`]Zmci f`Y`Xi W]h]cbU`VUW\_[ fci bX`]g`Uddfcdf]UH`Z`f`h`]g`Wci fgY`"

## 5ggYgga Ybh

5ggYgga YbhUg_	K Y][ \h	8i Y'8UHŸ	7ci fgY'@YUfb]b[ Ci hWca Yg'5ggYggYX
%"5gg][ ba Ybh'	%	%, #/##&\$&&'%) - 'DA	%ž&
&"5gg][ ba Ybh&	%	&) #/\$#&\$&&'%) - 'DA	%ž&
' "5gg][ ba Ybh%	%	\$( #/\$#&\$&&'%) - 'DA	%ž&
("5gg][ ba Ybh(	%	&) #/##&\$&&'%) - 'DA	%ž&
)": ]bU`YI Ua ]bUh]cb	(,	Bch5dd`]WJY	' ž'(ž)

5ggYgga Ybh% '5gg][ ba Ybh'

8i Y'XUHŸ. %, #/##&\$&&'%) - 'DA

A U[ bYh]WfYgcbUbW`]a U[ ]b[ 'Ugg][ ba Ybh

5ggYgga Ybh& '5gg][ ba Ybh&

8i Y'XUHŸ. &) #/\$#&\$&&'%) - 'DA

⇒ U[ Y'UbU`mg]g'Ugg][ ba Ybh

5ggYgga Ybh' . '5gg][ ba Ybh%

8i Y'XUHŸ. \$( #/\$#&\$&&'%) - 'DA

L!fUm]a U[ ]b[ 'Ugg][ ba Ybh

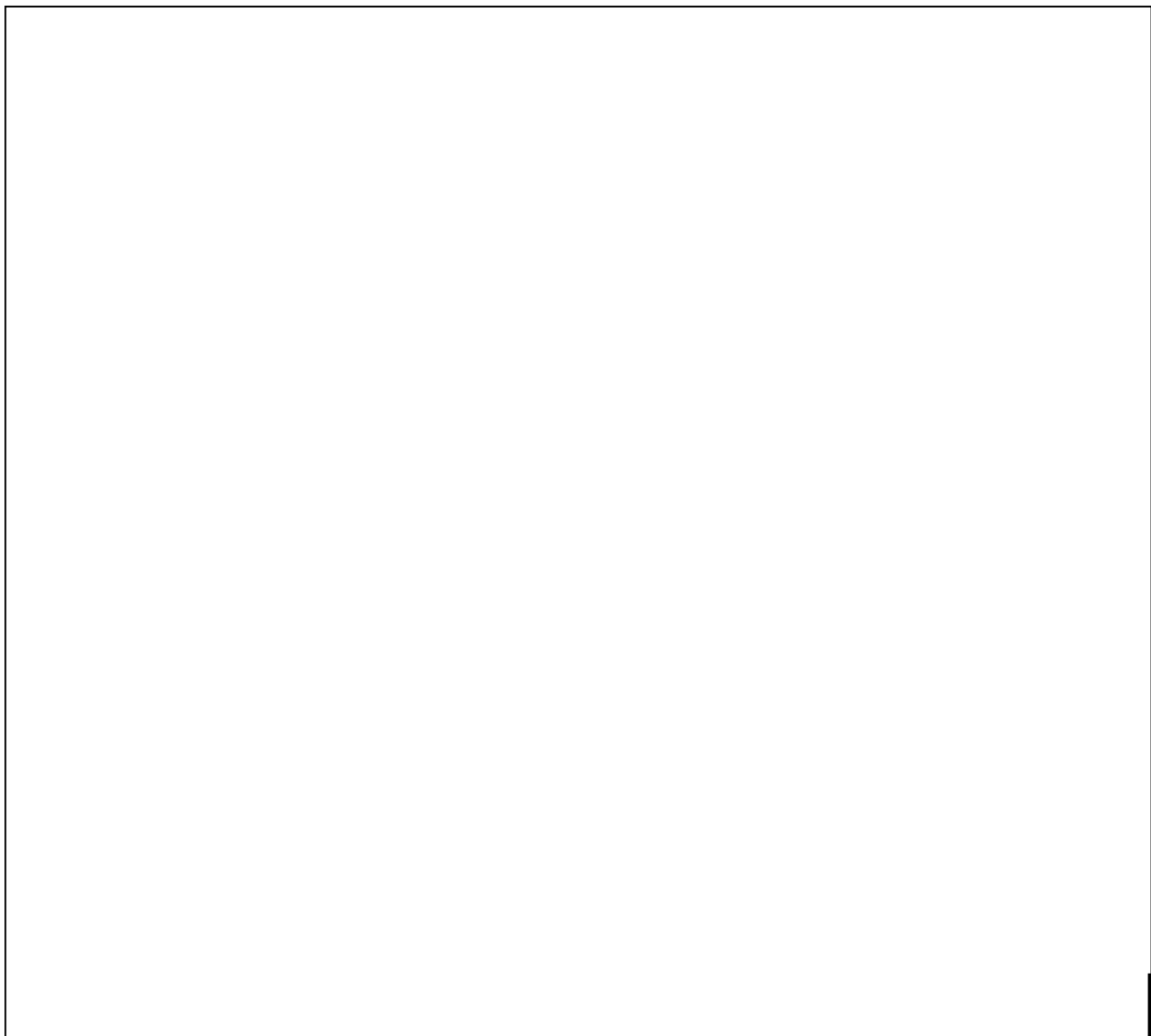
5ggYgga Ybh( . '5gg][ ba Ybh(

8i Y'XUHŸ. &) #/##&\$&&'%) - 'DA

Bi WYUf'a YX]WU`]a U[ ]b[ 'Ugg][ ba Ybh

5ggYgga Ybh) . : ]bU`YI Ua ]bUh]cb

: ]bU`YI Ua





F Ygci fWg

DfYgWf]VYX`F Ygci fWg

5`a UHf]U`k ]`VY`dfcj ]XYX`j ]U`A ccX`Y`UbX`HYUa g" `C b`]bY`UWfj ]hYg`]bWf X]b[ ``YWf fYg`UbX`fi hf]U`g`k ]`  
i h]gY`hY`HYUa g`d`UhZ`fa "

F YWca a YbXYX`F Ygci fWg

85H9G`HC`BC`H9



VY'X]gW'ggYX'a Um]bWi XY'UWV'gg'hc'a UHf]U'gžg][ bYfg'cf'bcH!HJ\_YfgžhY'dfcj ]g]cb'cZgYfj ]W'g  
UbX'UXX]h]cbU'YI Ua 'cf'UggYgga YbhUffUb[ Ya Ybhg""'9Uf'mbch]Z]W]h]cb ]g'YggYbh]U'hc'YbUV'Y'Ubm  
bYV'ggUfmiUX↑gha Ybhg'hc'VY'a UXY""

- Žmci 'VY']j Y'hUhmci f'dYfZcfa UbW' ]b'Ub'UggYggUV'Y'Wta dcbYbhczhY'Wti fgY'\Ug'VYYb  
UZZ'W'X'Vm]'bYgg'cf'UbcH'Yfi bYI dYW'X'W'fW a ghUbW'žmci 'g\ci 'X'a U\_Y'Ub'Udd']W]h]cb'Zcf  
gdYW]U'Wcbg]XYfU]cb'Ug'gccb'Ug'dcgg]V'Y'UZ'f'hY'Yj YbhVmij ]g]h]b[ 'I B GK 'Gh XYbh7YbfU""  
D'YUgY'hu\_'hc'hY'Wti fgY'W'cfX]bU'cf'Ug'k Y""UbX'bcH'hc'U'W'cbg]XYfU]cbg'UfY'bcH[ fUbH'X  
Ui hca Uh]W]'m'

- I B GK '\Ug'ghf]W'hd'c']W]Yg'UbX'YI dYW'U]h]cbg'fY'U]h]b[ 'hc'CWV' d%

YU 'h'UbX'

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# Gi Va ]gg]cb'cZ5ggYgga YbhiHUg\_g

@UVcfUhcfmfYdcfng'UbX'a U'cf'Ugg][ ba Ybht'k ]''fYei ]fY'U' [Bcb'D'U\[ \]Uflga'8YWUfUhc'7cj Yf'G\YYH'](#)

5gg][ ba Ybht'g\ci 'X'VY'gi Va ]H'X'cb'h'a Y''5'XU]mdYbU'micZ) i 'cZhY'a Uf\_g'Uj U]'UV'Y'Zcf'hUh  
Ugg][ ba Ybhk ]''Udd'mZcf'k cf\_'fYW'j YX'UZ'Yf'h'Y'Xi Y'XUH''5bmiUgg][ ba Ybhia cfY'h'Ub') 'XUmj''UH'k ]''bch  
VY'UW'W'dh'X''H\Y'cb'mYI Ya dh]cb'k ]''VY'k \Yb'df]cf'dYfa ]gg]cb'Zcf''UH'gi Va ]gg]cb'\Ug'VYYb'[ fUbh'X'Vm  
h'Y'7ci fgY'W'cfX]bUhc'f''9I h'bg]cbg'k ]''VY'[ fUbh'X'cb'mcb'a YX]W'cf'W'a dUgg]cbUH' '[ fci bXg'i bXYf  
YI hfYa Y'W'fW'a g'U'bv'W'g''

# 5 WUXYa ]W< cbYgmiUbX`D`U[ ]Uf]ga

D@5; =F =GA

6Yk UfY`5b`Ugg][ ba YbhUUh]bWm XYg`d`U[ ]Uf]gYX`a UHf]U`k ]`fYW]j Y`U`\$i : U]žUbX`ghi XYbhtg`k \c d`U[ ]Uf]gY`a UmZ]`hY`Wci fgY`Gh XYbhtg`k \c d`U[ ]Uf]gY`k ]`Uj Y`hY]f`bUa Yg`YbHYfYX`cb`U`d`U[ ]Uf]ga fY[ ]ghf`UbX`k ]`VY`]UV`Y`hc`X]gW]d`]bUfmiUW]cbž]bWm X]b[ `YI Wm g]cb`Zca `Ybfc`a`Ybh`  
#]g`YI dYWYX`hUUhU`ghi XYbhtg`a i ghUUhU`h]a Yg`gi Va ]hY]f`ck`b`k`cf`\_`Zcf`UggYgga Ybh`Gi Va ]h]b[ `hY k`cf`\_`cf`]XYUg`cZgca YcbY`Y`gY`k ]h]ci hWYUfmiUW\_bck`YX[ ]b[ `hY`gci fW`cZVcffck`YX`a UHf]U`cf`]XYUg`]g d`U[ ]Uf]ga "

5`UggYgga Ybhtg`k \]W`mci `UbX`]b`a i gh`Uj Y`U`[B`cb`D`U\[ \]Uf\]ga`8YWUfU\]cb`7cj`Yf`G`YYH`H\\]g`\]g`Zcf Vch`\]bX\]j \]Xi U`UbX`\[ fci d`k`cf`\\_`5HUVW`\]h\]c`mci f`Ugg\]\[ ba YbhVYZcfY`gi Va \]h\]b\[ `\]h\]c`hY`7`ci fgY 7`ccfX\]bUhc`f`cf`UhhY`GVX`cc`C`Z\]W`](#)

D`U[ ]Uf]ga `]g`hY`i`gY`cZUbchYf`dYfgcb`g`k`cf`\_`cf`]XYUg`Ug`]ZhYmik`YfY`mci`f`ck`b`K` \Yb`]h]g`bYW]ggUfmicf XYg]fUV`Y`hc`i`gY`chYf`dYcd`Y`g`a`UHf]U`mci`g`ci`X`UXYeI`UH`m`UW\_bck`YX[ Y`k` \cgY`k`cfXg`cf`]XYUg`hYm UfY`UbX`k` \YfY`mci`Zci`bX`hY`a`f`]j ]b[ `hY`Wca`d`YH`fYZYfYbW`XYH]`gž]bWm X]b[ `dU[ Y`bi`a`VYffg]H`Y @YUfb]b[ `7`YbHY`dfcj`XYg`Z`fHYf`]bZcfa`U]cb`cb`k` \UhWcbgh]h`hYg`D`U[ ]Uf]ga `Uh \h]dg`#]gh`XYbhi`bgk`"YXi`"Ui`#]U[ ]Uf]ga

# 5WUXYa ]W#Zcfa Uh]cb

7CI FG9'9J5@! 5H€B'5B8'89J9@CDA 9BH

Gh XYbhZYXVUW\\_ \Ug\YdYX'hc'g\UdY'UbX'XYj Y'cd'h\]g'Wci fgYž]bWi X]b[ 'ZYXVUW\\_cVHU]bYX'Zca'cb!  
]bY'Yj U'i Uh]cbg'Ug'dUfhcZI BGK 'g'Ug'dUfhcZI BGK 'g'a m9I dYf]YbW' dfcW'gg"Mc'i 'UFY'\][\`m  
YbWci fU[ YX'hc'Wca d'YH'gi W\ Ub'cb!]bY'Yj U'i Uh]cb'hcK UfX'h\Y'YbX'cZHYfa "' : YYXVUW\\_UbX'gi [ [ Ygh]cbg  
dfcj ]XYX'k ]"VY'ja dcfhUbh]b]ja dfcj ]b[ 'h\Y'Wci fgY'Zf'Z hi fY'gh XYbthg"

85H9G'HC'BC H9

FYZf'hc'A m BGK 'Zcf'æ dcfhUbh8UH'gžUj U]UV'Y'Uh  
[\fhdg.#a m'i bgk "YXi "Ui #gh XYbh#fYgci fW'g#? Ym8UH'g"\ha`](#)

57589A ⇒ '58J ⇒9

: cf]bZcfa Uh]cb'UVci h

- ""B cH'g'cb'UggYgga Ybthg'UbX'd'U[ ]Uf]ga ž
- ""GdYWU'7 cbg]XYfU]cbgž
- ""GW'cc'Gh XYbh9h ]Vg'C ZW'fz'UbX
- ""69GG

fYZf'hc'h\Y'GW'cc'k YVg]h'Uj U]UV'Y'Uh  
[\fhd.#k k k "Yb\[ \]bYYf\]b\[ "i bgk "YXi "Ui #/\]ca YX\]WU'!Yb\[ \]bYYf\]b\[ #](#)

Gi dd'Ya YbhUfm9I Ua ]bUh]cbg.

Gi dd'Ya YbhUfm9I Ua ]bUh]cbg'Zcf'HYfa '%&\$&&'k ]"VY'\Y'X'cb'fH67E'g\ci 'X'mci 'VY'fYei ]fYX'hc'g]hcbY"

H\]g'Wci fgY'ci h]bY'gYthg'ci hXYgW]dh]cb'cZWUggYg'Uhih\Y'XUH'Y'7ci fgY'Ci h]bY' ]g'di V' ]g\YX" H\Y  
bUh fY'cZWUggYg'a UmVXUb[ Y'Xi f]b[ 'h\Y'HYfa 'UZf'f'h\Y'7ci fgY'Ci h]bY' ]g'di V' ]g\YX" A ccX'Y'g\ci 'X'VY  
W'cbgi 'h\X'Zcf'h\Y'i d'hc'XUH' WUgg'XYgW]dh]cbg" 'Z'h\YfY' ]g'Ubm]bW'cbg]gh'bw]b'h\Y'XYgW]dh]cb'cZ  
UW]j ]h]Yg'VYtk YYb'h\Y'i b]j Yfg]m]h]a YHUV'Y'UbX'h\Y'7ci fgY'Ci h]bY'fUg'i dXUH'X' ]b'A ccX'Y'Z'h\Y'  
XYgW]dh]cb' ]b'h\Y'7ci fgY'Ci h]bY'# ccX'Y'Udd' ]Yg"

⇒a U[ Y'7 fYX]h

K ]\Y'a '7 cbfUX'F cYbh[ Ybz'X]gW'j YfYX'I !fUm]b'%' - ) "H\]g' ]g'h\Y'Zfghi !fUmicZU'\i a Ub'fF cYbh[ Ybthg  
k ]Zfthg'\UbX'E"

Cb' ]bY'F UX]c[ fUd\m7 cbh]bi ]b[ '9Xi WU]cb'Zcf'F UX]c'c[ ]WL' fUmHYW'bc'c[ ]gh' [6\]c'c\[ \]WU'9ZYW'g'cZ  
#fUX\]Uh\]cb'fW'YggYbhU'g"bY'h](#)

7F ⇒CG

7F ⇒CG'Dfcj ]XYf'7cXY.'\$\$\$- , ;

5W\_bck`YX[ Ya YbhcZ'7ci bHfm

K Y`UW\_bck`YX[ Y`hY`6YXY[ U`dYcd`Y`k`c`UfY`hY`hfUX]hcbU`W`gfcX]Ubg`cZhY`UbXg`cb`k`\\W`I`BGK  
?Ybg]b[ hcb`Wla`di`g]g`cWU`hYX"

