Mathematica code for :

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Increased stem cell proliferation in atherosclerosis accelerates clonal hematopoiesis.

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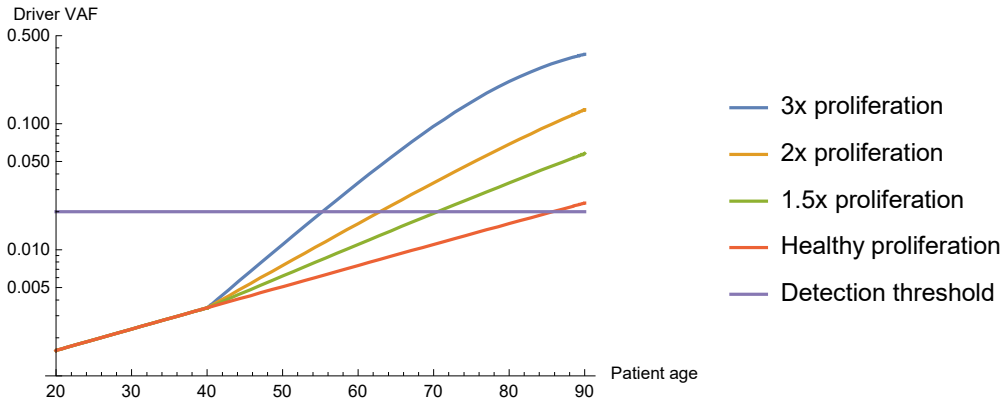
(*Table S2: Human model parameters*)
(*All time measurements in years*)
b = 365 / 28; (*Average baseline HSC proliferation rate*)
T = 40; (*Age of onset for elevated HSC proliferation rate*)
F = .02; (*Detection frequency (minimum VAF)*)
ts = 50; (*Mean age of baseline VAF data*)
fs = .0051; (*Frequency of the largest driver clone at age ts=50 years*)
s = .003; (*Selective effect of the largest driver clone*)
n = 10^4; (*Number of HSCs*)

(*Figure 3E: Driver clone expansion*)
Clear[R]; t0 = 20; tf = 90; (*Plot window*)
f0 = .5 / (1 + (.5 / fs - 1) * Exp[b s (ts - T)]);
LogPlot[{.5 / (1 + (.5 / f0 - 1) * Exp[-b s (t - T) (1 + (R - 1) HeavisideTheta[t - T])]) /.
    R → {3, 2, 1.5, 1}, .02} // Evaluate, {t, t0, tf}, PlotRange → {.001, .5},
 PlotLegends → {"3x proliferation", "2x proliferation", "1.5x proliferation",
   "Healthy proliferation", "Detection threshold"},
 AxesLabel → {"Patient age", "Driver VAF"}]
```

Out[ ]=

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t1 = 70;(*Age at sequencing*)
R = 2;(*HSC proliferation fold-increase*)
Clear[b, s]

(*Sensitivity analysis*)
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Mx = 13; My = 11;(*Grid size*)
f0 = 2 * .0005424; (*Initialization*)
f1 = 1 / (1 + (1 / f0 - 1) Exp[-b s (ts - t0)]);
f2 = 1 / (1 + (1 / f1 - 1) Exp[-b s (t1 - ts)]);
f2R = 1 / (1 + (1 / f1 - 1) Exp[-R b s (t1 - ts)]);
p2 = 1 - CDF[BetaDistribution[
      f2 (f2 (1 - f2) / Sqrt[f2 / (s n)] - 1), (1 - f2) (f2 (1 - f2) / Sqrt[f2 / (s n)] - 1)], F];
p2R = 1 - CDF[BetaDistribution[f2R (f2R (1 - f2R) / Sqrt[f2R / (s n)] - 1),
      (1 - f2R) (f2R (1 - f2R) / Sqrt[f2R / (s n)] - 1)], F];

(*Figure 3G*)
mat = Quiet[Reverse[Transpose[Table[Log2[f2R / f2] /. b → 365 / B,
       {B, 1, 600, 599 / (Mx - 1)}, {s, 0, .12, .12 / (My - 1)}]]]];
Quiet[ArrayPlot[mat, PlotRange → All, ColorFunctionScaling → False,
  ColorFunction → ColorData[{"Rainbow", {0, Log2[9]}}],
  PlotLegends → BarLegend[Automatic, Ticks → logTicks[0, 5]],
  FrameTicksStyle → Directive[Black, 12], FrameLabel → {s, 1 / b},
  Epilog → {Black, MapIndexed[Text[#1, Reverse[#2 - 1 / 2]] &,
     Reverse[Round[2^mat, .1]], {2}]}, Mesh → True]]

(*Figure 3H*)
mat = Quiet[Reverse[Transpose[Table[(Max[0, Min[Log2[9], Log2[p2R / p2]]] /. b → 365 / B) /.
       Indeterminate → 0, {B, 1, 600, 599 / (Mx - 1)}, {s, 0, .12, .12 / (My - 1)}]]]];
Quiet[ArrayPlot[mat, PlotRange → All, ColorFunctionScaling → False,
  ColorFunction → ColorData[{"Rainbow", {0, Log2[9]}}],
  FrameTicksStyle → Directive[Black, 12], FrameLabel → {s, 1 / b},
  Epilog → {Black, MapIndexed[Text[#1, Reverse[#2 - 1 / 2]] &,
     Reverse[Round[2^mat, .1]], {2}]}, Mesh → True]]

b = 365 / 28; (*Average baseline HSC proliferation rate*)
s = .005; (*Selective effect of the largest driver clone*)
Clear[R, n]
f1 = 1 / (1 + (1 / f1 - 1) Exp[-b s (ts - t0)]);
f2 = 1 / (1 + (1 / f1 - 1) Exp[-b s (t1 - ts)]);
f2R = 1 / (1 + (1 / f1 - 1) Exp[-R b s (t1 - ts)]);

(*Supplemental*)
mat = Reverse[
   Transpose[Table[Log2[f2R / f2], {R, 1, 2.2, 1.2 / (Mx - 1)}, {n, 30, 70, 40 / (My - 1)}]]];
ArrayPlot[mat, PlotRange → All, ColorFunctionScaling → False,
 ColorFunction → ColorData[{"Rainbow", {0, Log2[9]}}],
 PlotLegends → BarLegend[Automatic, Ticks → logTicks[0, 5]],
 FrameTicksStyle → Directive[Black, 12], FrameLabel → {ts, R}, Epilog → {Black, MapIndexed[
    Text[#1, Reverse[#2 - 1 / 2]] &, Reverse[Round[2^mat, .1]], {2}]}, Mesh → True]
```
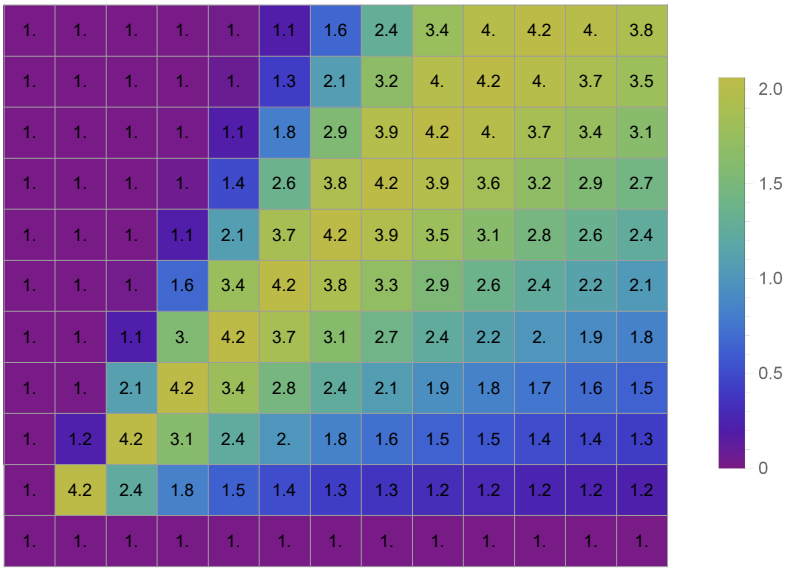

Out[ ]=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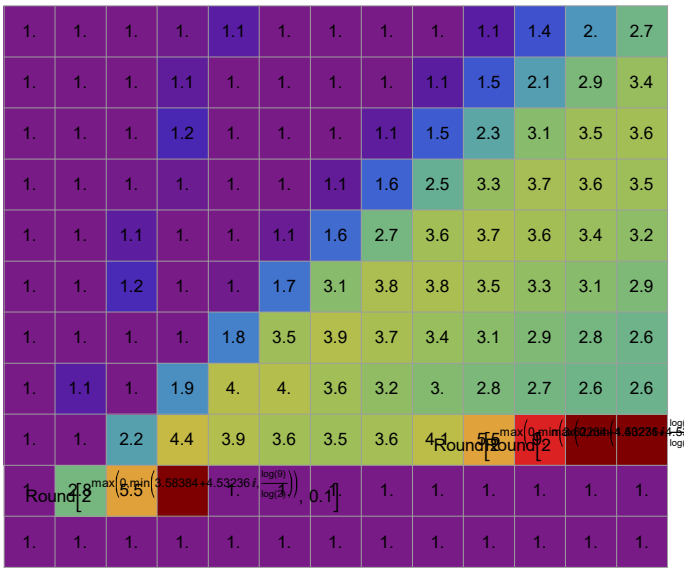
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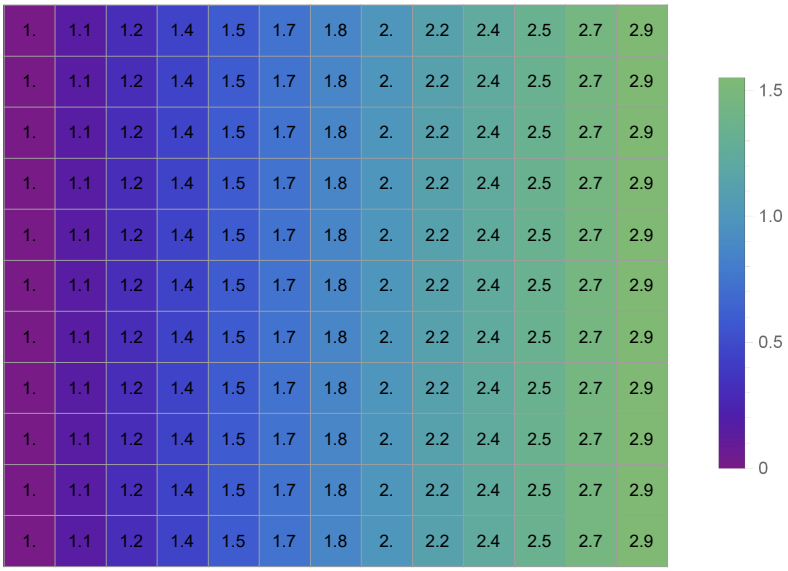

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(*Table S3: Mouse model parameters*)
(*All time measurements in days*)
y[t_] = {HSC[t], Neutro[t], Mono[t]};(*Column headers*)
b0 = 1 / 17.5;(*Proliferation rate*)
L = {Infinity, 0.45, 0.84};(*Mean lifespan*)
n = {10^4, 10^6, 10^5.5};(*Population size*)
y0 = {.18, .19, .17};(*Initial Tet2 fraction*)

R = 1.75;(*HSC proliferation fold-increase*)
s = .05; (*Selective effect of the largest driver clone*)
tf = 150; (*Plot window end*)

one = y0^0; e1 = {1, 0, 0}; n = n / (n.e1); d = 1 / L;
sol1 = NDSolve[
    {y'[t] == (1 + b0 / (d.n)) d * (one y1[t] - y[t]) + b0 s e1 y1[t] (1 - y1[t]) / (1 + s y1[t]),
     y[0] == y0, y1[t] == y[t].e1}, y[t], {t, 0, tf}];
sol2 = NDSolve[{y'[t] == (1 + R b0 / (d.n)) d * (one y1[t] - y[t]) + R b0 s e1 y1[t]
        (1 - y1[t]) / (1 + s y1[t]), y[0] == y0, y1[t] == y[t].e1}, y[t], {t, 0, tf}];

(*Figure 5C-E*)
Plot[{y[t] / y0 /. sol1, y[t] / y0 /. sol2} // Evaluate, {t, 0, tf}, PlotLegends → y[t],
 Frame → True, FrameLabel → {"Time (days)", "Tet2 freq. fold change"}, LabelStyle → Black,
 PlotStyle → {{Black}, {Red}, {Blue}, {Black, Dashed}, {Red, Dashed}, {Blue, Dashed}}]
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Out[ ]=