In[1]:=

```
yticks = {50, 100, 150, 200, 250, 300} 10^6;
pticks = {#, ToString[ #/10^6 ]} & /@ yticks;

(*Data from http://www.census.gov/population/www/censusdata/files/table-2.pdf,
http://www.census.gov/main/www/cen2000.html,
http://quickfacts.census.gov/qfd/states/00000.html,retrieved February 15 2015 *)
```

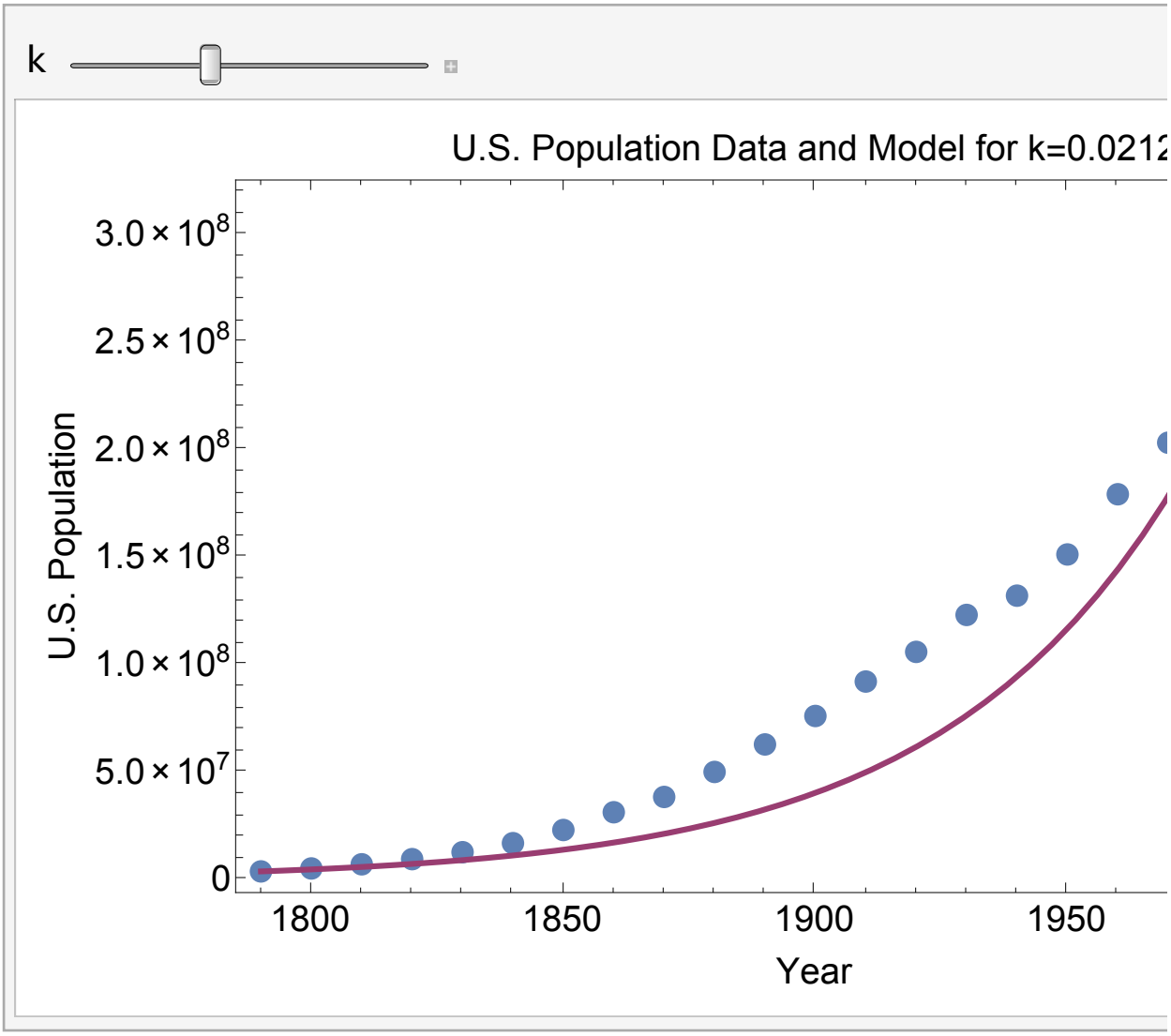
In[3]:=

```
HistoricalPopulationDataUS = {
   {1790, 3 929 214},
   {1800, 5 308 438},
   {1810, 7 239 881},
   {1820, 9 638 453},
   {1830, 12 866 020},
   {1840, 17 069 453},
   {1850, 23 191 876},
   {1860, 31 443 321},
   {1870, 38 558 371},
   {1880, 50 189 209},
   {1890, 62 979 776},
   {1900, 76 212 168},
   {1910, 92 228 496},
   {1920, 106 021 537},
   {1930, 123 202 624},
   {1940, 132 164 569},
   {1950, 151 325 798},
   {1960, 179 323 175},
   {1970, 203 302 031},
   {1980, 226 542 199},
   {1990, 248 709 873},
   {2000, 281 421 906},
   {2010, 308 745 538}};
```

In[28]:=

```
Manipulate[
 Show[ListPlot[HistoricalPopulationDataUS, Frame → True, FrameLabel → {"Year",
     "U.S. Population", "U.S. Population Data and Model for k=" <> ToString[k]},
   FrameStyle → Directive[FontSize → 20]], Plot[3 929 214 Exp[k (x - 1790)],
   {x, 1790, 2010}, PlotStyle → {Thickness[0.005], ColorData[1, 2]}],
  ImageSize → 750], {k, .01, .04}, LabelStyle → Directive[FontSize → 20]]
```

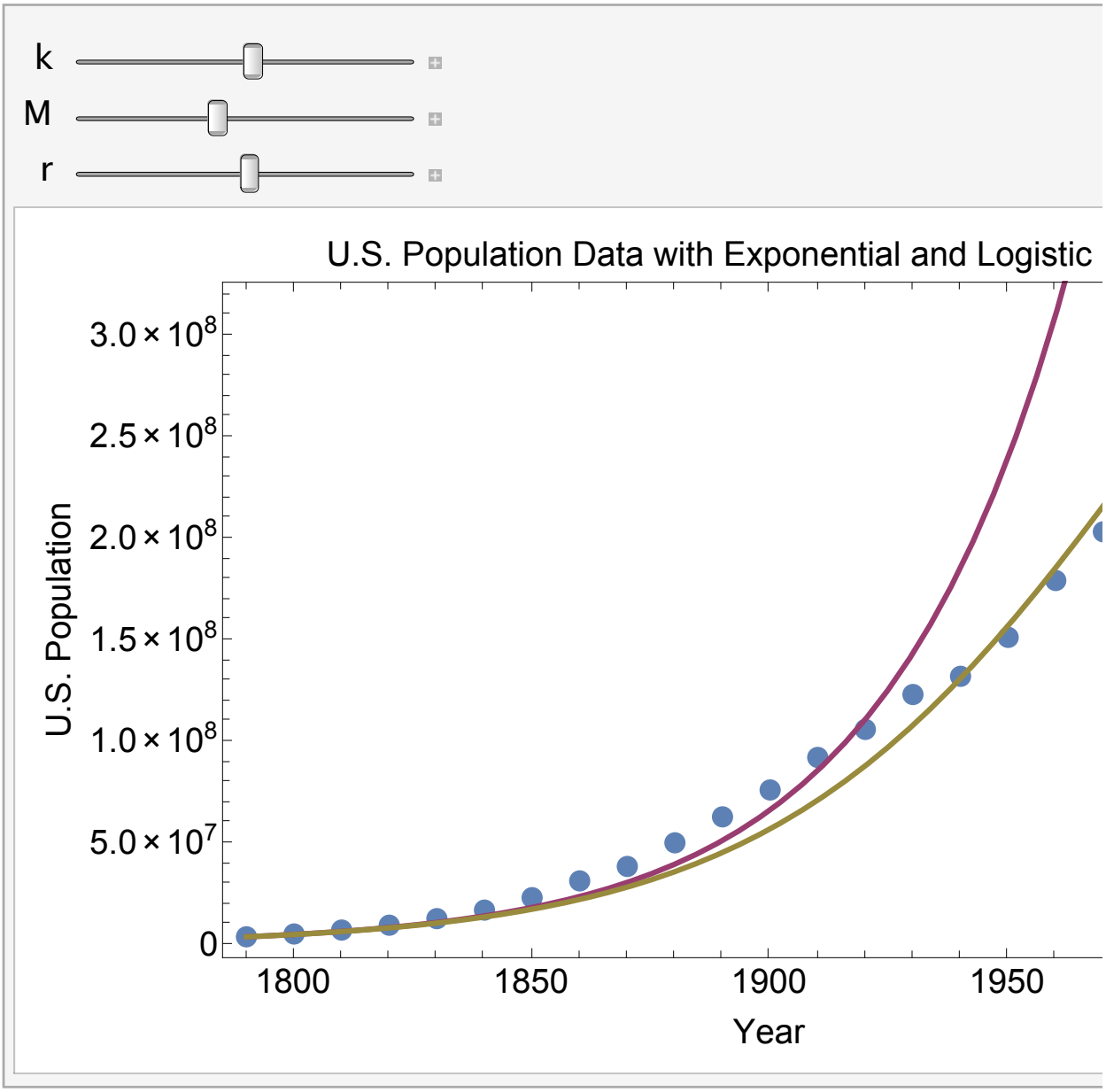
Out[28]=




```
PointLegend[{Red, Green, Blue}, {"red", "green", "blue"}]
```

In[61]:=
```
Manipulate[Show[ListPlot[HistoricalPopulationDataUS,
    Frame → True, FrameLabel → {"Year", "U.S. Population",
      "U.S. Population Data with Exponential and Logistic Models"},
    FrameStyle → Directive[FontSize → 20],
    PlotLegends → PointLegend[{ColorData[1, 1], ColorData[1, 2], ColorData[1, 3]},
      {"Historical Data                                                    ",
       "Exponential Model k =" <> ToString[k] ,
       "Logistic Model, M = " <> ToString[M/10^6] <> " million, r=" <> ToString[r]},
      LegendMarkers → {{Graphics[{Disk[]}], 15}, {Graphics[{Line[{{0, 0}, {2, 0}}]}],
         40}, {Graphics[{Line[{{0, 0}, {2, 0}}]}], 40}},
      LegendFunction → "Frame", LabelStyle → 20]],
   Plot[3 929 214 Exp[k (t - 1790)], {t, 1790, 2010},
    PlotStyle → {ColorData[1, 2], Thickness[0.005]}],
   Plot[3 929 214 E^(r (-1790+t)) M / (-3 929 214 + 3 929 214 E^(r (-1790+t)) + M), {t, 1790, 2010},
    PlotStyle → {Thickness[0.005], ColorData[1, 3]}]
   , ImageSize → 750], {k, .01, .04}, {M, 300 000 000, 800 000 000},
  {r, .01, .04}, LabelStyle → Directive[FontSize → 20]]
```

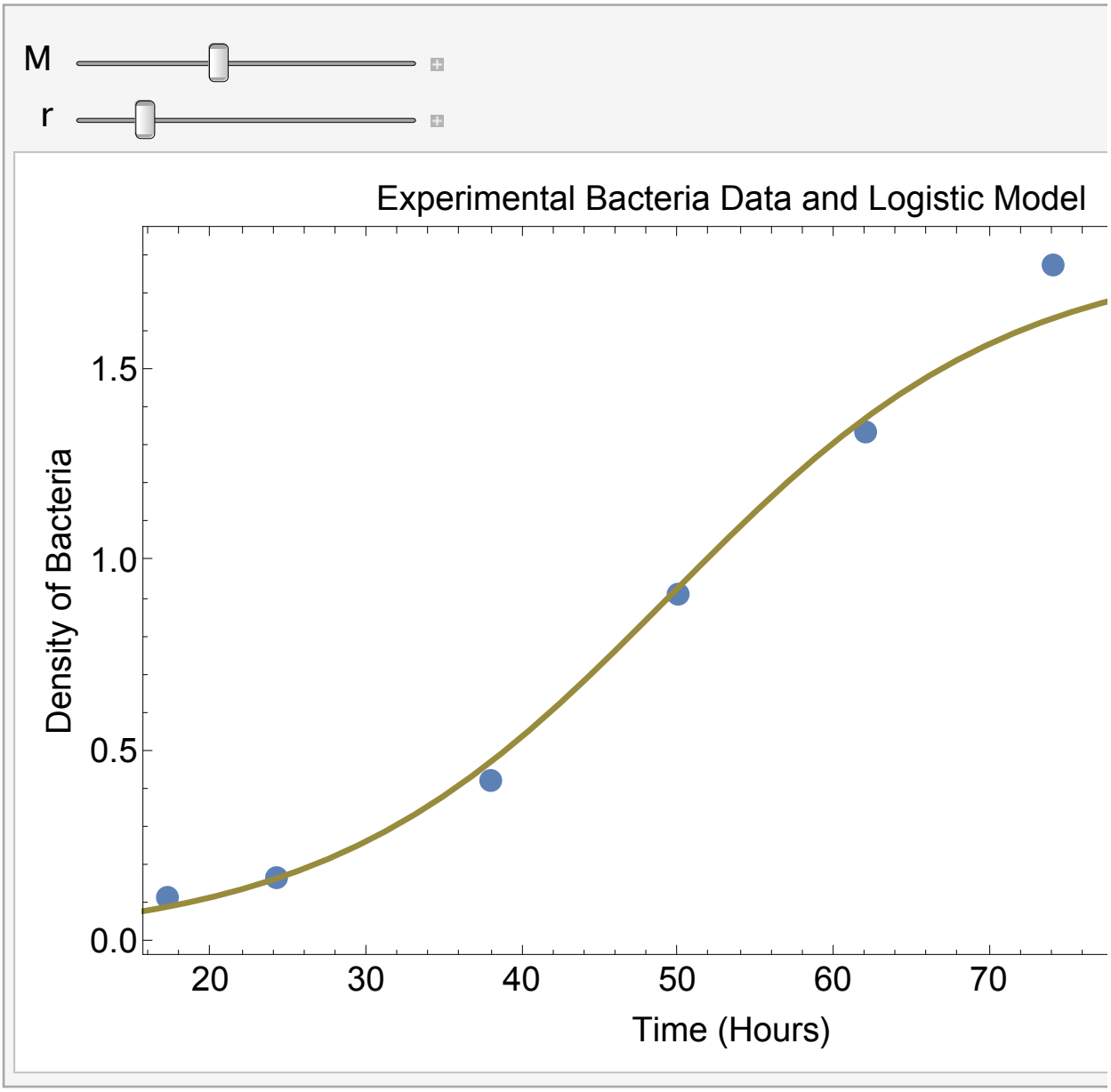
Out[61]=




```
(*Bacteria Culture: http://
 www.nature.com/srep/2014/140527/srep05057/full/srep05057.html,
from Saikin,Semion K.,
et al."Chromatic acclimation and population dynamics of green sulfur bacteria
    grown with spectrally tailored light." Scientific reports 4 (2014). *)
```

In[95]:=
```
BacteriaData = {
    {17.1633, 0.1163},
    {24.1732, 0.168},
    {37.9327, 0.4231},
    {49.9703, 0.9121},
    {62.0156, 1.3378},
    {74.0593, 1.7762},
    {89.7925, 1.7151}
   };
Manipulate[Show[ListPlot[BacteriaData, Frame → True, FrameLabel → {"Time (Hours)",
     "Density of Bacteria", "Experimental Bacteria Data and Logistic Model"},
   FrameStyle → Directive[FontSize → 20], ImageSize → 750], Plot[
   0.02 ℯ^(r t) M / (0.02 (-1 + ℯ^(r t)) + M), {t, 0, 90}, PlotStyle → {Thickness[0.005], ColorData[1, 3]}]],
  {M, 1, 3}, {r, .05, .3}, LabelStyle → Directive[FontSize → 20]]
```

Out[96]=


M
r
Experimental Bacteria Data and Logistic Model
Density of Bacteria
0.0
0.5
1.0
1.5
20
30
40
50
60
70
Time (Hours)