Introduction to SAS/GRAPH

• Graphics component of SAS system.

• Includes charts, plots, and maps in both 2 and 3 dimensions.

• Procedures included GCHART, GPLOT, GMAP, GCONTOUR etc…

• We will focus on PROC GPLOT
What can be done with SAS/GRAPH?

These samples courtesy of Robert Allison’s SAS Graph Examples
Elements of SAS/GRAPH
Overview

```
ods pdf file="c:\plots.pdf" style=analysis;

goptions reset=global ;
symbol v=dot i=rcclm95 cv=black ci=red co=blue;
title "2 Variable Plots";
axis1 order=0 to 2 by 0.2;
axis2 order=0 to 3 by 0.5;

proc gplot data=twovar;
   plot y1*x / haxis=axis1 vaxis=axis2;
run;
quit;

ods pdf close;
```

Taken from SAS 9.2 documentation
Elements of SAS/GRAPH
PROC GPLOT: Specifying an input data set

Similar to all other SAS PROC’s
– Proc gplot data=<libname>.<data set><options>;

   *using default Work library;
   proc gplot data=twovar;

   *setting new library;
   libname indata "c:\sasdata\datafiles";
   proc gplot data=indata.twovars;

   *specifying data to use
   libname indata "c:\sasdata\datafiles";
   proc gplot data=indata.twovar(where=(x<1));

Options include setting annotate data sets, image mapping for drill-down plots in web applications, Creating Uniform axis across plots, and specifying SAS catalog for placement of output.
• You can use up to 2 plots statements at a time, however, at least one Plot statement is required.

• The plot statement is used to control the axis, plotting points, labels, tick marks, and the plot legend.

• The only required arguments are…
  – Plot <Y Variable>*<X Variable> / <options>;
Elements of SAS/GRAPH
PROC GPLOT: Plotting Options

• Options for plotting
  – Plot options
    • Legend= or nolegend: specifies figure legend options
    • Overlay: allows overlay of more than one Y variable
    • Skipmiss: breaks the plotting line where Y values are missing

  – Appearance option
    • Axis: Specifies axis label and value options
    • Symbol: Specified symbol options
    • href, vref: Draws vertical or horizontal reference lines on plot
    • frame/fr or noframe/nofr: specifies whether or not to frame the plot
    • caxis/ca, cframe/cfr, chref/ch, cvref/cv, ctext/c: specifies colors used for axis, frame, text or reference lines.
Introduction to SAS/GRAPH

• We will begin with rather simple code and let SAS decide how our graph will look.

• Then we will step through a few options that allow us to control and adjust the graphic output.
Examples
2 Variable Plotting / Scatter plots
Examples

2 Variables

• Suppose subjects are given a doses of experimental medication based on body weight over a 24 hour period (mg/24hrs). Variable X

• On the following day, each subject had their Vascular Cell Adhesion Molecule (μg/ml) levels measured. Variable Y1

• The investigators are interested in seeing a plot of the dose given vs. the plasma VCAM levels to see if there may be an effect of the drug dose.

    proc gplot data=twovar;
    plot y1*x;
    run;
Examples
2 Variables

Very basic plot, below we get all of the default options. Not very exciting. Definitely not publication quality.

proc gplot data=twovar;
  plot y1*x;
run;

Cannot read axis marks

Crowded Axis

Axis labels don't describe the data
Examples

2 Variables: AXIS Statements

• AXIS<1..99> <options>;
  – Label Option;
    • Angle/a=degrees (0-359)
    • Color/c=text color
    • Font/f=font
    • Height/h=text height (default=1)
    • Justify=(left/center/right)
    • Label="text string"
      – Options precede label

• axis1 label=(a=90 c=black f="arial" h=1.2 "time"
  a=90 c=black f="arial" h=1.0 "hours");
Examples
2 Variables: AXIS Statements

• AXIS<1..99> <options>;
  – Order Option
    • Order=(a to b by c): major tick marks will show up at intervals based on c.
      – Example order=(0 to 3 by 1);
  – Value Option
    • value=(“” “” “”): applies text label to each major tick.
      – Example Value=( “Start” “Middle” “End”)


Examples
2 Variables: AXIS Statements

Resets previous options

\texttt{goptions reset=global ;}

Horizontal axis (X Variable)

\texttt{axis1 label=(f='arial/bo' h=1.9 "Dose" justify=c}
\texttt{ f='arial/bo' h=1.3 "mg/24 Hrs" );}

Vertical axis (Y Variable)

\texttt{axis2 label=(a=90 f='arial/bo' h=1.9 "Plasma Level");}

\texttt{proc gplot data=twovar;}
\texttt{ plot y1*x / haxis=axis1 vaxis=axis2;}
\texttt{ run;}

Call Axis statements

NOTE: you can also place the AXIS statements within the gplot proc
The LABEL options helped make the axis labels meaningful, but the axis tick marks remain crowded.
Examples
2 Variables: AXIS Statement

```plaintext
options reset=global;

axis1 label=(f='arial/bo' h=1.9 "Dose" justify=c f='arial/bo' h=1.3 "mg/24 Hrs")
   order=(0 to 2 by 0.5);

axis2 label=(a=90 f='arial/bo' h=1.9 "Plasma Level")
   order=(0 to 3 by 1);

proc gplot data=twovar;
   plot y1*x / haxis=axis1 vaxis=axis2;
run;
```
The axis are less crowded, but still very hard to read, using the Value= option will help.
Examples
2 Variables: AXIS Statement

goptions reset=global;

axis1 label=(f='arial/bo' h=1.9 "Dose" justify=c
              f='arial/bo' h=1.3 "mg/24 Hrs")
          order=(0 to 2 by 0.5)
          value=(f='arial' h=1.3 "0.0" "0.5" "1.0" "1.5" "2.0");

axis2 label=(a=90 f='arial/bo' h=1.9 "Plasma Level")
          order=(0 to 3 by 1)
          value=(a=90 f='arial' h=1.3 "0.0" "1.0" "2.0" "3.0");

proc gplot data=twovar;
  plot y1*x / haxis=axis1 vaxis=axis2;
run;
Examples

2 Variables

Now about those data points!
Examples
2 Variables: Symbol Statement

• Symbol<1…255> <options>;
  – Symbol options
    • Color= value color
    • Ci=line color
    • Height=symbol height
    • Line=line type
    • Value=symbol
    • Width=thickness factor
    • Interpol=point interpolations
Examples
2 Variables: Symbol Statement

• Symbol<1…255> <options>;
  – Symbol options
    • Interpolation options
      – Join, box, hilo interpolation, regression, spline, standard deviations.
    • value options
      – Dot, circle, star, square, plus, minus, “text value”.
    • Color options
      – 256 colors available.

www.devenezia.com/docs/SAS/sas-colors.html
Examples
2 Variables: Symbol Statement

Symbol options

- Interpolation options
  - None
  - Join: points connected by straight line
  - Needle: vertical line from horizontal axis to point
  - Stepx: (L,R,C) step function, stepxJ will add a verticle line to each step plot
  - stdkxxx: (M,P,J,B,T) k=1,2,3 (standard deviations) or
    » stdM=SEM, stdp=uses pooled sample variance, stdj=joins the errors, T will give tops and bottoms to error lines, where B will request error bars.
  - HILOxxx: (T,B,C,J)
Examples
2 Variables: Symbol Statement

Symbol options

• Interpolation options
  – R-series interpolation
  – Rxxxxxxx
    » RL: linear regression
    » RQ: Quadratic Regression
    » RC: Cubic Regression
    » CLM: CI for mean predicted values
    » CLI: CI for Individual predicted values
    » 90, 95, 99: confidence limits
Examples
2 Variables: SYMBOL Statement

```plaintext
symbol1 value=dot color=black interpol=None;

proc gplot data=twovar;
    plot y1*x / haxis=axis1 vaxis=axis2;
run;
```
Examples
2 Variables: Adding Regression Lines

symbol1 value=dot color=black
    interpol=r1clm95 ci=blue co=red line=2;

proc gplot data=twovar;
    plot y1*x / haxis=axis1 vaxis=axis2 regeqn;
run;

Regression Equation:
y1 = 0.481173 + 1.269433*x
Examples
Grouping Variables

• Many times we want to look at group differences.

• Demographic groups, treatment groups, etc…

• Grouping variable must be in the data file.
You need to add a new SYMBOL statement for the each additional group.

Add the grouping variable to the PLOT statement.
Examples
Grouping Variables

Not bad, but the figure legend is not well placed.
Examples
Grouping Variables: Legend Statement

- Legend<1…99> <options>;
  - Legend options
    - Across=: number of columns
    - Down=: number of rows
    - Frame/noframe
    - Position=(bottom, middle, top) (left, center, right)
      (inside, outside)
    - Origin=(x,y)
    - Label=
    - Order=
    - Value=

These options are the same as within the axis statement discussed earlier.
Examples
Grouping Variables: Legend Statement

goptions reset=global ;

axis1 label=(f='arial/bo' h=1.9 "Dose" justify=c 
            f='arial/bo' h=1.3 "mg/24 Hrs")
    order=(0 to 2 by 0.5)
    value=(f='arial' h=1.3 "0.0" "0.5" "1.0" "1.5" "2.0");

axis2 label=(a=90 f='arial/bo' h=1.9 "Plasma Level")
    order=(0 to 3 by 1)
    value=(a=90 f='arial' h=1.3 "0.0" "1.0" "2.0" "3.0");

symbol1 value=dot color=black interpol=none h=1.2;
symbol2 value=triangle color=black interpol=none h=1.5;

legend1 across=1 down=2 noframe
  position=(bottom right inside) mode=protect
  label=(f='arial/bo' h=1.4 "Gender")
  value=(f='Arial/bo' h=1.4 "Female" "Male");

proc gplot data=twovar;
  plot y1*x=gender / haxis=axis1 vaxis=axis2 legend=legend1;
run;
Examples
Grouping Variables: Legend Statement

Plasma Level

Dose
mg/24 Hrs

Gender
Female
Male
Examples
Repeated Measures/Longitudinal Plotting
Examples
Repeated Measures/Longitudinal Plotting

• Suppose that you have many observations on each subject taken at various time points.
  
• 40 subjects
• 2 treatments (Placebo and Active med)
• 5 time points (baseline plus 4 1-week intervals)
  – During the last week, both treatment groups receive Placebo
• Data should be in the Long format

At diagnosis, subjects are randomized to an experimental treatment or placebo. During the final week of treatment, all subjects will receive active medication.
Examples
Repeated Measures/Longitudinal Plotting

Create appropriate axis and legend statements as before.

```plaintext
options reset=global;

axis1 label=(f="arial/bo" h=1.5 "Time Since Diagnosis: Weeks")
order=(1 to 5 by 1)
value=(f="arial" h=1.2 "Baseline" "1" "2" "3" "4")
offset=(1,1);

axis2 label=(f="arial/bo" h=1.5 a=90 "Response")
order=(0 to 100 by 10)
value=(f="arial" h=1.2 "0" "10" "20" "30" "40" "50"
      "60" "70" "80" "90" "100")
offset=(1,1);

legend1 label=(f="arial" h=1.3 "Treatment Group")
value=(f="arial" h=1.2 "Treatment A" "Placebo")
position=(top left inside)
mode=protect noframe;

title "Individual Disease Progression";
```
Examples
Repeated Measures/Longitudinal Plotting

```
proc gplot data=long;
    plot y*time/ nolegend haxis=axis1 vaxis=axis2;
    symbol1 c=black i=none v=dot r=40;
run;
```

Individual Disease Progression
Examples
Repeated Measures/Longitudinal Plotting

```
proc gplot data=long;
    plot y*time=id / nolegend haxis=axis1 vaxis=axis2;
    symbol1 c=black i=join r=40;
run;
```

Joins the dots, By ID

*Individual Disease Progression*
Examples
Repeated Measures/Longitudinal Plotting

```sas
proc gplot data=long;
plot y*time=trt / legend=legend1 haxis=axis1 vaxis=axis2;
symbol1 i=stdlmj c=black r=1 w=3 l=3;
symbol2 i=stdlmj c=gray r=1 w=3 l=1;
run;
```

Plot data by trt group and create a symbol statement for each group.

---

**Individual Disease Progression**

![Graph showing Individual Disease Progression with Treatment Group, Treatment A, and Placebo lines.](#)
Examples

Using the Overlay statement to stack plots
Examples
Overlay 2 plots w/ the same data

Suppose that you are asked to graphically show progression of tumor growth for a group of subjects and overlay the progression of each treatment group.

50 subjects randomized to either low or high dose medication.

Tumor size is measured at baseline as well as the following 9 weeks.

The investigator would like an easy to present plot containing both pieces of information for a presentation to his peers.
Examples
Overlay 2 plots w/ the same data

Plot of individual values as before
```
proc gplot data=overlay;
   plot y*time=id / nolegend haxis=axis1 vaxis=axis2;
   symbol1 c=black i=join r=50;
run;
```

Grouping variable Symbol repeats

Plot of treatment group means and Standard errors as before
```
proc gplot data=overlay;
   plot y*time=trt legend=legend1 haxis=axis1 vaxis=axis2;
   symbol1 c=blue i=stdmj 1=l w=4 r=1;
   symbol2 c=red i=stdmj 1=w4 r=1;
run;
```
Examples
Overlay 2 plots w/ the same data

axis1 label=(f="arial/bo" h=1.5 "Time Since Randomization: Weeks")
  order=(1 to 10 by 1)
  value=(f="arial" h=1.2 "Baseline" "1" "2" "3" "4" "5" "6" "7" "8" "9")
  offset=(1,1);

axis2 label=(f="arial/bo" h=1.5 a=90 "Tumor Growth")
  order=(0 to 80 by 10)
  value=(f="arial" h=1.2 "0" "10" "20" "30" "40" "50" "60" "70" "80")
  offset=(1,1);

axis3 label=(f="arial/bo" h=1.5 a=90 "")
  order=(0 to 80 by 10)
  value=(f="arial" h=1.2 "0" "10" "20" "30" "40" "50" "60" "70" "80")
  offset=(1,1);

legend1 label=(f="arial" h=1.3 "Treatment Group")
  value=(f="arial" h=1.2 "Low Dose" "High Dose")
  position=(top left inside)
  mode=protect noframe;

title "Individual Disease Progression";

proc gplot data=overlay;
  plot y*time=id / nolegend haxis=axis1 vaxis=axis2;
  plot2 y*time=trt / overlay legend=legend1 vaxis=axis3;
  symbol1 c=black i=join r=50 w=0.5;
  symbol2 c=blue i=stdmj l=1 w=4;
  symbol3 c=red i=stdmj l=1 w=4;
run;
Examples
Overlay 2 plots w/ the same data

Individual Disease Progression

Tumor Growth

Time Since Randomization: Weeks

Treatment Group
Low Dose
High Dose
Examples

Overlay multiple plots from different variables

```sas
proc logistic data=analysis desc;
   where nephropathy ne .;
   model nephropathy = log_ox1dl_chol_base/clodds=wald;
   units log ox1dl chol base= SD;
   output out=OXresults p=predict l=lower u=upper xbeta=logit / alpha=0.05;
run;

proc gplot data=oxresults;
   plot predict*log_ox1dl_chol_base
   lower*log_ox1dl_chol_base
   upper*log_ox1dl_chol_base
   /overlay vaxis=axis1 haxis=axis2 nolegend;
run;
```

Use proc logistic to output the predicted probability of developing nephropathy given the baseline Oxidized LDL immune complex level as well as the 95% confidence limits.

Many PROCs can output predicted values, adjusted means, along with point wise confidence values.
Examples
Overlay multiple plots from different variables

![Graph showing the probability of Nephropathy (95% CI) against Baseline Ox LDL-IC.](image)
Examples
Overlay multiple plots from different variables
Examples
Overlay multiple plots from different variables

symbol1 v=none i=box00f c=white bwidth=1;
symbol2 v=none i=box00f co=libgr cv=libgr bwidth=10 w=6;
symbol3 v=none i=box00f co=black cv=black bwidth=0.5;

symbol5 v=none i=box00f co=libgr cv=libgr bwidth=10 w=6;
symbol6 v=none i=box00f co=black cv=black bwidth=0.5;

symbol7 v=none i=join l=1 c=vigb w=6;

axis1 label=(f="arial/b" h=1.9 "Baseline OxLDL-IC Quartile")
  order=(-0.5 to 3.5 by 0.25)
  value=(f="arial/b" h=1.5 "" "" "1st" "" "" "2nd" "" "" "3rd" "" "" "4th" ""
        ""
  offset=(1,1);

axis2 label=(f="arial/b" h=1.9 a=90 "Baseline LDL & HDL (mg/dl)")
  minor=none
  order=(0 to 250 by 25)
  offset=(5 pct)
  value=(f="arial/b" h=1.3 "0" "50" "100" "150" "200" "250");

axis3 label=(f="arial/b" h=1.9 a=270 "Baseline OxLDL-IC")
  minor=none
  order=(0 to 500 by 50)
  offset=(5 pct)
  value=(f="arial/b" h=1.3 "0" "100" "200" "300" "400" "500");

legend label=(f="Arial/BO" h=1.5 'Baseline Characteristics')
  position=(top left inside) across=3 mode=share noframe
  Value=(f="arial" h=1.4 "OxLDL-IC" "LDL Cholesterol" "HDL Cholesterol"
        "");

proc gplot data=plots;
  plot median*rank=group/ noframe haxis=axis1 vaxis=axis2 legend=legend;
  plot2 Oxmean*rank / overlay noframe haxis=axis1 vaxis=axis3 legend=legend
            skipmiss;
run;
quit; run;
The Annotate Facility
The Annotate Facility

Introduction

The Annotate Facility allows SAS users to customize graphical output. The customizations can be data driven or user specified. Text, shapes, lines and images can be added to output graphics.

Step 1. Create an annotate data set
this data file will give commands to SAS/GRAPH
Specific variables must be in the annotate data set. Others are allowed but ignored
What, how, and where are defined by these variables.
Table 1 list important variables.
# The Annotate Facility

## Introduction

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUNCTION</td>
<td>Specifies the Annotate drawing action. Table 2 below gives a list of important functions.</td>
</tr>
<tr>
<td>X</td>
<td>The numeric horizontal coordinate.</td>
</tr>
<tr>
<td>Y</td>
<td>The numeric vertical coordinate.</td>
</tr>
<tr>
<td>Z</td>
<td>For three-dimensional graphs, specifies the coordinate for the 3\textsuperscript{rd} dimension.</td>
</tr>
<tr>
<td>HSYS</td>
<td>The type of units for the size (height) variable.</td>
</tr>
<tr>
<td>XSYS</td>
<td>The coordinate system for the X variable.</td>
</tr>
<tr>
<td>YSYS</td>
<td>The coordinate system for the Y variable.</td>
</tr>
<tr>
<td>ZSYS</td>
<td>The coordinate system for the Z variable (for three-dimensional graphs).</td>
</tr>
<tr>
<td>ANGLE</td>
<td>Angle of text label or start angle for a pie slice.</td>
</tr>
<tr>
<td>COLOR</td>
<td>Color of graphics item.</td>
</tr>
<tr>
<td>LINE</td>
<td>Line type of graphics item.</td>
</tr>
<tr>
<td>POSITION</td>
<td>Placement/alignment of text.</td>
</tr>
<tr>
<td>ROTATE</td>
<td>Angle of individual characters in a text string or the sweep of a pie slice.</td>
</tr>
<tr>
<td>SIZE</td>
<td>Size of the graphics item. Specific to the function. For example, size is the height of the character for a label function.</td>
</tr>
<tr>
<td>STYLE</td>
<td>Font/pattern of a graphics item.</td>
</tr>
<tr>
<td>TEXT</td>
<td>Text to use in a label, symbol, or comment.</td>
</tr>
<tr>
<td>WHEN</td>
<td>Determines if Annotate command is executed (B)efore or (A)fter the graph.</td>
</tr>
</tbody>
</table>
The Annotate Facility

Introduction

The Annotate FUNCTION variable tells SAS what to do. The annotate coordinate system allows for flexibility in placing objects within the output. There are 12 possible conditions.

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>LABEL</td>
<td>Draws text.</td>
</tr>
<tr>
<td>MOVE</td>
<td>Moves to a specific point.</td>
</tr>
<tr>
<td>DRAW</td>
<td>Draws a line from the current position to a specified position.</td>
</tr>
<tr>
<td>COMMENT</td>
<td>As a documentation aid, allows you to insert a comment into the SAS Annotate file.</td>
</tr>
<tr>
<td>POLY</td>
<td>Specifies the starting point of a polygon.</td>
</tr>
<tr>
<td>POLYCONT</td>
<td>Continues drawing the polygon.</td>
</tr>
<tr>
<td>BAR</td>
<td>Draws a rectangle from the current position to a specified position</td>
</tr>
<tr>
<td>SYMBOL</td>
<td>Draws a symbol.</td>
</tr>
<tr>
<td>PIE</td>
<td>Draws a pie slice, circle or arc.</td>
</tr>
</tbody>
</table>
## The Annotate Facility

### Introduction

<table>
<thead>
<tr>
<th>Area</th>
<th>Unit</th>
<th>Coordinate System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>Absolute</td>
<td>Relative</td>
</tr>
<tr>
<td>% Values</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Graphics Output Area</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>% Cells</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>Procedure Output Area</td>
<td>5</td>
<td>B</td>
</tr>
<tr>
<td>% Cells</td>
<td>6</td>
<td>C</td>
</tr>
</tbody>
</table>
# The Annotate Facility

## Introduction

<table>
<thead>
<tr>
<th>MACRO</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>%DCLANNO</td>
<td>Declares the Annotate variables.</td>
</tr>
<tr>
<td>%LABEL(x, y, text-string, color, angle, rotate, size, style, position)</td>
<td>Places a label of text.</td>
</tr>
<tr>
<td>%MOVE(x, y)</td>
<td>Moves to a location.</td>
</tr>
<tr>
<td>%DRAW(x, y, color, line, size)</td>
<td>Draws a line from the current location to the specified location.</td>
</tr>
<tr>
<td>%COMMENT(text-string)</td>
<td>Allows an unexecuted comment to be inserted into the Annotate data set.</td>
</tr>
<tr>
<td>%POLY(x, y, color, style, line)</td>
<td>Begins drawing a polygon.</td>
</tr>
<tr>
<td>%POLYCONT(x, y, color)</td>
<td>Continues drawing a polygon.</td>
</tr>
<tr>
<td>%BAR(x1, y1, x2, y2, color, line, style)</td>
<td>Draws a bar.</td>
</tr>
<tr>
<td>%LINE(x1, y1, x2, y2, color, line, size)</td>
<td>Draws a line.</td>
</tr>
<tr>
<td>%PIEXY(angle, size)</td>
<td>Draws a pie slice.</td>
</tr>
<tr>
<td>%CIRCLE(x, y, size, color)</td>
<td>Draws a circle.</td>
</tr>
</tbody>
</table>
Proc GPLOT global options help make graphs more pleasing, however, there are cases where more work is needed to fully explain the data.

Mean HbA1c % during DCCT/EDIC study
The Annotate Facility

%annomac;

data anno bar;

%dclanno; length text $30;
xsys='2'; ysys='2'; hsys='2';
when='A';

%bar(1.021, 6, 2.935, 10, white, 3, solid);
%bar(11.055, 6, 11.940, 10, white, 3, solid);
%bar(2.935, 6, 11.02, 9.6, CX808080, 3, r5);
%bar(11.95, 6, 20.07, 9.6, CX808080, 3, r5);

function='label'; color='black'; x=1.9; y=9.1; style='ARIAL/bo';
text='Intensive';output;
function='label'; color='black'; x=1.9; y=9.0; style='ARIAL/bo';
text='Treatment';output;

function='label'; color='black'; x=1.9; y=7.3; style='ARIAL/bo';
text='Standard';output;
function='label'; color='black'; x=1.9; y=7.2; style='ARIAL/bo';
text='Treatment';output;

function='label'; color='black'; x=7; y=9.8; size=0.19; style='ARIAL/bo';
text='DCCT Trial';output;
function='label'; color='black'; x=16.5; y=9.8; size=0.19; style='ARIAL/bo';
text='EDIC Follow Up';output;

run;
The Annotate Facility

- Created shaded regions to designate study sections
- Deleted regions of non-interest
- Added treatment group and study section labels

Graph: Mean HbA1c during DCCT/EDIC study.
Suppose you want to jazz up your plots for a presentation. You can place a picture or graphic behind your data to accent the results. We are going to place an image behind the data, but only below the data series. NEAT!
The Annotate Facility

Anno data set 1:
Will place the image of the dollar over the plotting area.

```plaintext
data annodollar;
  length function $8;
  xsys='2'; ysys='1'; when='b';
  
  function='move'; x=&minyear; y=.1; output;
  function='image'; x=&maxyear; imgpath='C:\Documents and Settings\nab42\Desktop\dollar.jpg'; style='fit'; y=99.6; output;
run;
```

Anno data set 2:
Will create white Space above the Plotted line over time.

```plaintext
data annoblock; set data;
  xsys='2'; x=year; when='b';
  ysys='2'; y=dollarvalue; function='move'; output;
  ysys='1'; y=99.5; function='draw'; color=&backcolor; output;
run;
```

SET the anno data sets and call them in the GPLOT statement

```plaintext
data myanno; set annodollar annoblock;
run;

proc gplot data=data anno=myanno;
  plot dollarvalue*year / vaxis=axis1 haxis=axis2;
run;
quit;
```
Individual Net Worth
As a Function of Original Worth
I used to think correlation implied causation.

Then I took a statistics class. Now I don’t.

Sounds like the class helped. Well, maybe.