Fischer Stereochemistry Proof

0) Glucose is an aldohexose
1) The configuration of the last stereocenter was a guess,
2) Glucose + mannose are epimers, and they both can be synthesized from arabinose,
3) Arabinose acid is optically active
4) Glucaric + mannaric acids are optically active
5) Glucose forms an aldicaric acid that another sugar does as well

Glucose + mannose contain 3 stereocenters that are identical to those in arabinose
Glucose + mannose are epimers (differing by only one stereocenter).

3) Arabinose acid is optically active

(Can't be meso)

Not identical

Cannot be meso regardless of the configuration of the middle SC.ilion

→ could it be meso?

Mirror plane

meso
The only way arabinic acid can be optically active is if the top stereocenter is configured so that it does not form a mirror plane w/ the bottom stereocenter.

Both meso (cannot be arabinic acid) established by

optical activity of arabinic acid established by a guess

4) Glucaric & mannnace acids are optically active

The bottom 3 stereocenters in glucose & mannose are the same. The structures above represent two possibilities; each possibility, in turn, is a specific configuration of the bottom three stereocenters. If either structure in a pair is shown to be invalid, both structures in the pair are invalid.
5) Glucose makes the same aldonic acid as another sugar.

H  O  
H  H  H
H  OH
H  OH
H  OH

"Magic"

180°

H  O  
H  H  H
H  OH
H  OH
H  OH

Established

H  O  
H  H  H
H  OH
H  OH
H  OH

SAME!

H  O  
H  H  H
H  OH
H  OH
H  OH

Only one sugar can make this aldonic acid because it is rotationally symmetric.

H  O  
H  H  H
H  OH
H  OH
H  OH

H  OH
H  H  HO

H  OH
H  H  HO

D-glucose

Rotationally asymmetric

L-gulose