Fueled by:

Bisque

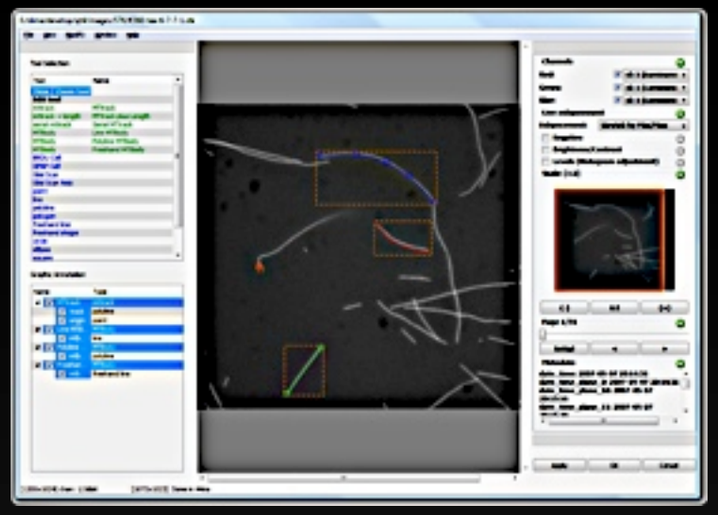
Bisque and iRods

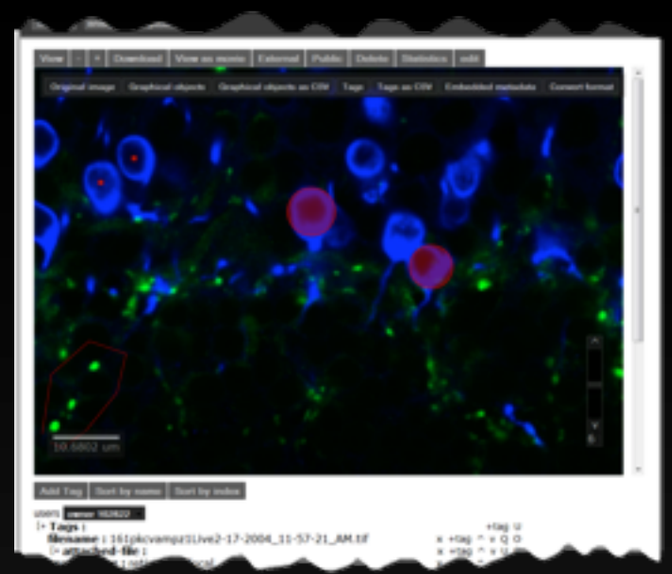
Center for Bio-Image Informatics, UCSB

http://bovary.iplantcollaborative.org

Kris Kvilekval

Bisque - Image database





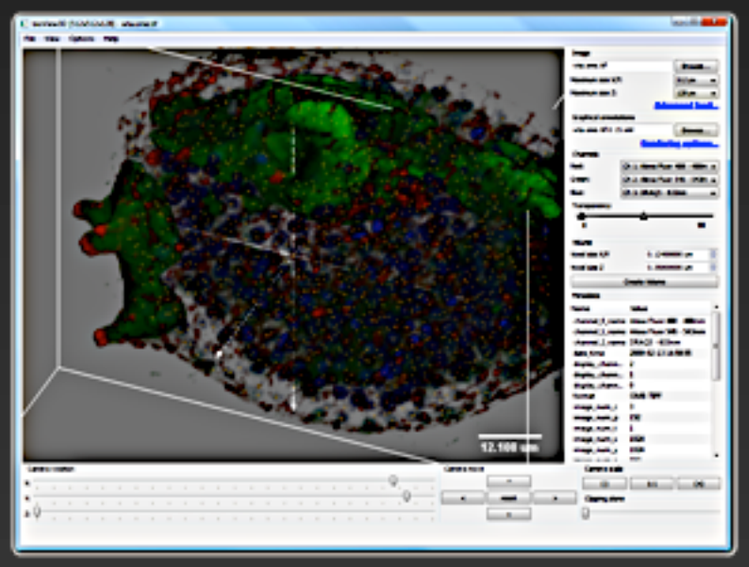
Ground truth

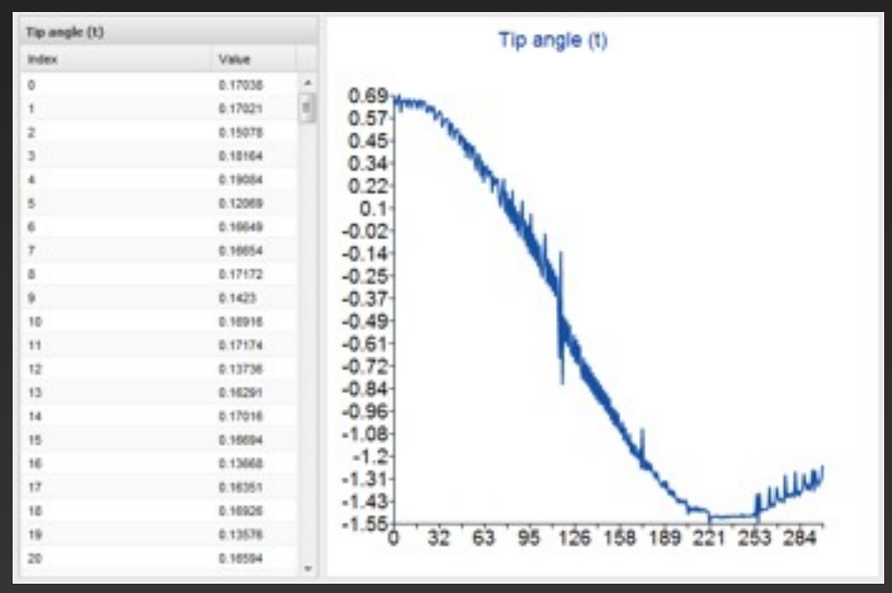
Automated analysis

Flexible and hierarchical annotations

Visualization

Generic statistics





Bisque basics

- Support varying data models
  - Database supports dynamic data model
- Everything is a web accessible resource
  - Image, Metadata, Analysis, Index
- Scalable and distributed
  - Add servers
  - Combine and use multiple diverse collections
- Rich web clients for interactive analysis
  - Web based applications

Flexible and hierarchical

- Hierarchical structure
- Flexible name:value fields
- Textual and 5D graphical annotations
- Biologically meaningful objects and groups

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    <tag name=”nested” value=”http://host/someplace” type=”object” />
</tag>
<gobject type=”mttrack” name=”MTtrack” >
    <gobject type=”polyline” name=”track” >
            <vertex x=”206” y=”542” t=”0” index=”0” />
            <vertex x=”206” y=”512” t=”1” index=”1” />
            <vertex x=”232” y=”502” t=”2” index=”2” />
    </gobject>
    <gobject type=”point” name=”origin” >
            <vertex x=”212” y=”552” />
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    </gobject>
</gobject>
```

"Bisque: A Platform for Bioimage Analysis and Management", Bioinformatics, Feb. 2010

Bisque architecture

Client tools

Scalable services

python

Java

XML

XML

Image Services

Data Services

Analysis Services

XML

XML

XML

XML, JSON

HTML

Client Services

XML

Analysis Challenges

- Data organization and access
- Using Computational Resources
- Development methods

- Datasets
- Storage hierarchies
- Movement

- Local machines
- Local/Remote clusters
- Environment

- Language Neutral
- Local development
- Distribution

HT-Imaging Challenges

Automated imaging can produce large-scale data

- Minimize data movement
- Protection/Ownership
- Integration with current workflow
- Metadata collection and binding
- Automated analysis

HT-Imaging

Automated Imaging

Bisque

Image discovery → Metadata binding → Initial Analysis

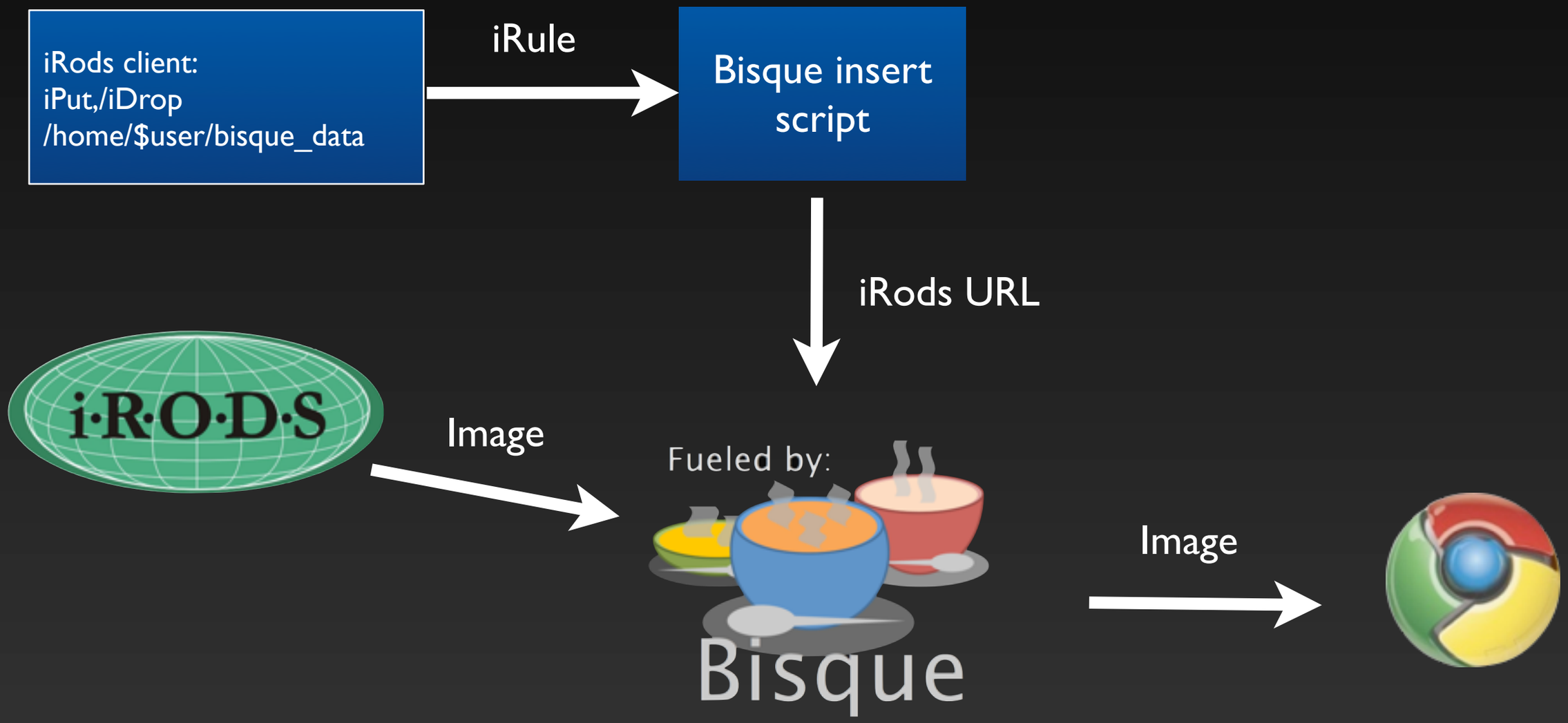
Image ingest

✓ Discovery: iRules based or Polling
✓ Pre-processing: unpacking/construction
✓ Initial analysis: resource based

Data sources:
- iRods
- Local disk
- Uploads

Data types:
- Images/Files
- Metadata Records
- Experimental Objects

Discovery with iRods



iRods Rule

irods://data.iplantcollaborative.org/home/<user>/bisque_data/mybigfile.data

```
### server/config/reConfigs/core.re
### Example Rules for registering irods rules.
###

acPostProcForPut {
    ON ($userNameClient != "bisque" && $objPath like "/iplant/home/\*/bisque_data/\*") {
       writeLine("serverLog","BISQUE: inserting object"++$objPath);
#       delay("<PLUSET>1s</PLUSET><EF>1s REPEAT UNTIL SUCCESS</EF>") {
       delay("<PLUSET>1s</PLUSET>") {
         msiExecCmd("insert2bisque.py", '$objPath $userNameClient', "winwood.iplantcollaborative.org", "null", "null", *cmdOut);
         writeLine("serverLog","BISQUE: inserted object"++$objPath);

       }
    }
}


acPostProcForCollCreate {
  ON ($collName like "/iplant/home/$userNameClient/bisque_data") {
        writeLine("serverLog","BISQUE: permitting bisque user RW on"++$collName);
        msiSetACL ('default', 'write', 'bisque', $collName);
        msiSetACL ('recursive', 'inherit', 'null', $collName);
    }
}

#### NEED acPreDelete
#### NEED acPreRename  (in and out of bisque_data)
```

Bisque insertion

```
#!/usr/bin/env python
import sys
import shlex
import urllib
import urllib2
import urlparse
import base64
import logging

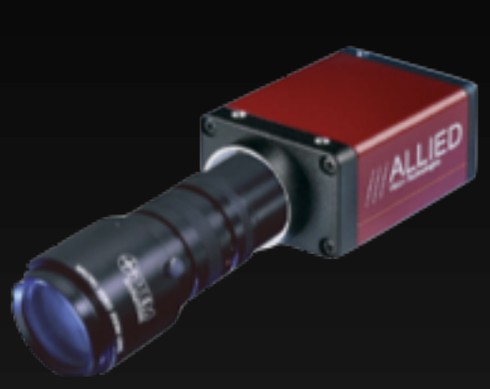
############################
# Config for local installation
LOGFILE='/tmp/bisque_insert.log'
BISQUE_HOST='http://bisque.ece.ucsb.edu'
BISQUE_ADMIN_PASS='guessme'
IRODS_HOST='irods://irods.ece.ucsb.edu'
# End Config

logging.basicConfig(filename=LOGFILE, level=logging.INFO)
log = logging.getLogger('i2b')

def main():
    log.debug( "insert2bisque recevied %s" % (sys.argv) )
    try:
        obj = sys.argv[1]
        user = sys.argv[2]
        url = "%s/import/insert?%s" % (BISQUE_HOST, urllib.urlencode( { 'url': IRODS_HOST+obj, 'user': user}))
        request = urllib2.Request(url)
        request.add_header('authorization',  'Basic ' + base64.encodestring("admin:%s" % BISQUE_ADMIN_PASS ).strip())
        r = urllib2.urlopen(request)
        response = r.read()
        log.info( 'insert %s -> %s' % (url, response))
    except Exception,e:
        log.exception( "exception occurred %s" % e )
        raise e


if __name__ == "__main__":
    main()
    sys.exit(0)
```

HT image pre-processing/analysis



raw files

i·R·O·D·S

images

files/images

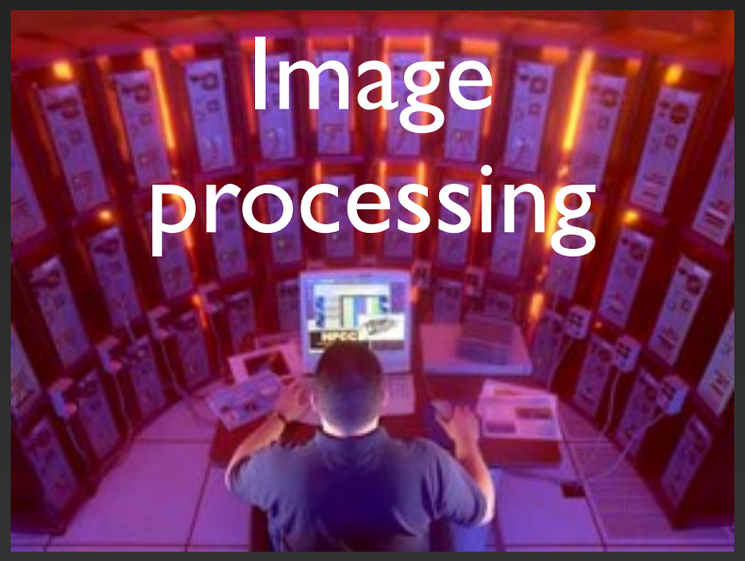
Fueled by:

Bisque

images

results

images



Condor
High Throughput Computing

Challenges

- Pre-processing ops require local files
  - ex: unpacking and image construction
    - Should it move to iRods server?
- Analysis also requires local files
  - Should it also move to iRods server?
- Should an IS run on the iRods server?
- iRods on clusters?

BQPhytomorph

Bisque

B.S. Manjunath
Kris Kvelikval
Dmitry Fedorov

Phytomorph

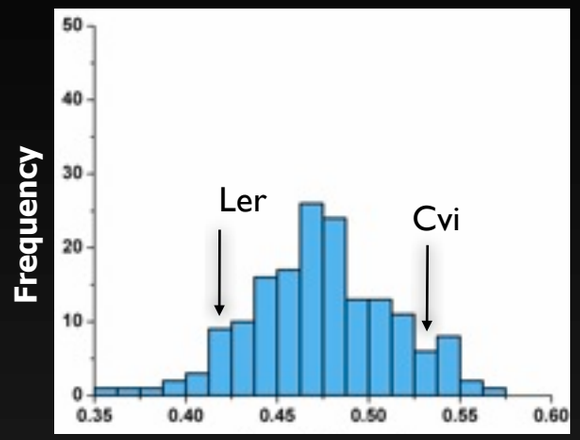
Edgar Spalding
Nathan Miller
Logan Johnson

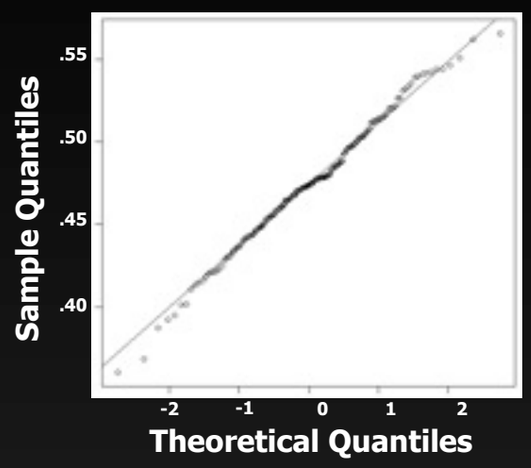
Whole Seedling-size Analysis

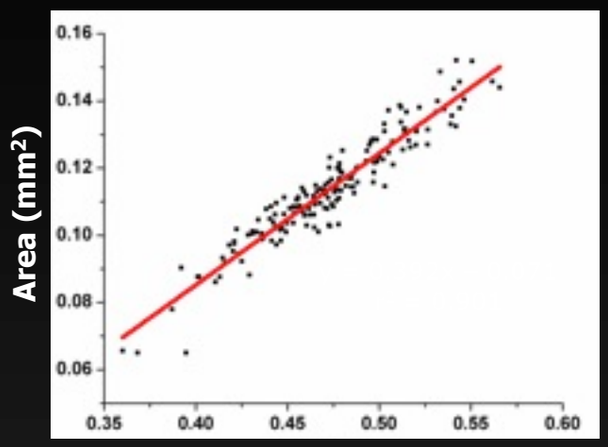
Source: Edgar Spalding

Seed Size Features

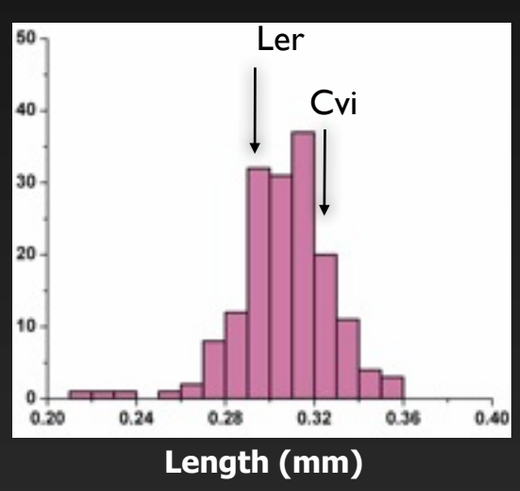
Major Axis

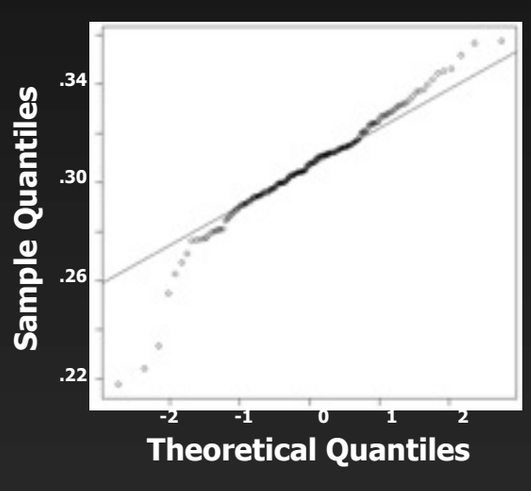


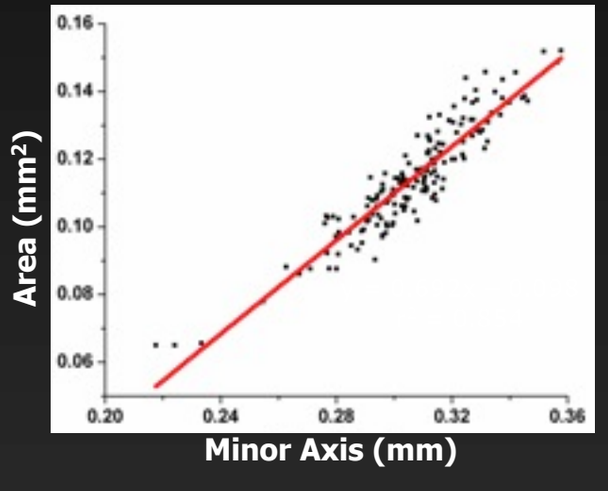




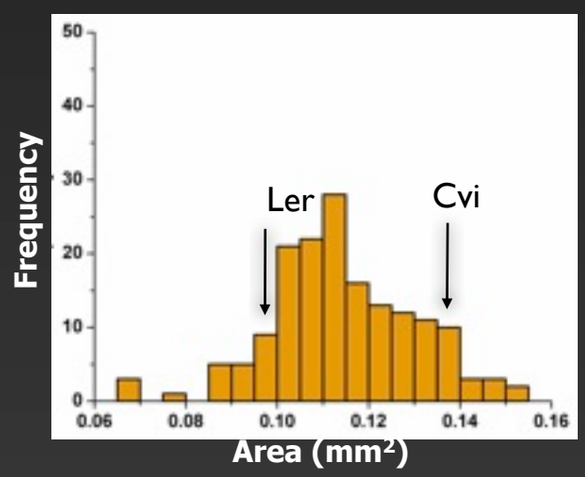
Minor Axis

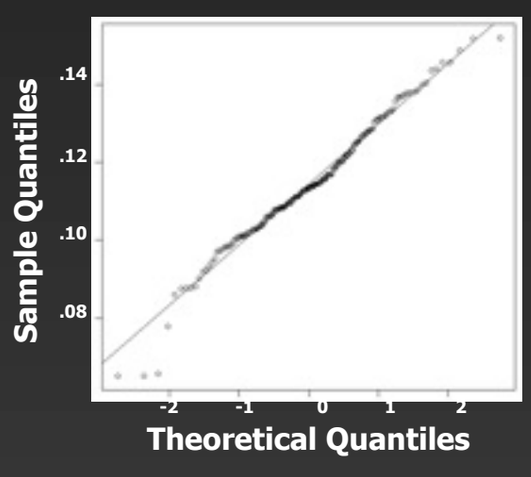


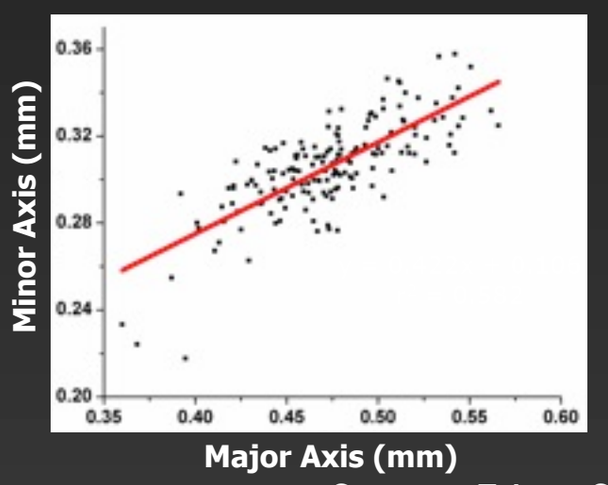




Area







Source: Edgar Spalding

Root Tip Angle

Cvi Ler

9 h after gravistimulation

164 lines
X 10 seedlings/line
1640 movies

QTL of gravitropism

Source: Edgar Spalding

Experimental Setup

Seeds Planted

1 mM KCl, 1 mM $CaCl_2$, 5 mM MES, pH 5.7

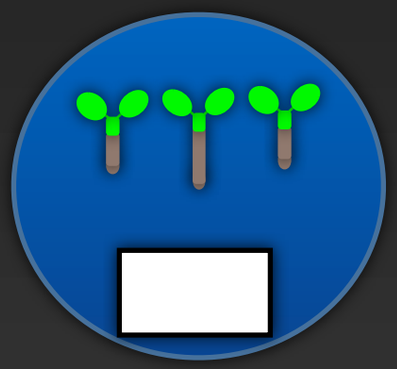
2-4 day Stratification

2-4° C

3 days in growth chamber

constant white light, 22.5° C

Record Initial Root Lengths



Place in front of camera in CCW orientation

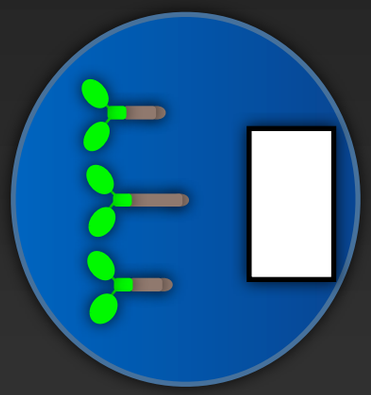
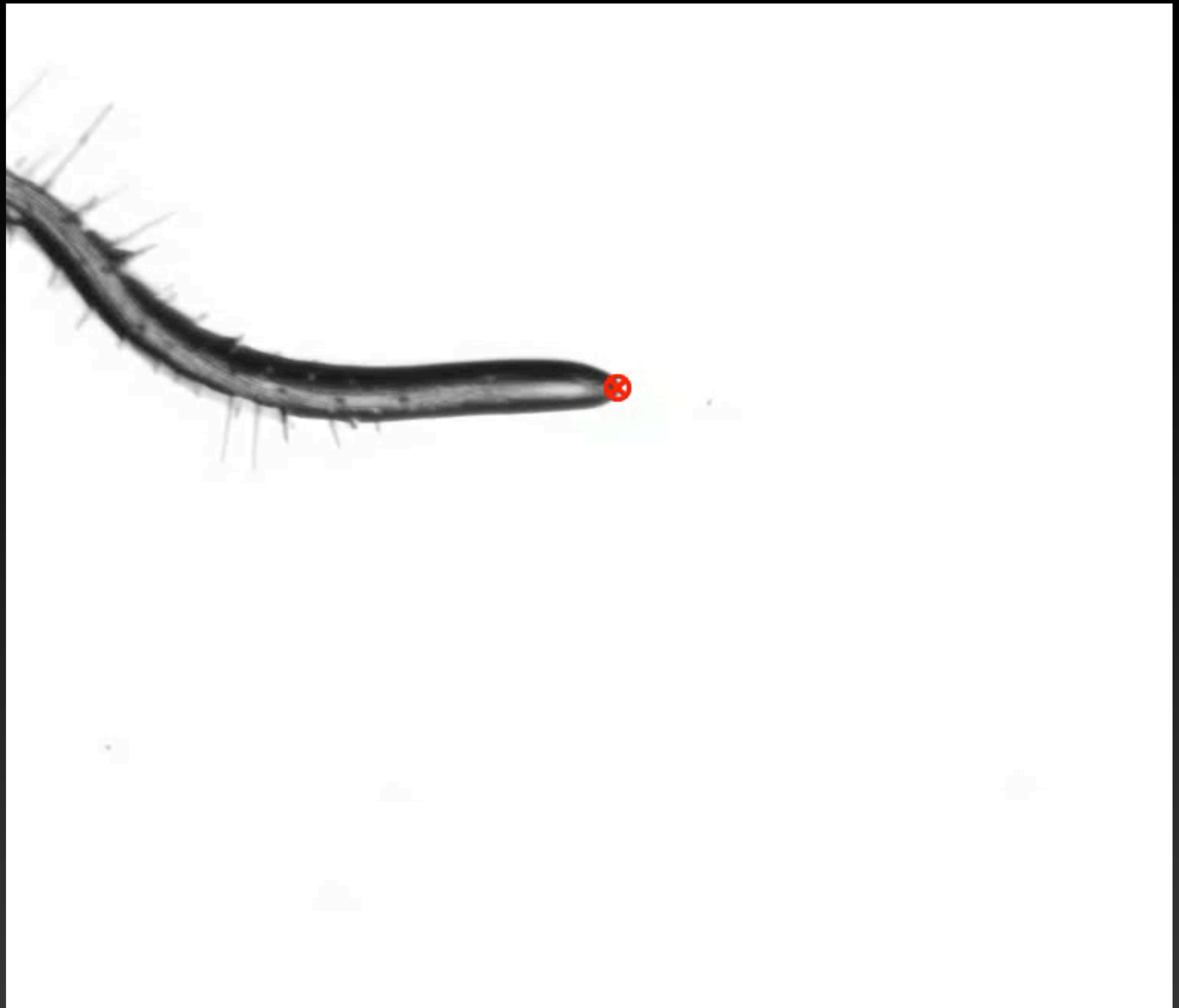


Image at 100 px/mm every 2 min for 8 hr

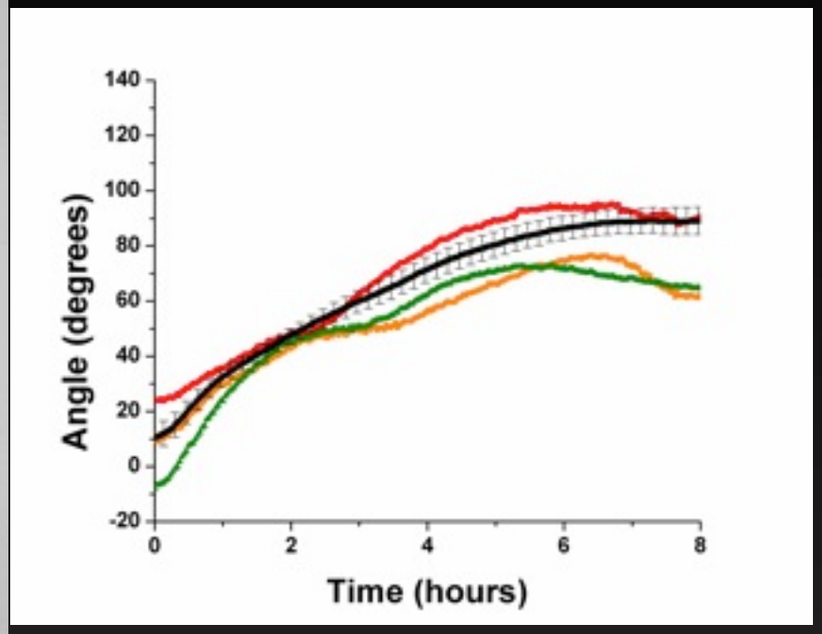
Source: Edgar Spalding



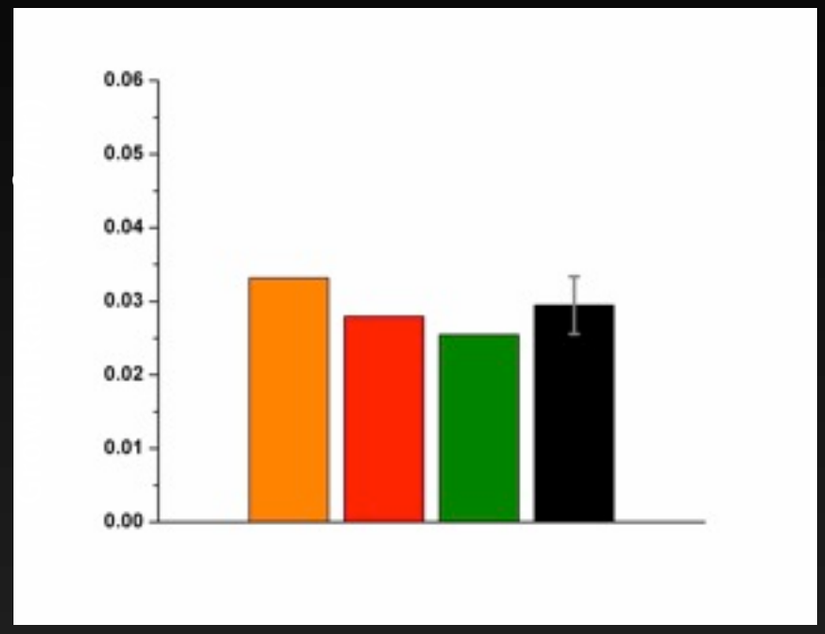
Multi-Tip and Growth-Rate

Cape Verde Islands

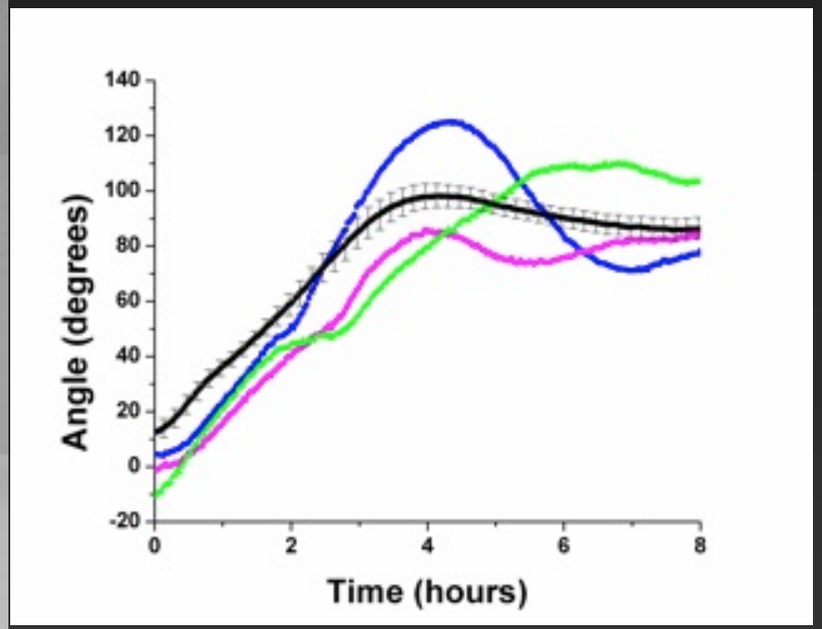
Tip Angle

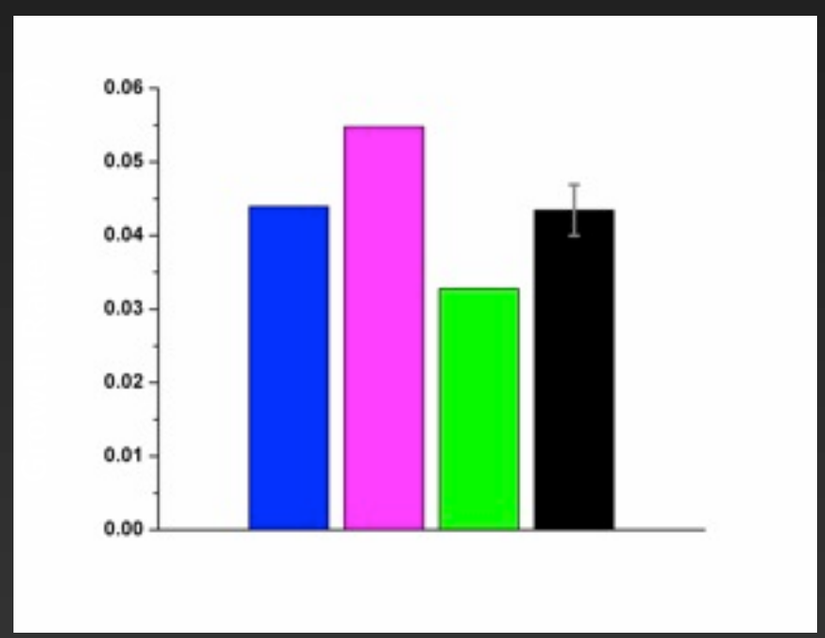


Average Growth Rate



Landsberg erecta





Source: Edgar Spalding