

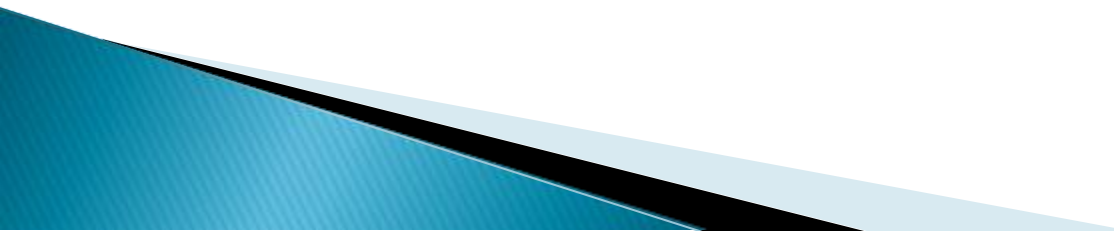
# Developing a Rapid DNA Infrastructure in Palm Beach County

Brandy Plean, M.S., F-ABC  
Senior Forensic Scientist  
Forensic Biology Unit  
Palm Beach County Sheriff's Office  
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# Embrace the Change



# Overview

- ▶ Conventional DNA Workflow
  - ▶ Why Rapid DNA?
  - ▶ Forensic Biology Unit's (FBU) Vision and Goals
  - ▶ The Plan for an Infrastructure
  - ▶ Validation and Implementation
  - ▶ Future Direction
- 

# Conventional DNA Workflow



**Extraction**  
≈ 2 hours



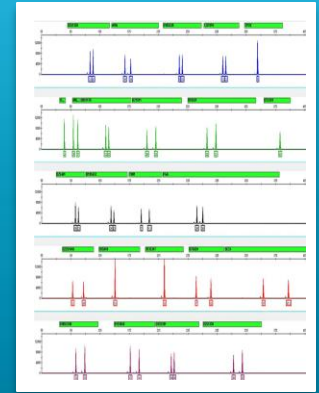
**Quantification**  
≈ 2 hours



**Amplification**  
≈ 2.5 hours



**Detection**  
≈ 1.5 hours



**Data Analysis**  
≈ 2 hours

*Timing is dependent on the # of samples being processed*

# Conventional vs. Rapid

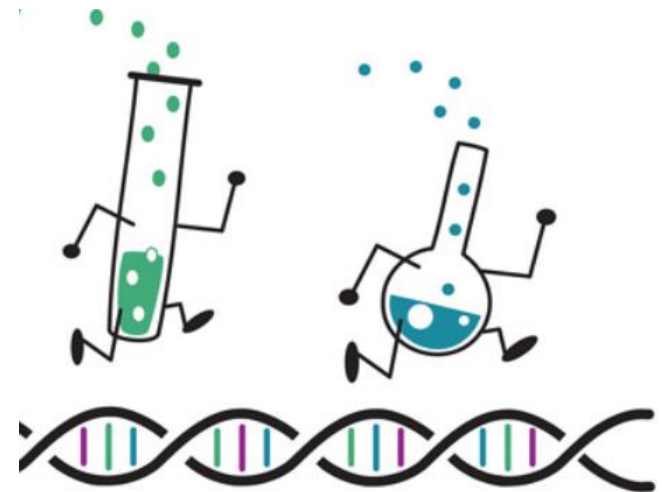
- Can be more informative
- Mixtures
- Multiple NDIS approved kits
- Personnel
- Multiple Rooms of Equipment
- Sample handling/ increased risk for contamination
- Extract storage
- Longer analysis times

Advantages

Disadvantages

# Why Rapid DNA?

- ▶ Accelerated processing of crime scene or reference samples to develop a DNA profile
  - Fully automated Rapid instrumentation
- ▶ Develops DNA profiles in *under* two hours
- ▶ Quick exclusions or inclusions
  - Develop investigative leads
  - Establish probable cause



# When will the FBU use Rapid DNA?

- ▶ **ASAP/Priority cases** with clear crime scene evidence from the suspect
  - e.g. a blood trail leading away from the scene
- ▶ **AND** (for now) ability to identify and obtain a standard from a person of interest/suspect(s)
  - As infrastructure improves this requirement will no longer be necessary
    - Migrating existing local database samples to Rapid database
- ▶ **OR** a case where a DNA profile has already been generated from evidence and a suspect standard(s) is collected for comparison
  - e.g. unknown profile developed from a rape/homicide case, a potential suspect is developed
- ▶ **Human trafficking, Mass disaster identification**

# Samples for Rapid DNA



- ▶ ~ One crime scene stain
  - Not meant for analysis of all samples in a case
- ▶ Single source (non-mixture) samples
- ▶ Samples with higher DNA content
  - Blood, saliva, bone, tissue, cigarette butts, gum, semen (not in SAK)
- ▶ Samples of sufficient quantity for **both** Rapid processing and conventional processing





# Samples NOT appropriate for Rapid DNA

(at this time)

▶ Sample of insufficient size to test with both Rapid DNA Analysis AND traditional DNA analysis

- Small or faint bloodstains
- Touch Samples
- Straws
- Drinking containers?



▶ Samples where a mixture of DNA is suspected



# FBU's Rapid Goals

- ▶ Develop a Rapid DNA infrastructure across the county to encourage collaboration with the FBU, between agencies, and the judicial system
- ▶ Ensure the responsible handling and processing of samples for DNA analysis
- ▶ Continue to supply the CODIS database with DNA profiles
- ▶ Offer informed feedback to agencies considering Rapid DNA technology
- ▶ Advise own agency with regard to its implementation in booking stations

**IF YOU CAN'T  
BEAT THEM**  
**JOIN THEM**

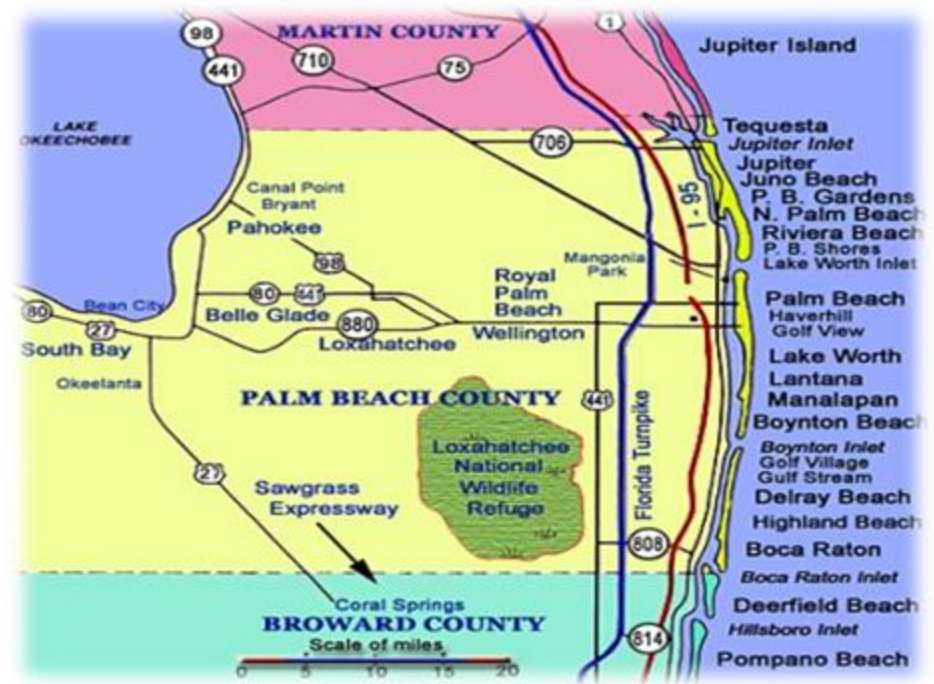


# The Plan for an Infrastructure



# Palm Beach County

- ▶ PBSO provides DNA services for over 30 local and Federal agencies
- ▶ Largest county in Florida totaling 2,383 square miles
- ▶ Population: >1.4 Million



# How do we accomplish this?

## ▶ Challenges

- Available to all law enforcement
- Limited CODIS eligibility

## ▶ Fact-finding

- Visit to Orange County, CA District Attorney's Office (Rapid DNA Program)

## ▶ Path Forward

- Survey for Rapid DNA demand in PBC
- Memo for approval (infrastructure)
- Met with the SAO
- Validation and Implementation

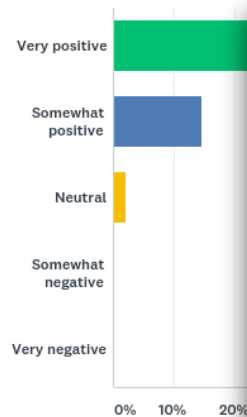


# Rapid DNA Demand in PBC

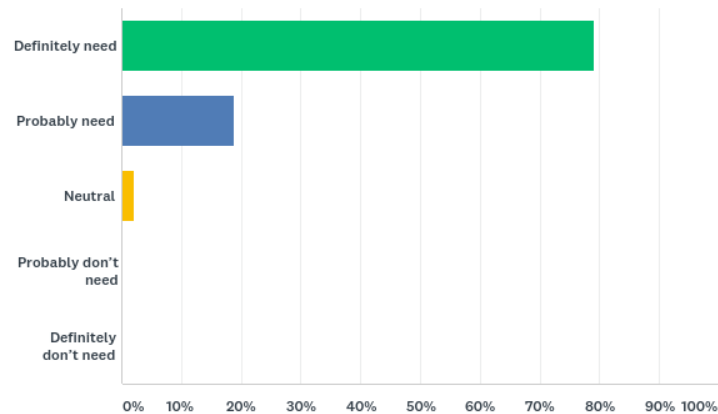


- ▶ Sent survey to gauge demand for Rapid DNA technology
- ▶ Received 48 responses
  - Palm Beach County LEO and Crime Scene Investigators

Q4 What is your first reaction to the potential availability of Rapid DNA Analysis for your cases?

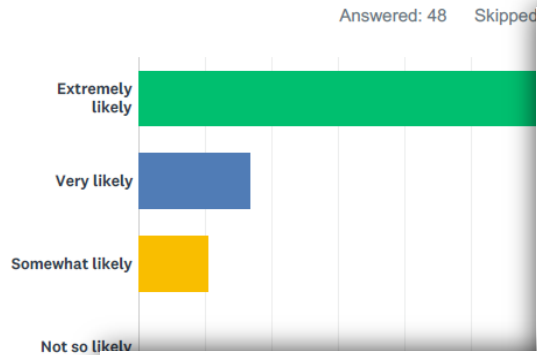


Q5 When you think about Rapid DNA Analysis, do you think of it as something you need or don't need?

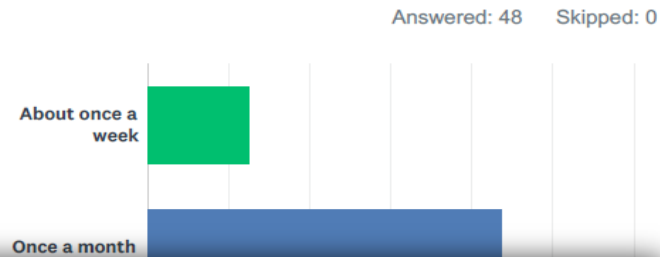


# Rapid DNA Demand in PBC

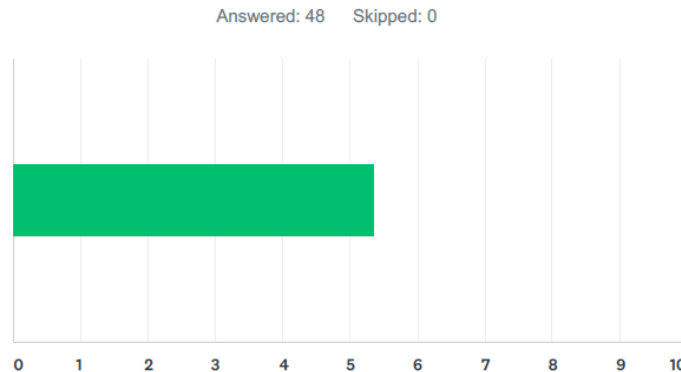
Q6 If Rapid DNA Analysis was available today, how likely would you be to request this service?



Q7 How often do you need DNA results in hours?



Q8 Thinking of the past six months, how many times could you have used Rapid DNA Analysis during your investigations?



70% 80% 90% 100%

# Memo for Action – COC approval

- ▶ Request funding for Rapid DNA instrumentation in order to pilot a Rapid DNA Program (RDP) in Palm Beach County
  - Requested funding for both the ANDE<sup>®</sup> 6C Rapid DNA Analysis System and the RapidHIT<sup>™</sup> ID System
- ▶ FBU had to initially choose one instrument
  - ANDE<sup>®</sup> 6C Instrument – year lease (NDIS approved)
- ▶ RapidHIT<sup>™</sup> ID obtained through seed agreement (short-term loan)





# Two New Tools in the Toolbox



RapidHIT™ ID System



ANDE® 6C Rapid DNA  
Analysis System

# RapidHIT™ ID System

- ▶ Installed June 12<sup>th</sup>
  - Training June 13<sup>th</sup>
- ▶ Expert system is *not yet* NDIS approved
- ▶ STR kit is NDIS approved
  - GlobalFiler™ Express
  - Modified Rapid DNA analysis *only* (human interpretation and technical review)
- ▶ One sample at a time
- ▶ Run time ~90 minutes



# ANDE<sup>®</sup> 6C Rapid DNA Analysis System

- ▶ Installed April 4<sup>th</sup>
  - Training April 9<sup>th</sup> – 11<sup>th</sup>
- ▶ Expert system is NDIS approved
  - Known reference buccal DNA samples only
- ▶ STR kit is **not** NDIS approved
  - ANDE's FlexPlex™ 27
  - No modified Rapid DNA analysis
- ▶ Up to five reference or four crime scene samples at a time
- ▶ Run time ~94-106 minutes



# Validation & Implementation Plan

- ▶ Use the Orange County District Attorney's Office (CA) Rapid DNA program as a model for implementation
  - Why re-invent the wheel?
- ▶ Summer 2019 - Two DNA Technical Assistance Program interns from Marshall University's Forensic Science Master's program
  - Conducted internal validation studies on both instruments to evaluate efficacy and reliability for forensic casework and/or database analysis
  - Validation studies in accordance with QAS



# Validation & Implementation Plan

- ▶ Develop protocols and procedures
  - e.g. Proficiency testing
- ▶ Conduct Rapid DNA training with hand-picked individuals from the FBU, SID (Human Trafficking), and CSI in order to be able to conduct “on-demand” Rapid DNA analysis
  - Interpretation of profiles will still be the responsibility of the FBU
- ▶ *Implementation goal of Winter 2019*



# Validation Plan

- ▶ Created a combined validation plan for both RapidHIT™ ID System and ANDE® 6C Rapid DNA Analysis System
  - Run same samples on both instruments
    - ACE Cartridge and A-Chip
    - INTEL Cartridge and I-Chip
- ▶ Concordance, Contamination, Sensitivity, Reproducibility/Repeatability, Precision, Mixtures, Known/Non-probative/Mock
  - Aged buccal swabs, blood (wood, brick, denim, concrete, dirt), drinking containers, cigarette butt, semen, gum, toothbrush, bone, tissue, FTA paper, hair

# Expert System First Pass Yield (FPY)

- ▶ Same samples run on both instruments
- ▶ Buccal reference samples with green checks
  - ACE Cartridge & A-Chip ✓
- ▶ RapidHIT™ ID
  - 83% (24/29)
- ▶ ANDE® (Instrument #2)
  - 59% (17/29)



# RapidHIT™ ID Sample Success

## ▶ ACE

- 24/29 green checks (83%)
- 3/29 drop-out; between 14 and 22 usable loci (10%)
  - Aged buccal swabs (2011, 2016, 2018)
- 2/29 were failed injections (7%)

## ▶ INTEL

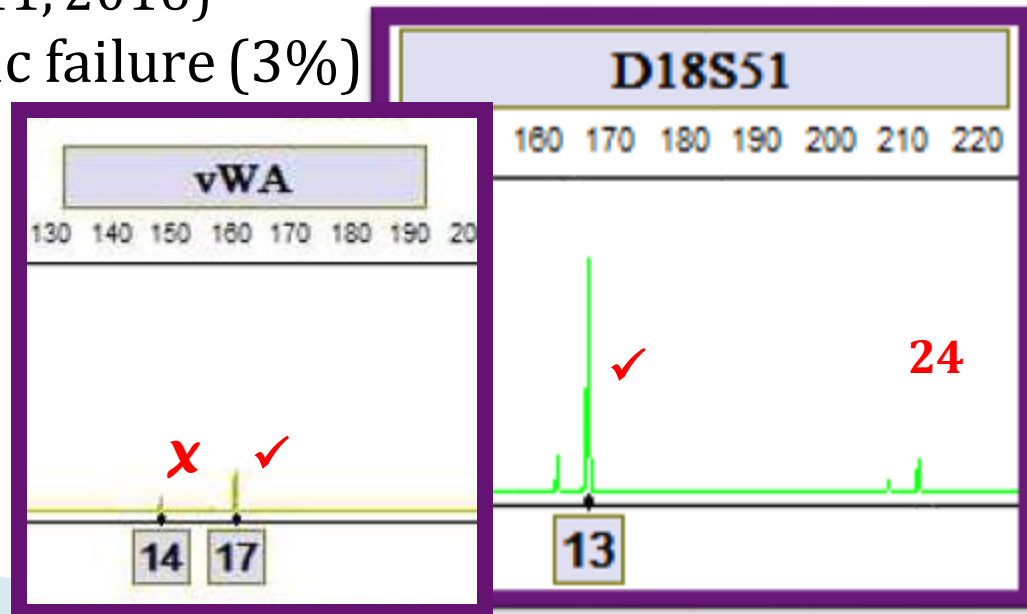
- 3/51 green checks (6%)
- 39/51 drop-out;  $\geq 12$  useable loci (76%)
- 6/51 drop-out; between 4 and 10 loci (12%)
  - All sensitivity samples\*
  - Useful?
- 2/51 samples generated  $\leq 1$  locus
  - Sensitivity replicate and mock aluminum bottle (4%)
- 1/51 failed cartridge (2%)

*No contamination observed in the primary cartridge for ACE or INTEL*



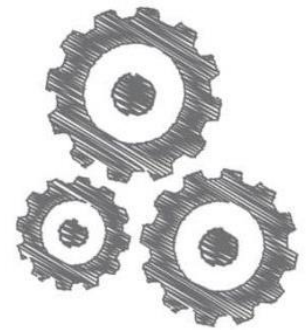
# ANDE<sup>®</sup> Sample Success

- ▶ A-Chip Instrument #2
  - 17/29 green checks (59%)
  - 9/29 drop-out; between 3 and 23 usable loci (31%)
    - Buccal sensitivity
    - Aged buccal swabs (2012, 2018)
  - 2/29 complete drop out (7%)
    - Aged buccal swabs (2011, 2016)
  - 1/29 failed due to fluidic failure (3%)
- ▶ A-Chip Instrument #1
  - Anomalies
- ▶ I-Chip
  - N/A



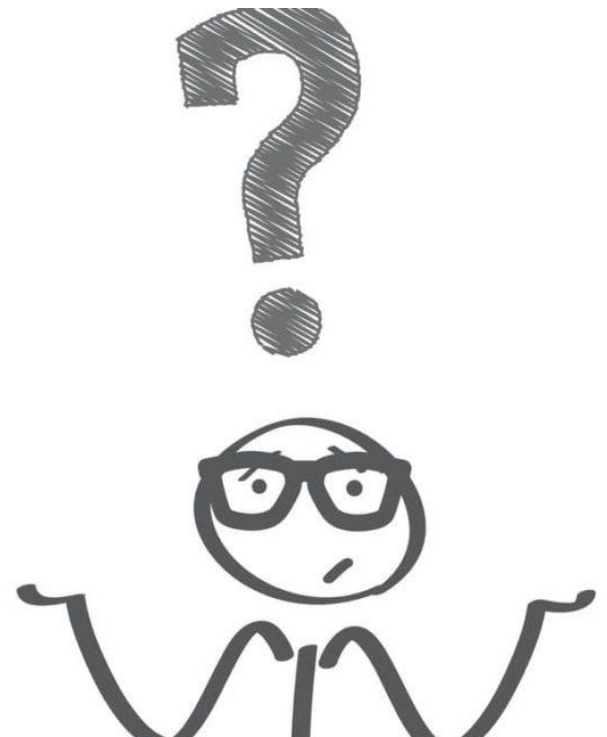
# RapidHIT™ ID Challenges

- ▶ Post validation - replaced optics assembly (laser, camera, heater)
  - Need to repeat a significant number of validation studies
- ▶ Primary cartridge
  - Leaking – broken capillary x2
- ▶ Ran out of gel
  - 44 injections still remaining
- ▶ Software upgrades



# ANDE<sup>®</sup> Challenges

- ▶ Replaced pneumatic valve sensors
- ▶ Instrument replaced during validation
  - Had to repeat A-chip studies
- ▶ Validation on hold
  - Experiencing contamination
  - Unable to get chips to proceed



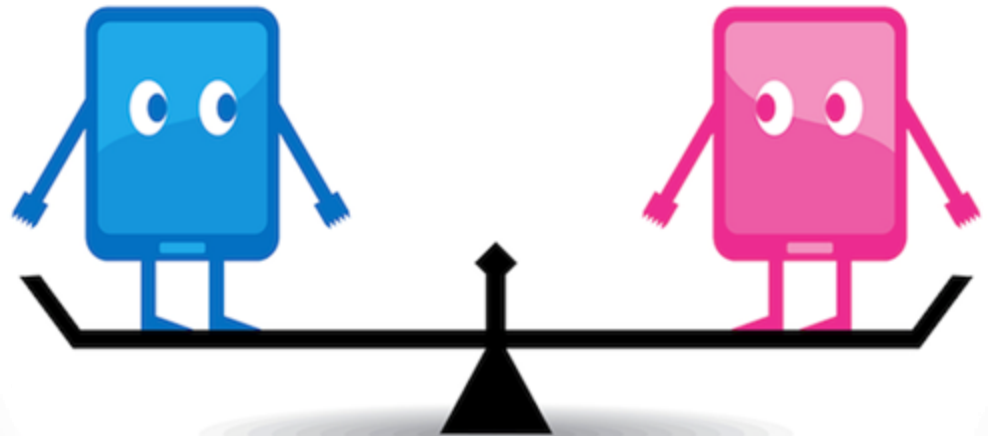
# Instrument Pros

## ▶ RapidHIT™ ID

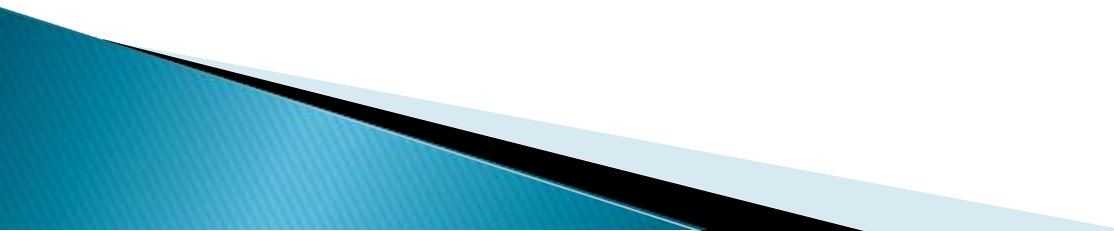
- Cartridges do not need to be removed immediately from instrument
- Electropherograms readily accessible

## ▶ ANDE®

- Ruggedized (portable)
- Larger run capacity



# Implementation Considerations

- ▶ Data transfer to a server
    - Remote Access
    - Off-site analysis and reporting
    - Worked with companies during validation to setup
    - In the process of finalizing logistics
  - ▶ Rapid Case Request program
    - Pilot program prior to implementation
  - ▶ Rapid DNA collection kits
    - Design for standardization of sample collection
- 

# Future Direction

- ▶ RapidHIT™ ID
  - Purchased 3 instruments
  - Bring one on-line for casework ASAP
    - Standards only
    - Buccal and blood on ACE
  - Wait for NDIS approval before validating others
    - Move forward with INTEL
- ▶ ANDE® 6C
  - Currently on hold



# Acknowledgements

## ▶ Palm Beach County Sheriff's Office

- Tate Yeatman, Crime Lab Director
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## ▶ ANDE

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- Dami Bullock, SVP of Strategic Initiatives and Customer Management
- Julie L. French, Vice President, Identification Applications

# Questions?



Brandy Plean

Palm Beach County Sheriff's Office

[pleanb@pbso.org](mailto:pleanb@pbso.org)