

INCREASING BIOINFORMATICS CAPACITY THROUGH THE BIOINFORMATICS REGIONAL RESOURCE

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Wisconsin State
Laboratory of Hygiene
UNIVERSITY OF WISCONSIN-MADISON

AMD - Bioinformatics Regional Resource

- Access to computational resources
- Training
- Workflows and Pipelines
- Consulting and Support





AMD – Innovate • Transform • Protect

AMD Training and Bioinformatics Leads 2018-19



- Training Lead Only
 - GA DPH
 - WY PHL
 - MI DHHS
- ★ Bioinformatics Resource Lead Only
 - CO PHL
 - FL BPHL
 - WI SLH
- ◆ Training & Bioinformatics Resource
 - VA DCLS
 - MN PHL
 - MA PHL
 - WA PHL



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Access to computational resources

- On-Prem Linux workstation
 - Specifications
 - Configuration
 - Issues



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**“I used to bury my bones.
Now I upload them to the cloud.”**

Access to computational resources

- On-Prem Linux workstation
 - Specifications
 - Configuration
 - Issues
- Obtaining access to Cloud infrastructure
 - Consulting with IT departments about access
 - Providing access through virtual computers hosted by us.
 - Connecting with Bioinformaticians using specific architectures



Training

- AMD Symposium
- 1 on 1 virtual training
- Linux virtual courses
- In person on-site training
- Organism/outbreak specific training
- Office Hours



Workflows and Pipelines

- Access to programs and pipelines used by state Bioinformaticians
- Implementing strict version control and locking down analysis programs and pipelines for validations
- User friendly approaches to running bioinformatics analyses and tools



Consulting and Support

- Ad-hoc analyses
 - Outbreak investigations
 - AR analyses
 - Validations
- Implementation of workflows or pipelines
- Tool Development
- On-demand expansion of infrastructure



OUTBREAK OF CARBAPENEM RESISTANT *ACINETOBACTER BAUMANNII*



Initial Presentation

- Facility A in Southeastern Wisconsin
 - notification of cluster of carbapenem-resistant *Acinetobacter baumannii* (CRAB)
 - occurring in five patients during September and October
- Highly resistant and identical on antimicrobial susceptibility testing (AST)

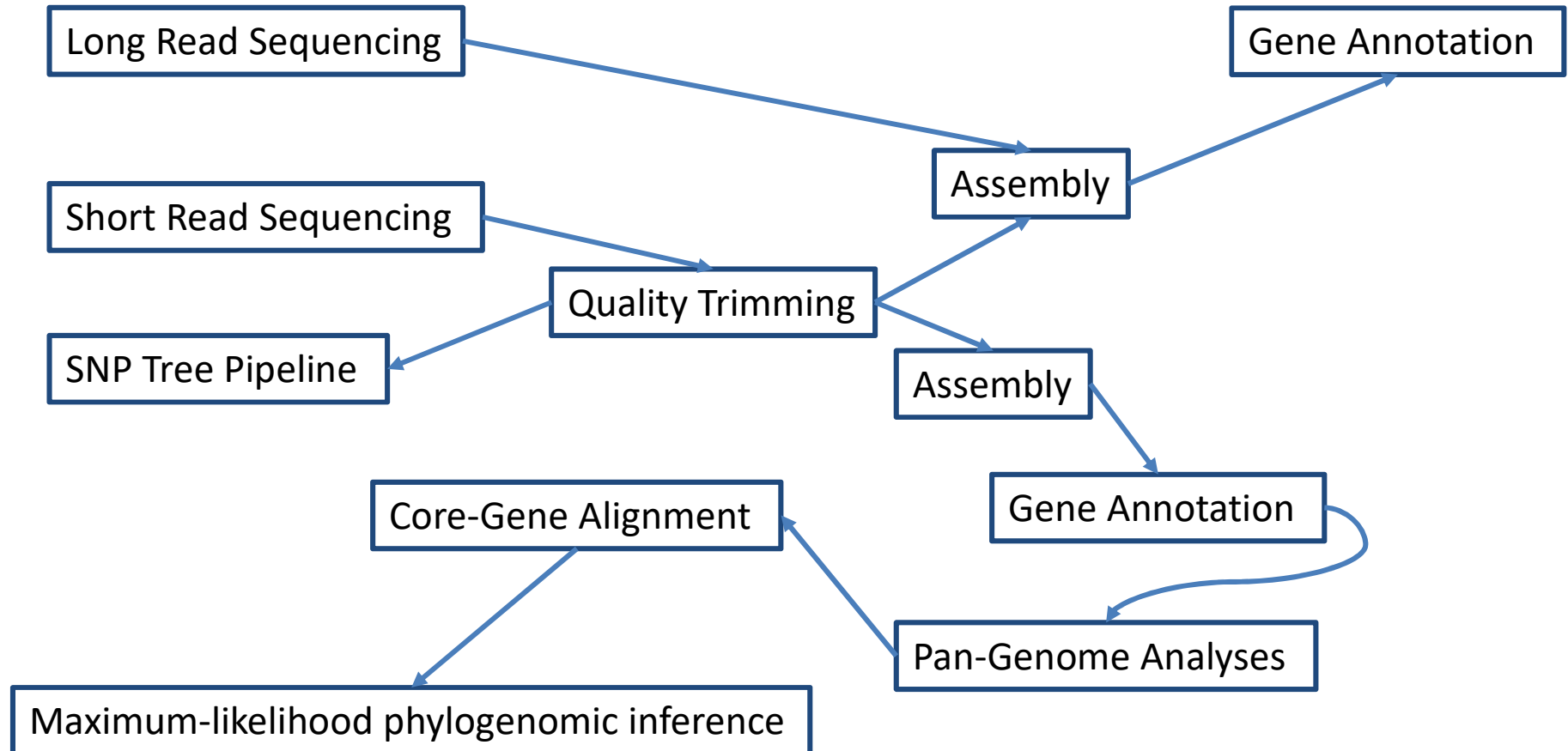


AST Profile

- Amikacin: **Resistant**
- Aztreonam: **Resistant**
- Cefepime: **Resistant**
- Cefotaxime: **Resistant**
- Ceftazidime: **Resistant**
- Ciprofloxacin: **Resistant**
- Colistin: **Susceptible**
- Doripenem: **Resistant**
- Doxycycline: **Resistant**
- Gentamicin: **Resistant**
- Imipenem: **Resistant**
- Levofloxacin: **Resistant**
- Meropenem: **Resistant**
- Minocycline: **Intermediate**
- Piperacillin-tazobactam: **Resistant**
- Polymyxin-B: **Susceptible**
- Ticarcillin-clavulanate: **Resistant**
- Tobramycin: **Resistant**
- Trimethoprim-sulfamethoxazol: **Resistant**



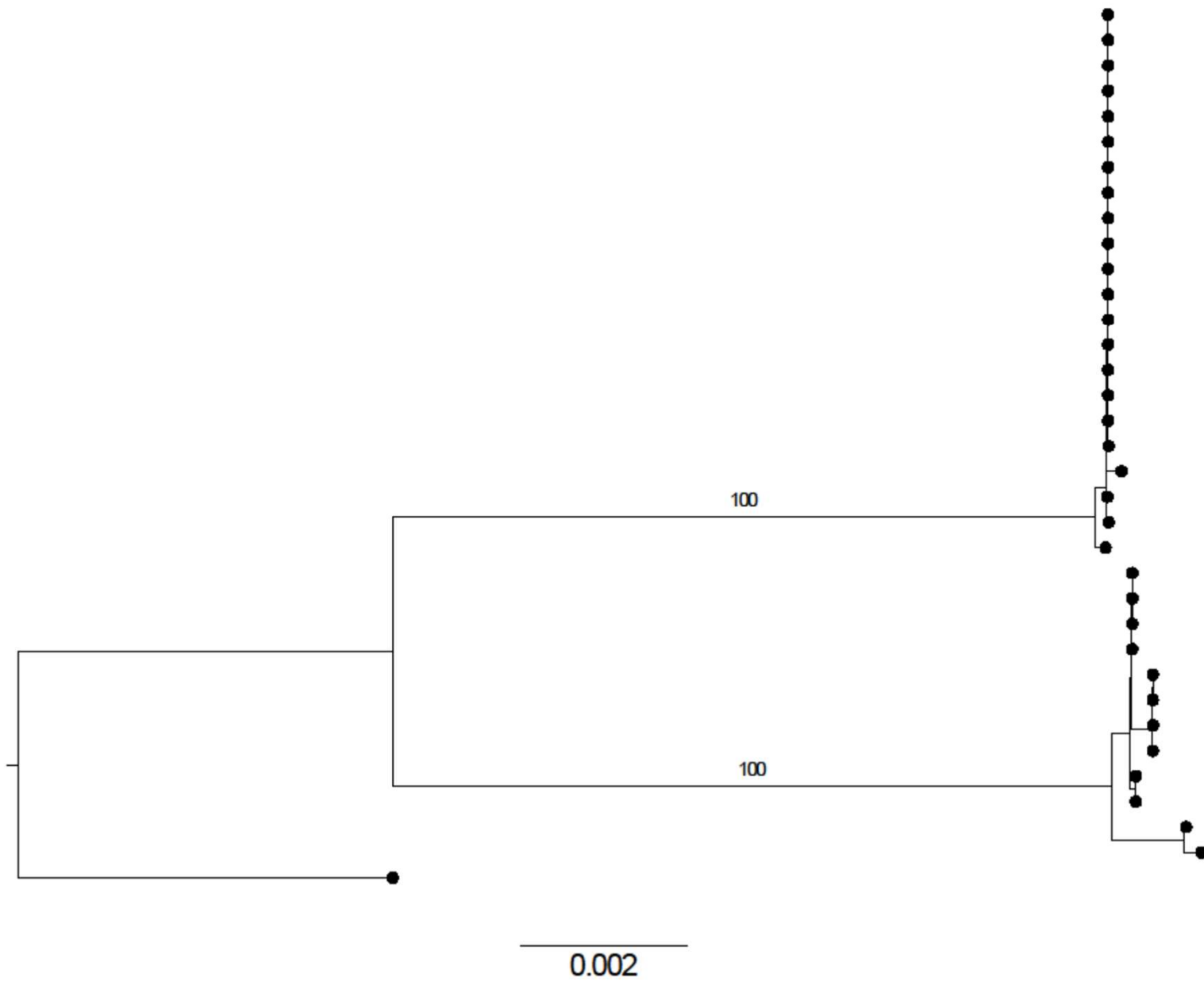
Sequence analyses workflow

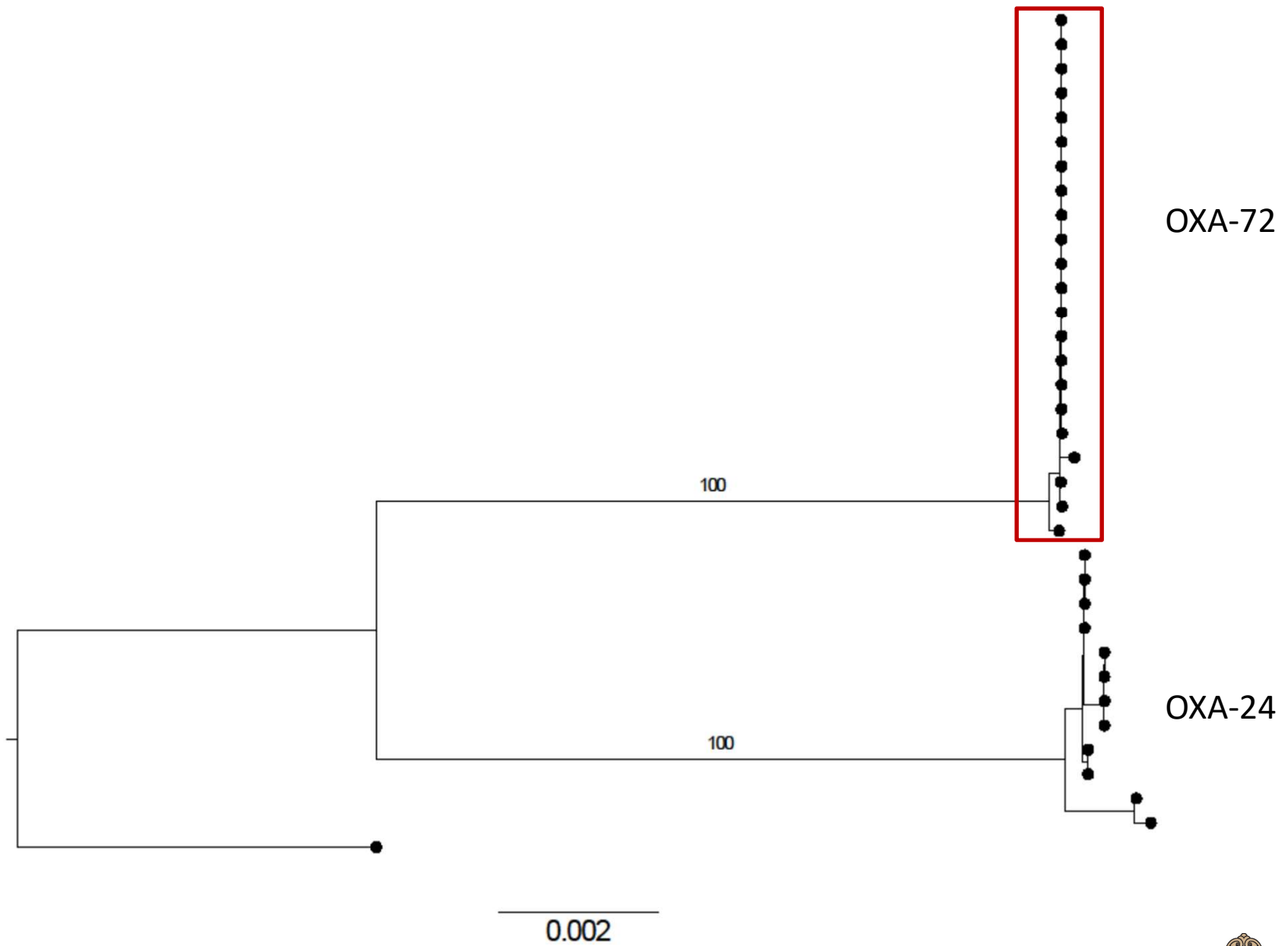


Resistance Mechanisms

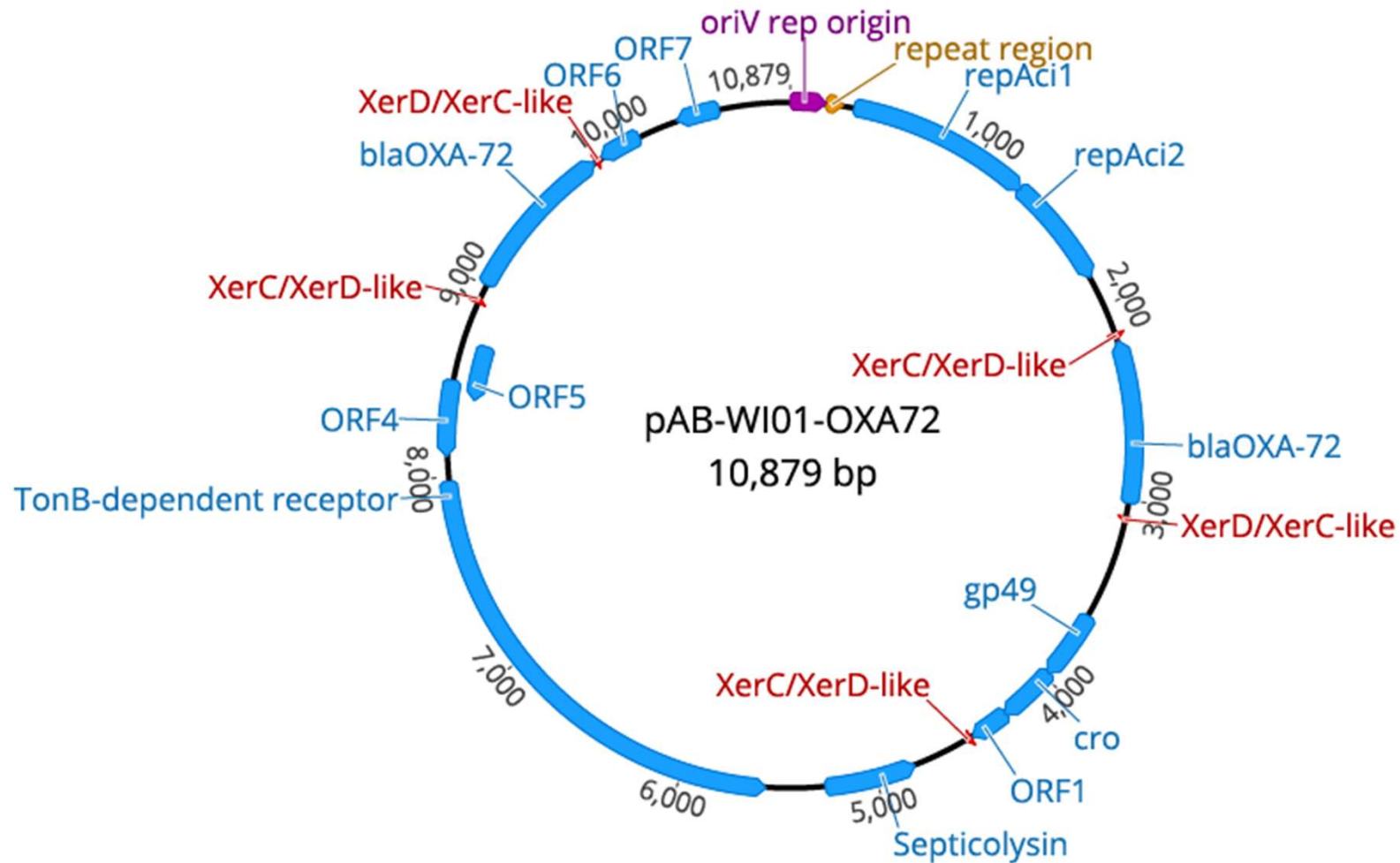
- Aminoglycoside Resistance
 - AAC(3)-Ia
 - AAC(6')-I_p
 - aadA5
 - APH(6)-I_d
 - ANT(3'')-IIa
 - APH(3'')-I_b
 - armA
- Beta-lactamase
 - OXA-66
 - **OXA-72**
 - ADC-25
- Dihydrofolate Reductase
 - dfrA17
- Macrolide
 - mphD
- Sulfonamide
 - sul1
 - sul2
- Numerous multidrug efflux complex proteins



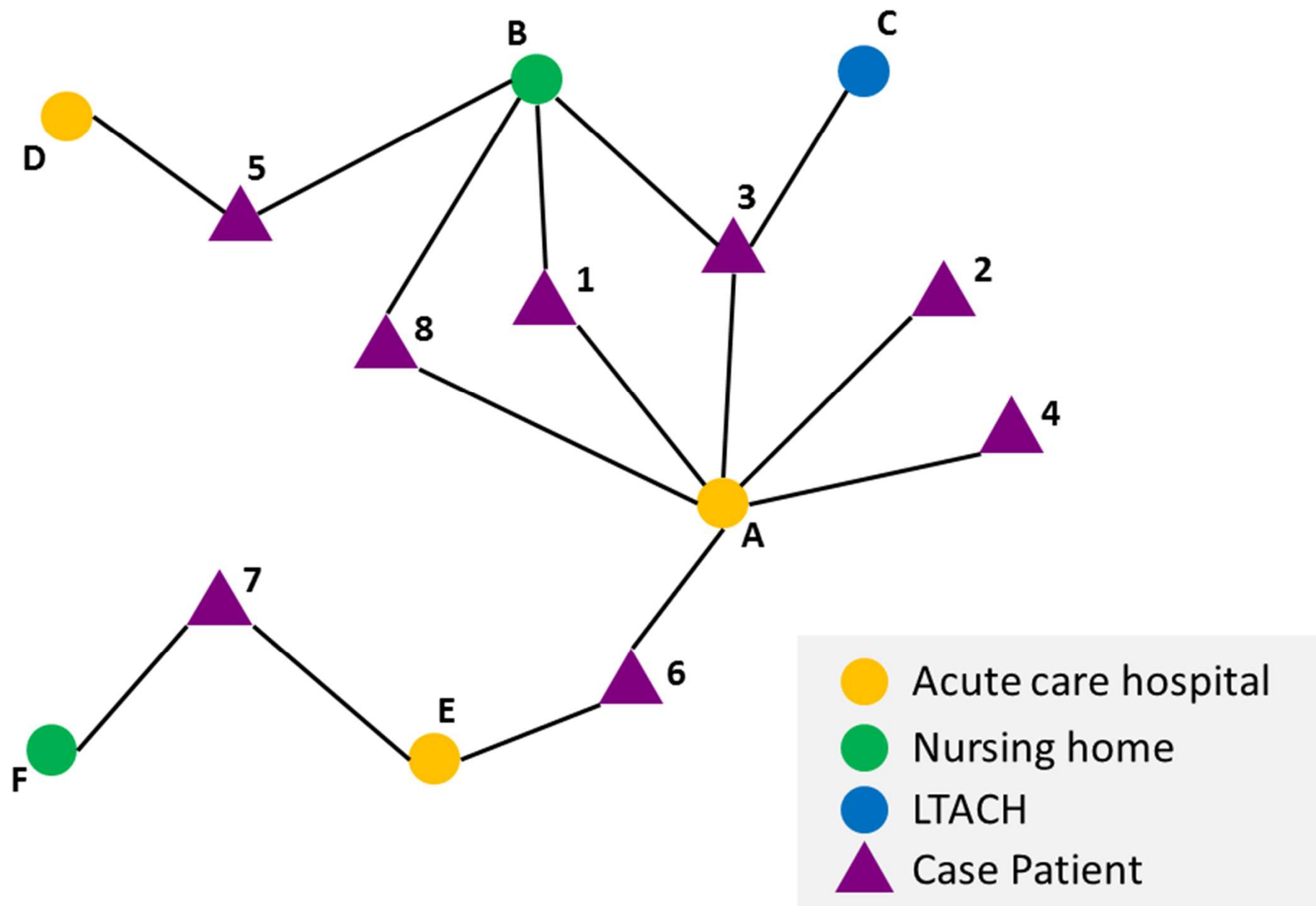








Povilonis et al. J Antimicrob Chemother 2013; 68: 1000–1006
doi:10.1093/jac/dks499



Conclusions

- Wisconsin has a few different CRABs that have colonized patients
 - OXA-24
 - OXA-72
- Indication this could be part of a larger nationwide issue
- Continued surveillance is needed to help prevent the spread of this resistance



Acknowledgements

- Sara Wagner
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- Dr. Silvia Munoz-Price
- Dr. Allen Bateman



DISCUSSION



Discussion

- What are some of the biggest needs/barriers to using NGS in your lab?
- What are the barriers for epidemiologists?
- What is needed to make NGS data readily usable by epidemiologists?



Discussion

- What aspects of NGS do you see bring the most value?
- What are the key areas of support you would like to see from both the Training and Bioinformatics Resource?

