

# SEQAFRICA Virtual Training Course

Zoom and Slack Online Platforms

February 2021

## Course information

**Title:** Introduction to Whole Genome Sequencing (WGS) in Antimicrobial Resistance (AMR).

**Language of instruction:** English.

**Offered as:** Webinar with lectures, exercises and panel discussion.

**Duration of course:** 6 x ½ days.

**Responsible:** Rene S. Hendriksen (DTU), [rshe@food.dtu.dk](mailto:rshe@food.dtu.dk)

**Course co-responsible:** Pernille Nilsson (DTU), Anthony Smith (NICD, South Africa), Jinal Bhiman (NICD, South Africa), Marco van Zwetselaar (KCRI, Tanzania), Beverly Eygir (NMIMR, Ghana), Iruka N. Okeke (UI, Nigeria).

## General course objectives:

The course provides an introduction to Whole Genome Sequencing (WGS) and its use in Antimicrobial resistance (AMR) surveillance.

The participant will upon completion of the course i) know what WGS is and how it can be used and ii) be able to use freely available online tools to perform simple bioinformatics analysis and interpret results.

## Learning objectives:

A participant who has met the objectives of the course will be able to:

- Describe the potential uses of WGS in public health microbiology
- Describe the different sequencing platforms and the technology behind using the correct terminology
- Plan sampling/surveillance appropriate for with WGS studies with epidemiology in mind
- Perform drag-and-drop bioinformatics using online analysis tools and interpret the results

## Content:

The course covers sampling strategies for doing WGS in AMR, sequencing terminology, detailing state-of-the-art technology including technical specifics of whole genome sequencing to give the participants a thorough understanding. Furthermore the course covers what the output data looks like, the importance of quality control and the use of online tools to analyse the data for species identification and AMR detection.

The course will comprise of lectures and hands-on exercises that the participants will have to complete and submit answers to in between course days.

## Course literature:

No literature required.

## Audience:

None and novel users.

## Day 1: Monday – 15 Feb 2021 – Why and how to bring WGS into AMR

Join Zoom for Day 1

Time (CET)	Content/Activity	Lecturer / Facilitator
08.45 – 09.00	<b>Joining the call</b> – Assistance will be provided at this time to help participants join	
09.00 – 09.15	<b>Welcome and Introduction (Live)</b>	Rene S. Hendriksen/Pernille Nilsson (DTU, Denmark)
09.15 – 09.45	[1] <b>The present and future in AMR surveillance.</b> The potential of using WGS in AMR surveillance (Pre-recorded Lecture)	Rene S. Hendriksen (DTU, Denmark)
09.45 – 10.00	<b>BREAK</b>	
10.00 – 10.30	[2] <b>Application of WGS in public health microbiology:</b> Cholera and Haiti. Genomic epidemiology of the Haitian Cholera outbreak. (Pre-recorded Lecture)	Rene S. Hendriksen (DTU, Denmark)
10.30 – 11.00	[3] <b>Taking epidemiology into account –what to sequence and how much?</b> (Pre-recorded Lecture)  <b>Note:</b> Attendants are encouraged to review the treatment guidelines for syndromes/pathogens or organisms in their country (to know what data will help clinicians and public health people in their country or region)	Alessandro Foddai (DTU, Denmark)
11.00 – 11.30	<b>BREAK</b>	
11.30 – 12.00	[4] <b>Overview of terminology and different sequencing platforms:</b> Illumina, Ion Torrent, Pacific Biosciences (PacBio), Oxford Nanopore Technologies (Pre-recorded Lecture)	Jette Sejer Kjeldgaard (DTU, Denmark)
12.00 – 12.15	<b>Q&amp;A and Wrap-up (Live)</b>	

## Day 2: Wednesday – 17 Feb 2021 – Quality control and identification/characterization

Join Zoom for Day 2

08.45 – 09.00	<b>Joining the call</b> – Assistance will be provided at this time to help participants join	
09.00 – 09.15	<b>Welcome and Introduction (Live)</b>	
09.15 – 09.45	[5] <b>Basic quality control of raw reads</b> (Pre-recorded Lecture)	Mushal Allam (NICD, South Africa)
09.45 – 10.15	[5E] <b>Exercise: Basic quality control of raw reads using FastQC.</b> A tutorial where you learn how to import, view and check the quality of a sequenced data using FastQC. (Live introduction)  Note: You will perform the exercise on your own computer and submit replies through this <a href="#">SurveyMonkey link</a> prior to Day 5.	Mushal Allam (NICD, South Africa)

10.15 – 10.30	<b>BREAK</b>	
10.30 – 11.30	[6] <b>Bioinformatics Basics:</b> General introduction to bioinformatics and introducing genome assembly. (Pre-recorded Lecture)	Marco van Zwetselaar (KCRI, Tanzania)
11.30 – 11.45	<b>Q&amp;A and Wrap-up (Live)</b>	
<b>Day 3: Friday – 19 Feb 2021 – Bioinformatics with online tools</b> Join Zoom for Day 3		
08.45 – 09.00	<b>Joining the call</b> – Assistance will be provided at this time to help participants join	
09.00 – 09.15	<b>Welcome and Introduction (Live)</b>	
09.15 – 09.45	[7] <b>Online tools 1:</b> Introduction to online tools. Kmers, MLST and serotyping of <i>Salmonella</i> and <i>E.coli</i>	Stanford Kwenda (NICD, South Africa)
09.45 – 10.00	<b>BREAK</b>	
10.00 – 10.30	[8] <b>Online tools 2:</b> CGE Online Bioinformatics Tools. SpeciesFinder, KmerFinder, ResFinder.	Sonda Tolbert (KCRI, Tanzania)
10.30 – 11.00	[9] <b>Online tools 3:</b> Presentation of online tools available for microbial identification using sequence analysis: Pathogenwatch, autoMLST, pubMLST-ribosomal MLST	Anthony Smith (NICD, South Africa)
11.00 – 11.15	[9E] <b>Exercise using online tools:</b> Participants will download sequence data and tasked to perform analysis using the presented online tools. (Live introduction). To be handed in through this <a href="#">SurveyMonkey link</a> prior to Day 5.	Anthony Smith (NICD, South Africa)
11.15 – 11.30	<b>Q&amp;A and Wrap-up (Live)</b>	
<b>Day 4: Monday – 22 Feb 2021 – Focus</b> Join Zoom for Day 4		
08.45 – 09.00	<b>Joining the call</b> – Assistance will be provided at this time to help participants join	
09.00 – 09.15	<b>Welcome and Introduction (Live)</b>	
09.15 – 10.15	[10] <b>Phylogeny:</b> construction, visualization and interpretation. Tools: Microreact (Pre-recorded Lecture)	Erkison Odih (UI, Nigeria)
10.15 – 10.30	<b>BREAK</b>	
10.30 – 11.00	[10E] <b>Exercise on phylogeny:</b> Participants will be given an exercise on phylogeny	Erkison Odih (UI), Sonda Tolbert (KCRI)

		and Ayorinde Afolayan (UI)
11.00 – 11.30	[11] <b>Genotype to Phenotype:</b> Prediction of AMR by WGS (Pre-recorded Lecture)	Jette Sejer Kjeldgaard (DTU, Denmark)
11.30 – 11.45	[11E] <b>Exercise Phenotype based on genotype:</b> Determining phenotype based on genotype. (Live introduction). To be handed in through SurveyMonkey link prior to attending Day 5.	Jette Sejer Kjeldgaard (DTU, Denmark)
11.45 – 12.00	<b>Q&amp;A and Wrap-up (Live)</b>	
<b>Day 5: Wednesday – 24 Feb 2021 – Results and Nagoya protocol</b> Join Zoom for Day 5		
08.45 – 09.00	<b>Joining the call</b> – Assistance will be provided at this time to help participants join	
09.00 – 09.15	<b>Welcome and Introduction (Live)</b>	
09.15 – 10.15	<b>Going through results from all exercises (Live)</b>	
10.15 – 10.30	<b>BREAK</b>	
10.30 – 11.00	<b>Going through results from all exercises (Live)</b>	
11.00 – 11.30	<b>BREAK</b>	
11.30 – 12.15	[12] <b>The Nagoya protocol:</b> An introduction	Carolina Dos Santos Ribeiro (RIVM)
12.15 – 12.30	<b>Q&amp;A and Wrap-up (Live)</b>	
<b>Day 6: Friday – 26 Feb 2021– Genomic surveillance</b> Join Zoom for Day 6		
08.45 – 09.00	<b>Joining the call</b> – Assistance will be provided at this time to help participants join	
09.00 – 09.15	<b>Welcome and Introduction (Live)</b>	
09.15 – 10.00	[13] <b>Practical examples of genomic surveillance</b> Presentations from five different institutions: 1. NICD, South Africa: Genomic surveillance of enteric pathogens (Anthony Smith) 2. FDA, USA: Genomic and metagenomics based surveillance of AMR in the United States under the National Antimicrobial Resistance Monitoring System (NARMS) (Errol Strain)	Intro by Rene S. Hendriksen (DTU, Denmark).  Anthony Smith (NICD, South Africa), Errol Strain (FDA, USA)
10.00 – 10.15	<b>BREAK</b>	
10.15 – 11.30	[13] <b>Practical examples of genomic surveillance cont.</b> 3. EFSA or DTU, Denmark: How surveillance is set up. 4. PGI, Africa Union/Africa CDC: Surveillance of pathogens.	Rene S. Hendriksen (DTU, Denmark), Sofonias K. Tessema

	(Sofonias K. Tessema) 5. WHO: The tricycle project (Jorge Raul Matheu Alvarez)	(Africa Union, ACDC), Jorge Alvarez (WHO)
11.30 – 11.45	<b>BREAK</b>	
11.45 – 12.30	[14] <b>Panel Discussion: Genomic Surveillance (Live)</b>  Chair(s):  Panel: <ul style="list-style-type: none"> <li>• Anthony Smith (NICD, South Africa)</li> <li>• Errol Strain (FDA, USA)</li> <li>• Rene S. Hendriksen (DTU, Denmark)</li> <li>• Sofonias K. Tessema (Africa Union/ACDC)</li> <li>• Jorge Raul Matheu Alvarez (WHO)</li> </ul>	
12.30 – 12.45	<b>Concluding remarks and close (Live)</b>	Pernille Nilsson and Rene S. Hendriksen (DTU)