COLA'S Fall Edition 2021

inSIGHTS

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LETTER FROM THE CHAIR

FALL EDITION 2021

Molecular testing has experienced explosive growth over the course of the COVID-19 pandemic. Much of this has been due to the need for highly sensitive SARS-CoV-2 detection as the country returns to work and to school, and the need for specific viral genotyping to assist public health authorities in monitoring the spread of variants of concern.

Beyond its pandemic applications, however, molecular testing is thriving and slowly edging out more traditional testing platforms by delivering highly specific and sensitive disease detection.

For example, in microbiology, molecular testing has been instrumental in identifying new and nonculturable pathogens. While culture testing is still the microbiology "gold standard," molecular methodologies are increasingly being used to identify and categorize microorganisms. Besides organism identification, appropriate molecular targets can also much more quickly detect mutations in infectious organisms that could indicate antimicrobial resistance than the traditional microbiology laboratory. This allows clinicians to select the safest and most appropriate antimicrobial drugs more quickly, which helps each individual patient and also protects future patients by minimizing the development of drug-resistant organisms.

With the addition of genomics testing to more clinical laboratories, treatment plans for oncology patients can be optimized based on their own genes and the mutations found in their tumors. Genotyping assays have also been used for chronic disease management; for example, Hepatitis C Virus (HCV) treatment plans can vary depending on the specific viral genotype as determined by the clinical laboratory.

As these technologies become more available and affordable, new molecular laboratories have a need for support and education if they are to succeed in delivering quality results. The majority of these tests are laboratory-developed, and their performance specifications and quality control measures must be carefully established. COLA continues to develop educational resources to support COLA-accredited laboratories that are considering adding molecular testing.

While we certainly hope that the need for SARS-CoV-2 testing begins to wane, the benefits of molecular technology have inspired many laboratories to take a step towards the future by investing in molecular assays. Turning these assays towards new targets will expand the impact of molecular testing in healthcare overall and will surely change the clinical laboratory in a lasting way.

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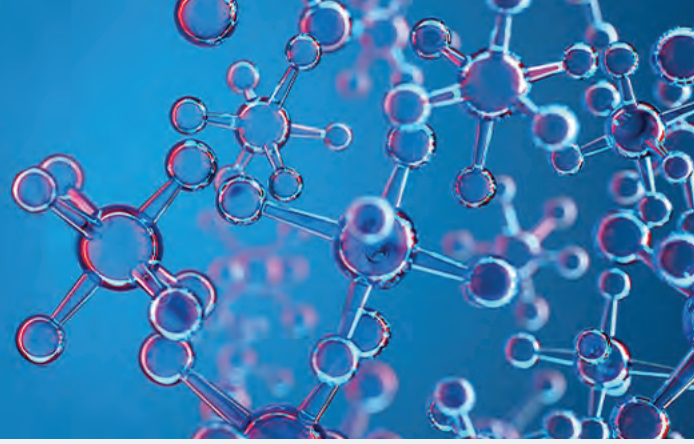
William E. Kobler, MD
Chair, COLA Board of Directors

LABORATORY PRACTICES TO ENSURE QUALITY **MOLECULAR TESTING**



By Nicole Colby, MLS(ASCP)cm, SBBcm, SCcm

Nicole Colby, MLS(ASCP)cm, SBBcm, SCcm, graduated from the University of Kansas in 2005 with a bachelor's degree in Clinical Laboratory Sciences. During the twelve years at York Hospital, Ms. Colby accepted the position of Chemistry Specialist, implemented many new instruments and assays, assisted with the implementation process of a new Laboratory Information System. She obtained Specialist Certifications in Blood Bank and Chemistry. Ms. Colby worked as a COLA surveyor, improving the quality of laboratories and the skills of those she meets. Currently, Ms. Colby is filling the role of Technical Training Specialist, and is responsible for the education of all COLA Technical Staff, as well as assisting with the creation of tools to educate laboratorians as a whole.

The number of laboratories performing molecular diagnostic testing is increasing due to the availability of supplies and equipment, knowledge, and the desire for reduced turn-around times, especially for infectious disease testing. However, careful consideration must be given to the laboratory setup, assay design, and laboratory protocols to obtain high-quality patient results.

LABORATORY WORKSPACE AND EQUIPMENT

Ensuring quality molecular test results requires that we start at the beginning – the design and use of the laboratory space. To prevent wasted time and money as well as the risk of inaccurate patient results, it's important to consider how your setup can best minimize potential nucleic acid contamination. Contamination can occur through splashes or aerosols of specimens, controls, or reagents during processing steps, and spread by laboratory equipment such as extraction instruments and pipettors (CLSI,2015). Laboratory workspaces for reagent preparation, sample preparation, and amplification must all be separate, and the flow of samples must move in one direction (unidirectional workflow). Within the separate workspaces, the use of biosafety hoods or "dead-air" boxes, as appropriate, can be useful to prevent aerosols from contaminating specimens and reagents. Each separate workspace must have its own equipment, including pipettors. Color-coding the equipment may be useful to ensure its use in only the designated area, maintaining the unidirectional workflow (CLSI,2015).

Laboratories must implement proper procedures for maintaining workspaces free of nucleic acid contamination.

This should include regularly changing gloves after each step of the workflow as well as changing lab coats when moving to a new area. All equipment and surfaces must be cleaned regularly using 10% bleach or other commercial cleaning solutions designed to degrade nucleic acid (CLSI,2011). Bleach solutions lose effectiveness over time, so should be made up regularly, and surfaces should be rinsed with water or ethanol after the bleach solution, as bleach is corrosive to equipment.

QUALITY CONTROL

The use of proper quality control can identify potential issues with testing, including the presence of contamination, specimen problems such as the presence of inhibiting substance or lack of sufficient human sample, and failed amplification.

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Therefore, every qualitative PCR assay must include a positive control, a non-template or negative control, an extraction control, and an internal control (if the lack of product amplification is a negative result) performed every run. Depending on the target selected, the internal control may also act as an extraction control.

A positive control is any sample that contains the target sequence to be identified, preferably in the appropriate biological matrix (Furtado et al, 2014) The concentration of the target nucleic acid should be near the limit of detection (LoD) for the assay to properly challenge the system and minimize the risk of contaminating other samples. A reasonable target for this is a concentration of 3x the LOD for the assay (CLSI,2015). The purpose of the positive control is to ensure the system properly amplifies any target nucleic acid that may be present. The positive control does not need to contain all targets identified by the assay, but the included target(s) should be rotated over time, so all analytes are evaluated.

The non-template control is instrumental for detecting possible contamination issues. The control is typically molecular-grade water and must undergo each step of the extraction and amplification process. Since no nucleic acid should be present, no amplification should occur in the non-template control well. The presence of amplified material demonstrates possible contamination or primer-dimer formation and invalidates the run (CLSI,2011). The non-template control is most useful when placed at the end of a run to identify contamination that could have occurred in previous pipetting steps (Burd,2010).

The internal control identifies possible problems at the individual sample level. This control can either identify a target added to the sample during processing (exogenous) or a target that is always present in the original sample, such as a gene from human cells (endogenous). The presence of substances that inhibit amplification can be identified as the internal control will fail to amplify.

Samples with a failed internal control can then be re-extracted to try to obtain acceptable results, or recollected.

Endogenous internal controls also have the advantage of demonstrating the presence of the human material, which can be useful to identify a properly collected specimen instead of a plain swab (Burd,2010).

Lastly, it is important to ensure the assay's extraction step properly extracts nucleic acids from the samples. Depending on the material used, the positive control or internal control could demonstrate successful extraction if the target to be identified is present in an intact cell (Burd,2010).

COMPETENCY ASSESSMENT

Evaluating testing personnel's ability to perform an assay properly is vital in all laboratories, including those performing molecular testing. Adhering to proper protocols and maintaining good techniques is critical to molecular testing, and so a good competency assessment process should include a comprehensive direct observation of testing. This includes observing that unidirectional workflow is maintained, laboratory protocols for mitigating nucleic acid contamination such as regularly changing gloves are strictly followed, and manual pipetting is performed accurately.

QUALITY ASSESSMENT

A well-rounded Quality Assessment (QA) plan is important for all clinical laboratories. While a molecular laboratory should still perform general QA activities such as review of rejected specimens, review of quality control records, and assessment of turn-around times, some important, molecular-specific QA activities should be considered. Monitoring shifts or trends in cycle threshold (Ct) values of positive and/or internal controls across runs can be helpful to identify early problems with test systems (CLSI,2011). New lots of critical reagents should be evaluated using quality controls or previously tested samples before placing them into use. By evaluating new reagent lots, the laboratory can be assured that the new reagents do not have initial contamination and can demonstrate the same level of performance as previous lot numbers (CLSI,2015).

Molecular laboratories also must monitor for signs of potential environmental contamination. The use of a non-template control with each run is important but should not be the only strategy. Surveillance testing using wipe tests is good laboratory practice to identify the presence and source of contamination. Different surfaces in the laboratory are swabbed then tested to identify the presence of nucleic acids. Positive results in the wipe test indicate contamination in the laboratory, which must be resolved (CLSI,2011). Additionally, the percent positivity of the laboratory's assays can be monitored. An increased or decreased percentage of positive results for an assay could also indicate contamination or other test system issues and requires investigation (CLSI,2015).

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GENOMIC TESTING
SIGNIFICANCE OF PRIVACY POLICIES

By Sindhu Kommareddy, MS, Pharm D

Sindhu Kommareddy, MS, Pharm D is a graduate from pharmacology & toxicology programs with an abundance of knowledge of epidemiology, biostatistics, pharmacotherapeutics, pharmacovigilance, and pharmacology with hands-on experience in the use of various data analytical tools such as Excel, SAS, Minitab. Sindhu works as a Lab Manager and Toxicology Supervisor at SV Diagnostic Lab.

With the increased popularity of genomic testing among larger populations, more and more people are opting to know about their genetic profiles. Such testing has become so favorable that prenatal screenings are also being done to detect changes in fetus genes or chromosomes even before birth for potential hereditary genetic disorders. However, with increased testing comes the burden of increased safety of genomic data, and not many people are aware of their rights to protect genetic information. Moreover, to keep this data safe and secure, informaticists, lab technologists, and physicians must be knowledgeable about security threats and privacy regulations which will help build trust between the patient and the health care providers.

WHAT IS A GENE?

A gene is the basic physical and functional unit of heredity, and they are made up of DNA. Some people may have changes in the DNA sequence which is called a mutation. A mutation can affect how the body works. Genes are like instructions telling the body how to function, grow and develop (NSW,2021).

WHAT IS A HEREDITARY GENETIC DISORDER?

A genetic disorder occurs when one or more genes are altered. If this genetic alteration is passed on to offspring, then it is a hereditary genetic disorder. These disorders are transmitted in the same family. Sometimes genetic testing is considered medically necessary to establish a molecular diagnosis to determine if the family members are at immediate risk of inheriting a disease.

WHAT IS GENETIC TESTING AND WHY IS IT IMPORTANT?

Genetic (DNA) testing is a medical test that identifies changes in genes, chromosomes, or proteins (US. National Library of Medicine,2021). DNA testing is a powerful tool to gauge a patient's risk of disease.

This testing will help to:

- Identify genetic alterations that are causing a condition
- Predict risks for specific conditions
- Help families to understand a condition, access support and plan for the future
- Helps to find the best treatment, screening or therapy for you or your child.
- Earlier detection, which increases the chance of a successful outcome (Virginia Oncology Associates,2021)

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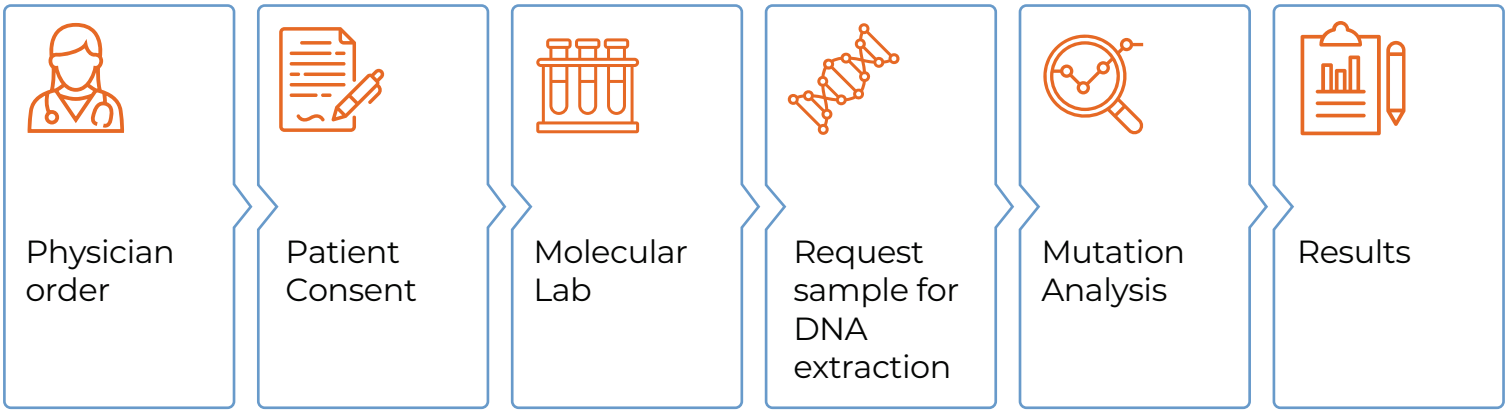
HOW IS A GENOMIC TEST DONE?

Once you decide to have genomic testing, a healthcare provider will order a gene test. A sample will be collected and sent to the molecular laboratory to find out about your gene. Results will be sent back to the health care provider.



HOW IS MY GENOMIC INFORMATION PROTECTED?

Health Insurance Portability and Accountability Act (HIPAA) is the most effective privacy policy (Cucoranu, I. et al, 2013). Results and genomic information from the test will be stored securely using a security system that meets the requirements of HIPAA.

Major security elements include:

- **Prevention of unauthorized access to patient's medical records (confidentiality)** (Cucoranu, I. et al, 2013)
- **Prevention of unauthorized alterations or loss to data (integrity)** (Cucoranu, I. et al, 2013)
- **Prevention of compromises to availability of data to authorized individuals** (Cucoranu, I. et al, 2013)

WHAT IS HIPAA PRIVACY RULE?

The U.S. Department of Health and Human Services (HHS) issued the Privacy Rule to implement the requirement of the Health Insurance Portability and Accountability Act of 1996 (HIPAA). The privacy policy standards address the use and disclosure of people's health information, referred to as "Protected Health Information" by organizations subject to the Privacy Policy (Covered Entities), as well as the standards for privacy rights of individuals to understand and control how their health information is used (HHS,2021).

A key objective of the Privacy Policy is to ensure that people's medical information is adequately protected while allowing the flow of medical information necessary to provide and promote quality healthcare and protect the health and well-being of the public (HHS,2021). The rule creates a balance that allows for meaningful use of information while protecting people's privacy, seeking care and healing (OCR,2021).

The HIPAA security standards final rule mandate administrative, physical, and technical safeguards to ensure the confidentiality, integrity, and security of ePHI (Cucoranu, I. et al, 2013). Electronic health records (EHRs) provide a valuable way to manage complex medical information; as such, EHRs will become established in the future to manage the large and complex datasets that accompany genetic/genomic tests and interpretations (Cucoranu, I. et al, 2013).

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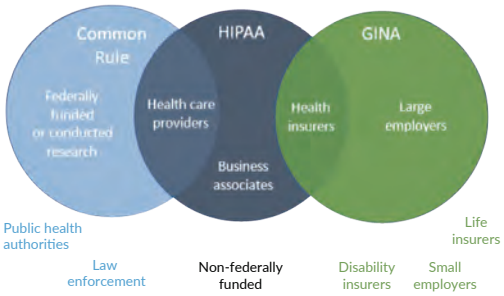
HIPAA OMNIBUS RULE

The Department of Health and Human Services (HHS) issued an omnibus final rule in 2013. On October 7, 2009, the Department published a notice of proposed rulemaking to strengthen the privacy protections for genetic information under the HIPAA Privacy Rule by implementing the protections for genetic information required by Genetic Information Nondiscrimination Act (GINA). Before the passage of the 2013 HIPAA Omnibus Rule, genetic information was not explicitly included in the HIPAA regulations' definition of protected health information (PHI) (Compliancy Group,2021). With the passage of the Omnibus Rule, genetic information is now explicitly included in the definition of PHI. As such, covered entities must implement safeguards under the HIPAA Privacy Rule to prevent unauthorized use or disclosure of HIPAA genetic information (OCR, 2021).

The GINA of 2008 is a federal law prohibiting discrimination in health coverage and employment based on genetic information (Office for Human Research Protections, 2021). GINA, together with already existing nondiscrimination provisions of the Health Insurance Portability and Accountability Act (HIPAA), generally prohibits health insurers or health plan administrators from requesting or requiring genetic information of an individual or the individual's family members or using it for decisions regarding coverage, rates, or preexisting conditions (Office for Human Research Protections, 2021). The law also prohibits most employers from using genetic information for hiring, firing, or promotion decisions and any decisions regarding terms of employment (Office for Human Research Protections, 2021).

To whom do the main federal laws apply?



WHY IS GENETIC PRIVACY IMPORTANT?

An individual Gene or DNA is unique, and people often consider it as private. A human genome is the single most crucial piece of information which an individual possesses. Following characteristics of genetic/genomic test information makes it more important to have genetic privacy (McGuire, A. L., 2008)

- Uniqueness
- Predictive Capability
- Immutability
- Requirement of testing
- Historical misuse
- Variability in public knowledge and perspectives
- Impact on family
- Temporality

Genetic information associated with personal identifiers is generated and used in various contexts that may or may not be related to health (e.g., clinical genetics, direct-to-consumer (DTC) testing, and forensics). Genetic information is an essential clinical tool in an increasing number of medical specialties, including clinical genetics, oncology, obstetrics, neurology, pediatrics, and behavioral health (Clayton, E. W. et al, 2019). As more genetic information is obtained, collected, stored, used, and disclosed by physicians and molecular laboratory facilities, the likelihood of privacy, confidentiality, and security breaches increases. Some scenarios where such breaches may occur include the following (Clayton, E. W. et al, 2019).

- Healthcare providers share or access genetic information without the authority or legitimate need to see it
- The amount of genetic information obtained and disclosed exceeds what is necessary for a legitimate health purpose
- Genetic information is used for a purpose unrelated to the disclosure.

Each of these and many other situations in the clinical setting raise essential legal and ethical questions. While people often worry about discrimination when their health information is leaked beyond medical care (Clayton, E. W. et al, 2019). In health care, peoples' main concerns are the protection of their privacy, dignity, and independence. While these concerns may seem abstract or indirect, many people consider them very important, and concerns about these issues often affect a patient's behavior and health outcomes, such as when patients restrict the disclosure of confidential information to their providers to defend their privacy (Clayton, E. W. et al, 2019).

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HOW CAN A MOLECULAR LAB BE HIPAA COMPLIANT?

The workflow in the molecular laboratory depends on the use of the laboratory information system, which collects, generates, analyzes, stores, and manages Electronic Protected Health Information (ePHI) (Cucoranu, I. et al, 2013). In addition to LIS, laboratories are likely to store ePHI in software that runs laboratory instruments and automation lines. Therefore, it is critical in molecular practice to ensure that the data contained in the laboratory software remains protected and secure at all times (Cucoranu, I. et al, 2013). Accordingly, security policies and procedures must be in place and enforced in the laboratory. Following HIPAA administrative, physical, and technical safeguards will help us secure PHI.

ADMINISTRATIVE SAFEGUARDS

Security Management Process
Identify and analyze potential risks to e-PHI and must implement security measures.

Assigned Security Responsibility Workforce Security
Designate a security official who is responsible for developing and implementing lab security policies and procedures.

Information Access Management
Implement policies and procedures for authorizing access to e-PHI

Security Awareness and Training
Implement periodic security reminders, password management, Log-in monitoring

Security Incident Procedures
Develop a plan for incident response and repositing

Contingency Plan
Develop data backup plan, disaster recovery plan, emergency mode operation plan

Evaluation
Implement periodic technical and non-technical evaluations

Business Associate Contracts and Other Arrangements
Written contracts

PHYSICAL SAFEGUARDS

Facility Access Controls
Limit physical access to its facilities while ensuring that authorized access is allowed

Workstation Use
Implement policies and procedures to specify proper use of and access to workstations and electronic media

Workstation Security
Restrict access to authorized users

Device and Media Controls
Implement policies and procedures regarding the transfer, removal, disposal, and re-use of electronic media

TECHNICAL SAFEGUARDS

Access Control
Implement technical policies and procedures that allow only authorized persons to access electronically protected health information (e-PHI)

Audit Controls
Implement hardware, software, and/or procedural mechanisms to record and examine access and other activity in information systems that contain or use e-PHI

Integrity
Implement policies and procedures to ensure that e-PHI is not improperly altered or destroyed

Person or Entity Authentication
Implement authentication step prior to granting access

Transmission Security
Implement technical security measures (Encryption, Integrity control)

The responsibility of assuring that patient data in the molecular laboratory remains private and secure rests with the physicians, molecular lab technologists and other health care providers, ideally working closely with their information services division. As we look to the future and explore our quest to provide quality and efficient genomic testing, it is essential to follow privacy policies and keep that trust and faith of the patient unblemished.

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VALIDATING YOUR MOLECULAR TESTING POST-PANDEMIC

By : Lauren Albrecht, MPH, MLS(ASCP)cm

Lauren Albrecht has six years of clinical laboratory experience, where she spent most of that time working in the blood bank at University Hospitals in Cleveland, Ohio. She received an MPH in epidemiology at Kent State University to help supplement her Medical Laboratory Scientist certification. Currently, she is a COLA surveyor, where she has been educating and assisting laboratories to follow CLIA regulations for the past three years in the Midwest and East Coast areas of the country.

The COVID-19 pandemic led many laboratories to investigate the feasibility of validating and implementing PCR assays to help with the massive amounts of testing needed to help minimize the spread of the SARS-CoV-2 virus in their communities. Laboratories equipped with the qualified personnel and space adopted molecular assays obtained from the Food and Drug Administration's (FDA) In Vitro Diagnostics Emergency Use Authorization (EUA) list. But during the summer of 2021, when the incidence of COVID-19 started to decrease as vaccination rates increased, this left many laboratories trying to figure out how best to use their newly acquired capabilities.

Although a few molecular methods have been fully approved by the FDA, laboratories that have brought in manual extraction kits and PCR analyzers for their SARS-CoV-2 assays will still need to create a laboratory developed test (LDT) method if they use these systems for other assays that are not on the EUA list. Any testing method that the laboratory decides to use, regardless of the manufacturer's purchased materials, will require a full LDT validation if that specific method has not been granted FDA approval. It will also be important to ensure that staff performing the testing have been adequately trained on the new methods and are capable of producing high-quality results.

The laboratory director will need to consider what type of molecular assay to offer. Many laboratories new to molecular and microbiology testing are offering various pathogen panels. Your laboratory can bring in a Urinary Tract Infection (UTI) Panel or a Respiratory Pathogen Panel (RPP) that tests for a range of bacterial, fungal and viral pathogens as well as antimicrobial resistance markers, all in one sample. Such panels can be run in a fraction of the time it typically takes for a culture to grow. Due to the popularity of these pathogen panels, this article will focus specifically on the validation of microbiology panels.

Determining what organisms to include in these panels is the first decision to be made, and this should be done in consultation with the laboratory's Clinical Consultant.

Once the panel targets have been selected, primers and probes for these targets can be ordered from a manufacturer. Repurposing the same instrumentation used for your COVID PCR testing, your laboratory is now ready to begin the LDT validation process. A laboratory implementing an LDT is required to complete a full validation study to establish the accuracy, precision, sensitivity, specificity, reportable range, and reference range of the assay, along with any other performance characteristics required for test performance (C.F.R,2009).

A good validation study will incorporate the use of whole organisms, as this is how these organisms are found in human specimens. Obtaining the organisms that will be detected on your panel helps to prove your assay will work with actual patient samples. Another requirement of any LDT validation is to validate the entire method being used from start to finish. For example, if your laboratory is performing an extraction step on patient specimens, you must include the extraction phase in the validation. Whole organisms must be added to the sample matrix, and these created samples will be taken through the entire testing method, including extraction, amplification, and analysis. Successful validation results ensure that the extraction kit obtains adequate genetic material with the organisms you want to be detected and that your primers and probes accurately detect the nucleic acids that have been extracted.

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Before performing any testing for your validation study, ensure there is a complete, written, and approved validation plan that will detail the following metrics: accuracy, precision, sensitivity, specificity, carryover, stability, and in semi-quantitative cases: reportable range. The validation plan should summarize the specifics of the materials used in the study (including the organisms used and their source), the setup for each study and how it will be performed, and a definition of the acceptance criteria for each parameter. When a surveyor reviews your plan, they should be able to tell exactly what was in your validation samples, how the samples were tested, how the data was evaluated, and what specific criteria the results were compared with to demonstrate that the study was successful. In addition, your laboratory director will need to approve a procedure for the test or test panels. The procedure needs to incorporate detailed instructions for all testing personnel and all the specifics of your assay including but not limited to:

- samples in use
- extraction kit detailed information
- procedures to avoid contamination
- primers and probes that are to be used along with their storage requirements
- amplification platform and analysis software to be used

Concerning accuracy and precision, a minimum suggested sample size would be to run a positive and negative sample five times over a period of five days. It is important to have sufficient data points to be comfortable with the repeatability of the assay. Accuracy will be assessed by ensuring that all samples that should be a positive result as positive and that the negative samples all test negative. A target for assay precision, such as an acceptable coefficient of variation (CV) for positive samples' cycle threshold (Ct) values, must be set must be set prior to beginning validation. The target CV may be assay-specific.

Regarding sensitivity, you will want to determine the lowest amount of whole organism your assay can detect.

Consider starting with a known concentration of an organism and titrating it out to determine the lowest concentration (e.g., copies/µL, CFU/mL) that can be accurately detected. The lowest concentration that can be accurately detected over multiple runs will become the limit of detection (LOD) for this assay.

Specificity must be assessed to ensure the primers and probes used in the assay will only detect the target organisms to be identified and nothing else. An in silico study can be used to ensure that the purchased primers and probes will not bind to any other genetic material that could be in your patient samples. A good in silico study will use large public databases of known genetic sequences to make sure the primers and probes purchased will not cross-react with anything else. This information should be readily available as part of your validation summary, as your surveyor may request to see the results. It may also be beneficial for your laboratory to perform additional specificity studies to confirm that there is no cross-reactivity within your own testing environment. Consider performing an N-1 study. An N-1 study entails evaluating each individual assay with a sample containing all targets in the panel with the exception of the target being tested for. This will ensure that those organisms will not create a false positive for the target organism deliberately excluded from the sample.

Specificity testing also includes the evaluation of interfering substances. Interfering substances to be evaluated should be matrix-specific. Urine specimens may contain blood, pyrimidine, lubricants, or spermicide, for example. Respiratory specimens could contain saline, sinus spray, blood, or menthol rub. Blood and heparin are notorious for causing inhibition problems in molecular assays. The laboratory can create mock patient samples using whole organisms and add one interfering substance to each mock sample to see if the organisms can still be accurately detected.

A carryover study is vital when evaluating any extraction methods, because it can detect the potential for contamination in this step of the process. The laboratory should set up a testing plate in a checkerboard pattern for each extraction method that alternates controls and samples – preferably with a high concentration of target material - with blank wells in between. The extraction method will be verified when the blank wells do not detect any product.

The last parameter to be evaluated is specimen stability. It is important to determine how patient samples are to be collected, stored, and transported. The laboratory is responsible for performing the necessary testing to determine how long and under what conditions samples remain viable. For this study, use as many real organisms on your panel as possible with concentrations about two times the LOD. It will be important to make sure that the Ct values, over time and the manner of storage, do not change drastically as this could lead to a change in the final result of the test. This is why using a concentration near the LOD is very important in this study.

If the laboratory decides to perform a semi-quantitative panel to determine a low, mid, or high concentration of organisms in a UTI panel to help determine treatment for the patient based on Ct values given, a reportable range study will need to be performed. This study can be conducted by creating samples at the CFU/mL ranges that will be your low, mid, and high cutoff levels and then running those levels multiple times to see your average Ct value for each cutoff. Acceptable coefficient of variation (CV) for the Ct values at each of these ranges must be set prior to performing this study.

Lastly, it is important to include several testing personnel in the validation process as this demonstrates acceptable results can be obtained in real-world conditions and can be used as part of the training process. With good preparation, the laboratory can be assured that high-quality results can be obtained, and that patients are provided with the best care the laboratory can provide.

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LABORATORY ENRICHMENT FORUM

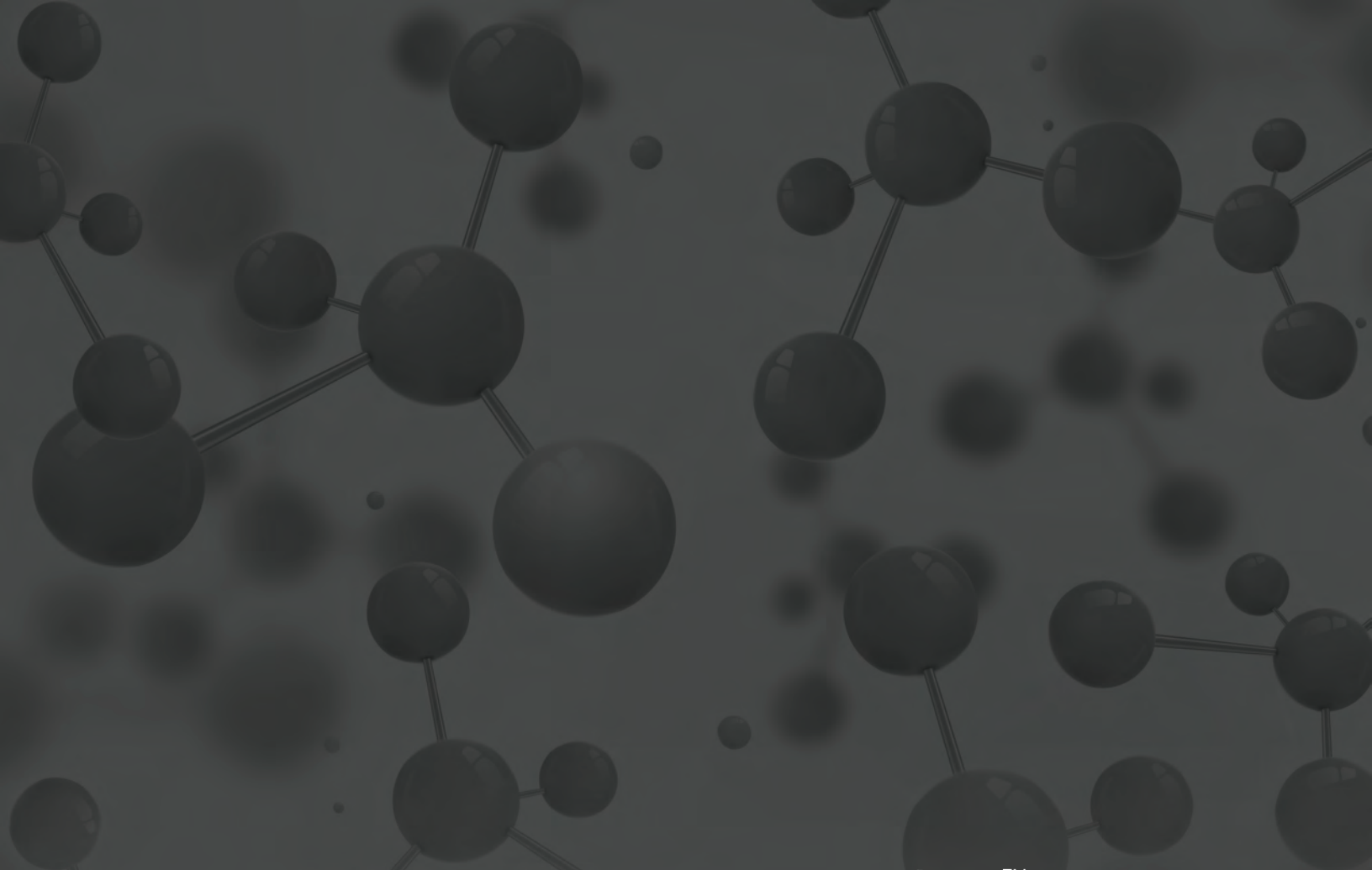
CHARLOTTE, NORTH CAROLINA

COLA's Annual Laboratory Enrichment Forum will provide an engaging opportunity to share ideas with a diverse group of professionals committed to the highest quality in laboratory services. Some of the brightest minds in the industry will share their perspective on the latest developments in laboratory science, along with the essentials of CLIA compliance and accreditation.

Who Will Attend

- Laboratory Directors
- Managers
- Supervisors
- Technical Consultants
- Testing Personnel
- Quality Managers
- Regulatory Experts

FOR MORE INFORMATION email learn@cola.org or visit cola.org/forum



OUR COMMITMENT TO YOU

We are a physician-directed accreditation organization dedicated to quality, education and safety in laboratory medicine for the promotion of public health.

ABOUT COLA:

For more than 30 years, COLA's accreditation program has provided an extra pair of eyes for laboratories striving to produce quality test results. COLA is also the only provider of a laboratory accreditation program with quality-engineered processes certified to ISO 9001. This means our customers benefit from unique services that are standardized and represent a commitment to customer satisfaction. Just as importantly, COLA provides materials to guide successful completion of inspections and adherence to regulations; and has a dedicated staff of subject matter experts steered by a coaching approach.