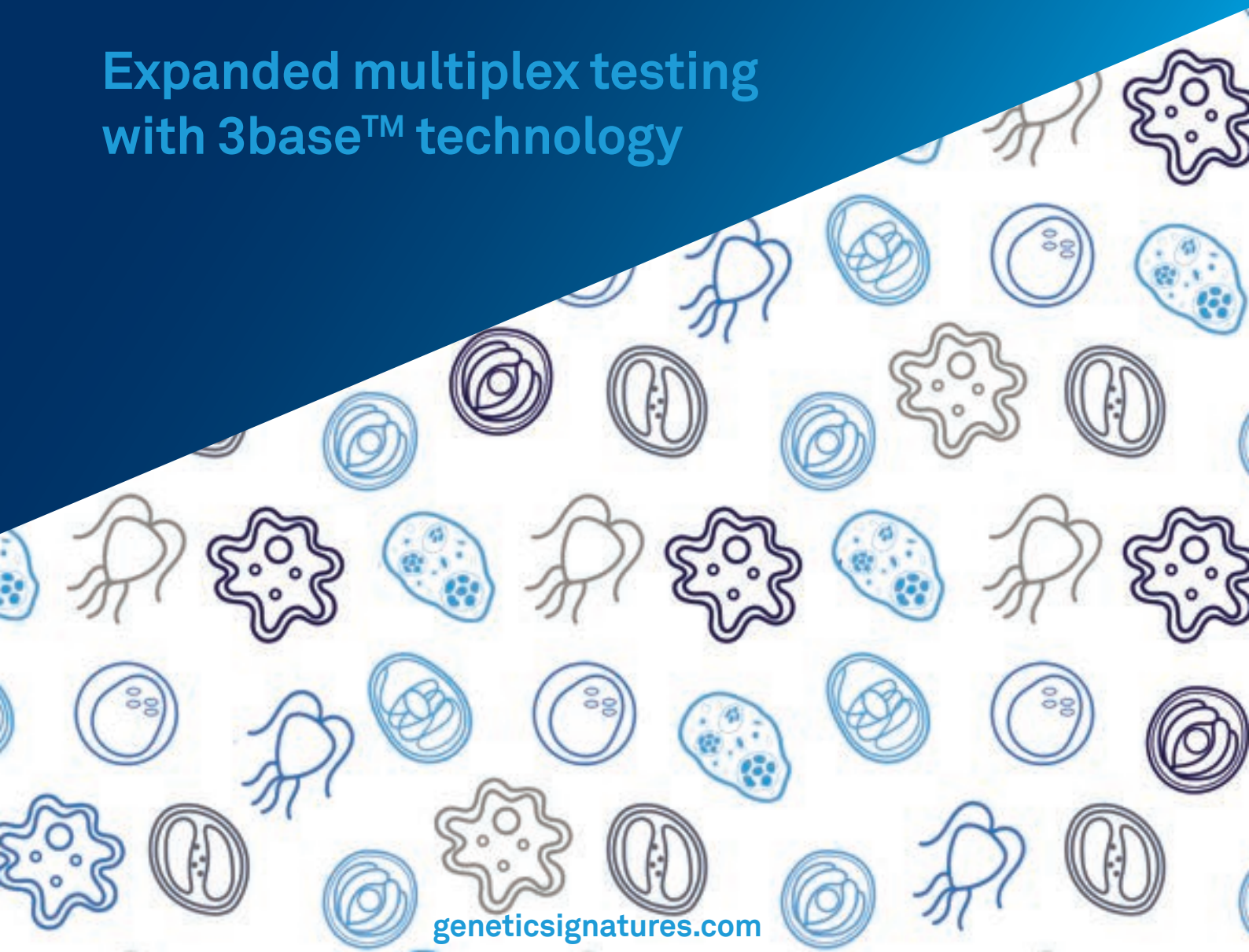
Genetic Signatures
Transforming Molecular Diagnostics

FDA 510(k) cleared

EasyScreen™ Gastrointestinal Parasite Detection Kit and automated workflow

A comprehensive FDA 510(k) cleared molecular solution for gastrointestinal parasites

Expanded multiplex testing with 3base™ technology



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Diagnostic & clinical challenges for detecting and treating gastrointestinal parasites

Each year, over 3.5 billion people worldwide are infected with GI parasites, resulting in over 200,000 deaths and significant health and economic burdens. It is estimated that there are approximately 65 million cases of parasitic GI infections in the US per annum with only 15% presenting to medical professionals[1-10]. The incidence of gastrointestinal parasites in the US remains a public concern. Local cases are often linked to contaminated water, food or surfaces. Additionally, GI parasites can be acquired during international travel or through intra family-transmission, with asymptomatic cases playing a significant role in spreading infection[10-12].

Diagnostic challenge

Traditionally, GI parasites have been identified by the detection of trophozoites or cysts by microscopic examination of stool samples, using a range of staining techniques. This process is categorized as highly complex, time-consuming, labor-intensive, and requires highly trained and experienced staff[1,11].

Physicians are not always aware of the requirement to order specific staining tests (such as for *Cyclospora* spp.), leading to misdiagnosis, extended disease and under-reporting of infections.

Misdiagnosis is further impacted by microscopy's low test sensitivity (<50%) due to sporadic shedding of cysts into stool, which require multiple tests on alternative days to achieve >90% test sensitivity. However, most laboratories only receive a single sample due to low patient compliance. This challenge also impacts immunoassay testing methods[13].

Traditional testing for gastrointestinal parasites

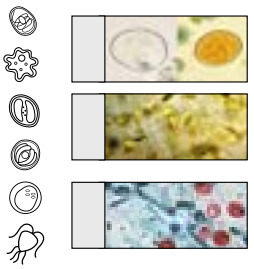
1 sample = ~50% accuracy

2* samples = ~70% accuracy

3* samples = ~90% accuracy

* Requires 3 samples separated by 3-4 days to achieve higher test accuracy, due to sporadic shedding of parasite / ova. However, laboratories often receive only one sample due to low patient compliance

Multiple testing requirements



- Recommend 3 samples per patient
- Often 2-3 slides per sample
- **= 6-9 slides per patient**

- Only 1 patient tested at a time
- 3 patient samples needed
- Up to 9 tests per patient
- Low specificity and sensitivity
- Detects commensals & artifacts
- Highly laborious & complex test
- Manual interpretation required
- Longer time to result, sometimes days / weeks

Treatment challenge

Treatment of GI parasite infections is challenging due to parasite diversity and their specific treatment requirements, despite causing common symptoms. Misdiagnosis can lead to ineffective treatment. In addition, misuse or overuse of anti-parasitic drugs can lead to the development of antimicrobial resistance. Thus, timely and accurate detection of parasitic pathogens can support appropriate patient management and improve health outcomes.

Symptoms	Gastrointestinal parasite	Anti-parasitic treatment
Common set of symptoms from all GI parasite infections include: • Abdominal pain • Diarrhea • Greasy stools • Nausea or vomiting • Gas or bloating • Dysentery • Fatigue • Weight loss	*Giardia duodenalis*	Metronizadole, tinidazole, nitazoxanide
	Cryptosporidium spp.	Nitazoxanide (some patients)
	Entamoeba histolytica	Metronizadole, tinidazole
	Cyclospora cayetanensis	Trimethoprim-sulfmethoxazole
	Dientamoeba fragilis	Nitaoxanide (no established guidelines)
	Blastocystis hominis	Albendazole
	Enterozytozoon bieneusi	Lodoquinol (US), secnidazole, ornidazole
	Encephalitozoon intestinalis	Metronizadole, tinidazole

Syndromic testing for 8 clinically significant gastrointestinal parasites **in a single test**

EasyScreen™ Gastrointestinal Parasite Detection Kit & automated workflow

Detect with Precision, Treat with Confidence

Cleared for supply in the US (FDA 510(k)),
Europe (CE-IVD) and Canada (Health Canada)

- 8 leading clinically relevant parasites targeted in a single test
- Automated multi-batch workflow performs sample extraction & PCR setup for 1 to 60 samples (480 parasite tests) / run
- Increased sensitivity & specificity compared to traditional methods
- User friendly, wizard-driven interface & automated results interpretation - no 'technical' laboratory experience needed
- Automated processes provide significant walk away time
- Reliable workflow, with global customer support on hand

- ***Giardia lamblia / intestinalis***
- ***Cryptosporidium* spp.**
- ***Entamoeba histolytica***
- ***Cyclospora cayetanensis***
- ***Dientamoeba fragilis***
- ***Blastocystis hominis***
- ***Enterocytozoon bieneusi*** } **Microsporidia**
- ***Encephalitozoon intestinalis*** } **Microsporidia**

3base™ advantage for parasite detection

Simplify to amplify!

Patented technology simplifies the genetic code for more efficient pathogen detection

Publications & resources

International Journal of Molecular Sciences
2023, 24, 13387

The Application of 3base™ Technology to Diagnose Eight of the Most Clinically Important Gastrointestinal Protozoan Infections

Free on-demand webinars
Advances in Gastrointestinal Parasite Testing

Featuring leading parasitologists: Prof. David Bruckner, Prof. Marc Couturier, Lynne Garcia, Dr. Damien Stark & Dr. Susan Madison-Antenucci

Advantages of 3base™

3base™ technology, unique to Genetic Signatures, chemically converts all cytosine (C) bases into thymine (T), so that Cs disappear from the native 4-base nucleotide sequence altogether, resulting in 3-base sequence of only As, Ts and Gs. This conversion significantly reduces the complexity of the genetic code and provides many advantages for multiplex PCR detection of infectious diseases.

1,048,576
sequence combinations for a 10 digit number with **4-base**

59,049
sequence combinations for a 10 digit number with **3base**™

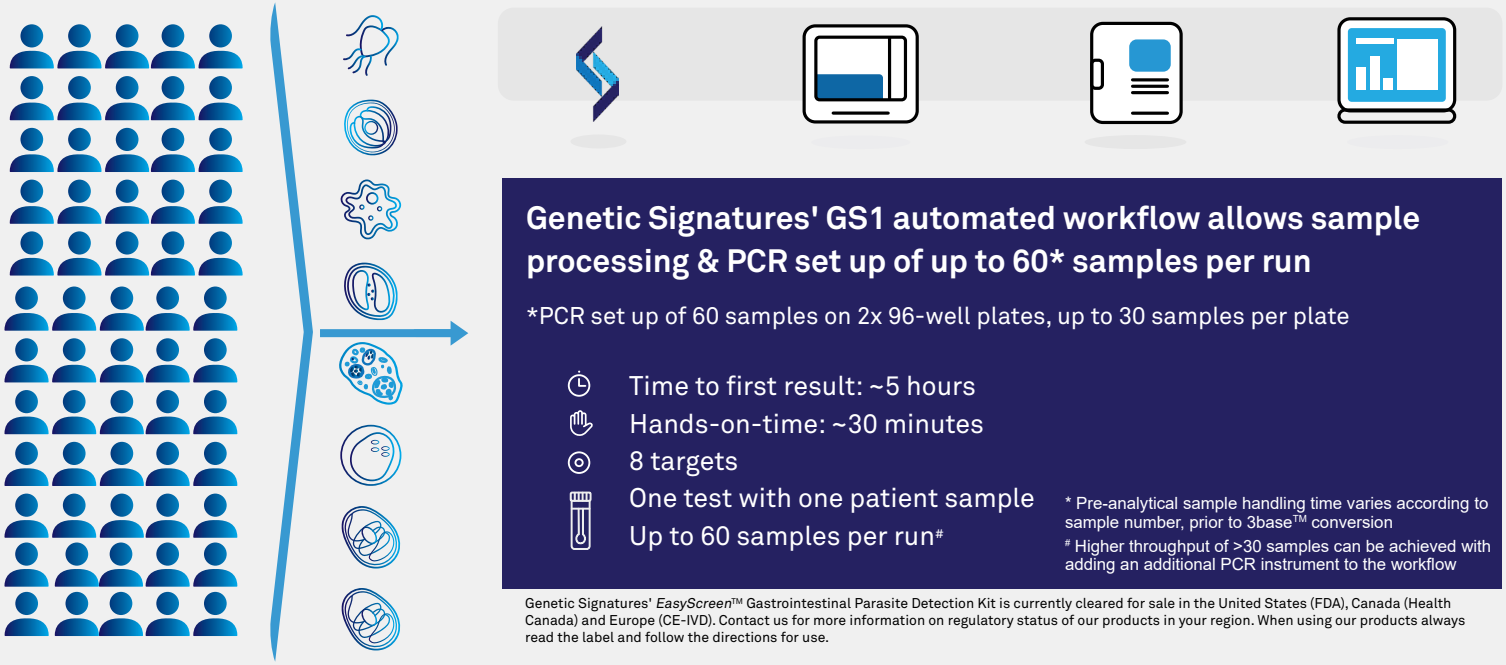
- **Simplified** with more efficient multiplex PCR
  - Fewer primers, less competition, and more harmonized PCR conditions
  - Reduced G-C content with 3base™ conversion improves PCR performance for G-C rich pathogens
- **Simplified** with uniform sample processing conditions
- **Unique sample processing method is more efficient at lysing difficult pathogens such a parasites**
- **Simplified** for use in any laboratory with reduced contamination risks in routine microbiology labs
  - 3base™ converted samples are not affected by native 4 base sequence contamination

A simple, automated workflow

Genetic Signatures' molecular workflow for gastrointestinal parasite detection

Up to 60 patient samples, for the detection of 8 leading parasites, in a single test!

Testing 1-60 patient samples in a single workflow | 8 GI parasite targets | Sample lysis & 3base™ conversion | Sample processing & PCR setup (1–60 samples) | Real-time PCR | Analysis



Genetic Signatures' GS1 automated workflow allows sample processing & PCR set up of up to 60* samples per run

*PCR set up of 60 samples on 2x 96-well plates, up to 30 samples per plate

- Time to first result: ~5 hours
- Hands-on-time: ~30 minutes
- 8 targets
- One test with one patient sample
- Up to 60 samples per run#

* Pre-analytical sample handling time varies according to sample number, prior to 3base™ conversion

Higher throughput of >30 samples can be achieved with adding an additional PCR instrument to the workflow

Genetic Signatures' *EasyScreen*™ Gastrointestinal Parasite Detection Kit is currently cleared for sale in the United States (FDA), Canada (Health Canada) and Europe (CE-IVD). Contact us for more information on regulatory status of our products in your region. When using our products always read the label and follow the directions for use.

A simplified, intuitive, user-friendly workflow

Reagent and sample traceability through barcode enabled software

Automated sample processing & PCR set up

The GS1 workflow delivers minimal processing and PCR set up time with maximized walkaway time for up to 60 samples

Easy to use & with flexibility to run multiple runs in a single day

Intuitive, user-friendly graphical wizard software provides a visual step-by-step operation and trouble shooting guide

Multiplex PCR detection, validated on leading PCR instruments

The eulate plate is removed from the GS1 system and loaded into the PCR machine. At this time, a new batch of samples can be loaded for extraction on the GS1, allowing an overlapped workflow.

Simplistic results calling & interpretation

Supported by positive and negative controls for confidence in results interpretation and easy upload to LIS software

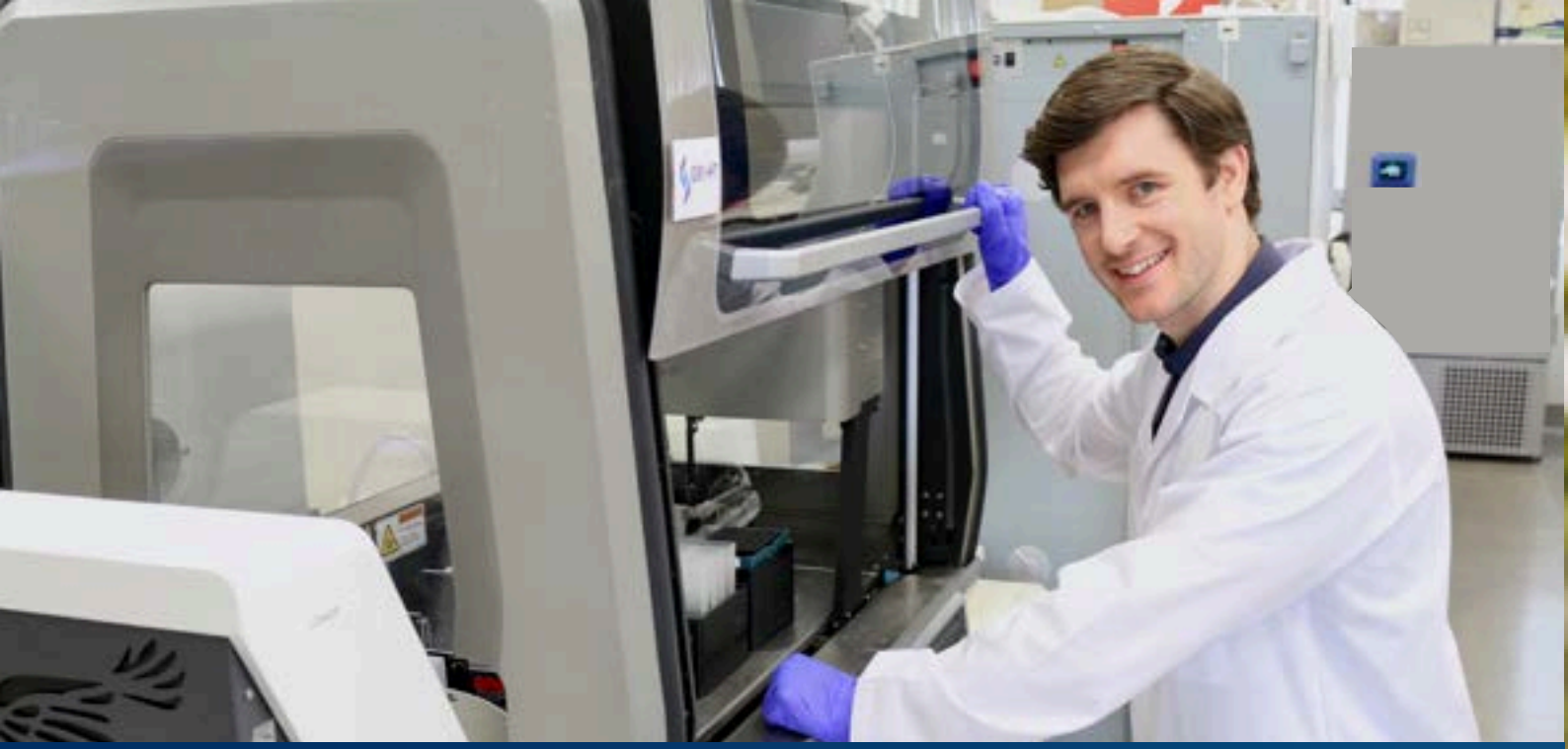
Benefits of employing Genetic Signatures' automated molecular solution for parasite testing

Feature	Traditional Microscopic Ova & Parasite (O&P) Examinations	*EasyScreen*™ Gastrointestinal Parasite Detection Kit & automated workflow	
Number of tests required	Multiple — repeats for negative results	Single test — positive and negative controls	✓
Patient samples that can be processed	One at a time	1-to-60 in a single batch	✓
Test reliability	Staining unreliable and varied performance with one sample	Testing – controlled and reproducible with one sample	✓
Test Accuracy	Many false negatives - ~55% sensitivity with one sample	Significantly improved sensitivity and specificity from a single sample	✓
Pathogen coverage	Not all pathogens tested or reported, also non-pathogenic identified	Tests for 8 most clinically relevant pathogens	✓
Duplicate testing	Testing 3x samples is recommended but low patient compliance	Only one sample required – high sensitivity	✓
Labor required	Extensive hands-on time - ~90 min for 10 tests (so technically 2 patients)	Minimal ~30 min — many automated steps for up to 60 patient samples in a single workflow	✓
Turnaround time	Many days to weeks	Same day reporting	✓
Training & experience	Requires highly skilled, experienced staff	No specialized experience or training required	✓
Need to outsource	Often outsourced due to high test complexity and level of skills and labor required	Ability to bring testing back in house	✓
Workplace injury	Repetitive stress injuries, sore back and neck from microscope work	No overly repetitive work with minimal hands on time required	✓
Profit margin	Often almost neutral or negative[6,11]	Higher throughput and capability to bring assays in house	✓

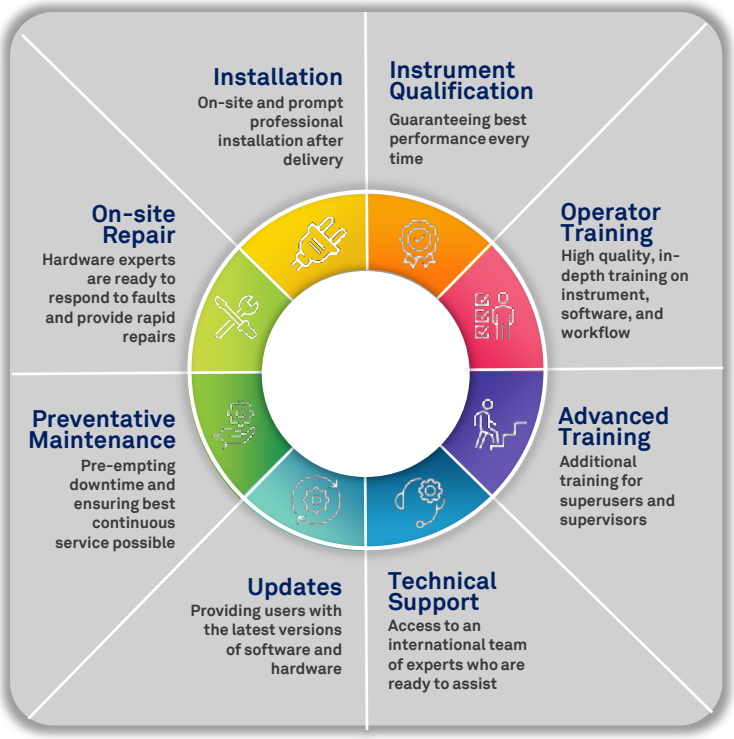
Visit geneticsignatures.com to watch the 3-part webinar series on the "Advances in Gastrointestinal Parasite Testing" and hear from 5 leading parasitologists about the benefits of employing molecular diagnostics solutions.

> "The majority of diagnostic parasitology testing is categorized as high complexity, requiring a high level of interpretation & judgment – particularly related to microscopy."
>
> **Lynne Garcia, MS, FAAM, CLS, BLM**

> "Molecular detection for common gastrointestinal protozoa is the logical progression of testing, especially given the ever-increasing volumes of traditional O&P testing and the decreasing workforce and proficiency labs are experiencing."
>
> **Marc Couturier, Ph.D., D(ABMM)**



Excellence in customer service and support



We are here to support you!

- Our mission is to provide exceptional technical service and support to our customers by delivering reliable, efficient, and responsive service solutions.
- We are committed to understanding and addressing our customers' needs, resolving technical issues promptly and effectively, and continuously improving our skills and knowledge.
- We strive to build long-term relationships with our customers based on trust, integrity and superior service delivery.

Access to your local and global team

- Field Application Scientists (FASs) and Field Service Engineers (FSEs) deliver all on-site service and support to you and your laboratory.
- Remote access is also available with a range of communication resources to support you.

> *"The support provided by the [Genetic Signatures] team was exceptional. They were available at short notice to solve various issues during the start-up process and offered their support at every stage. They are quick to respond to queries and often check to ensure things are working according to plan."*
>
> ***Specialist Biomedical Scientist,***
> ***The Royal Marsden NHS Foundation Trust***

Transforming Molecular Diagnostics

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