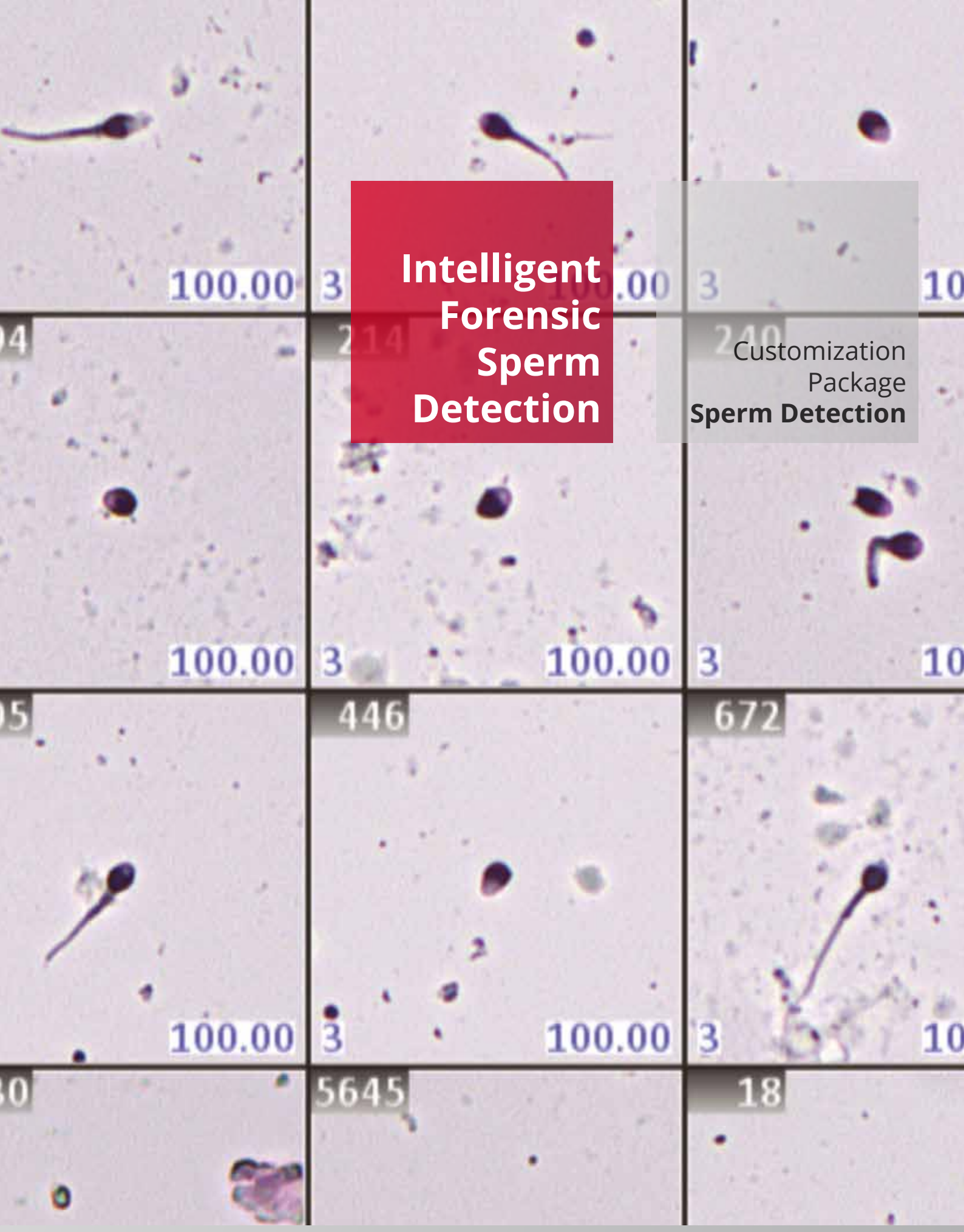


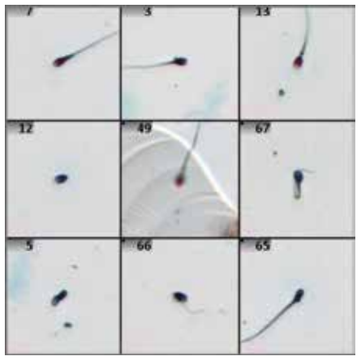
Intelligent Forensic Sperm Detection

Customization Package
Sperm Detection

MetaSystems

METAFER CUSTOMIZATION PACKAGE

SPERM DETECTION



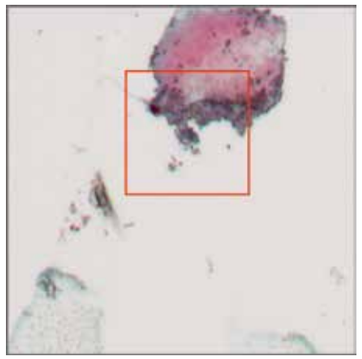


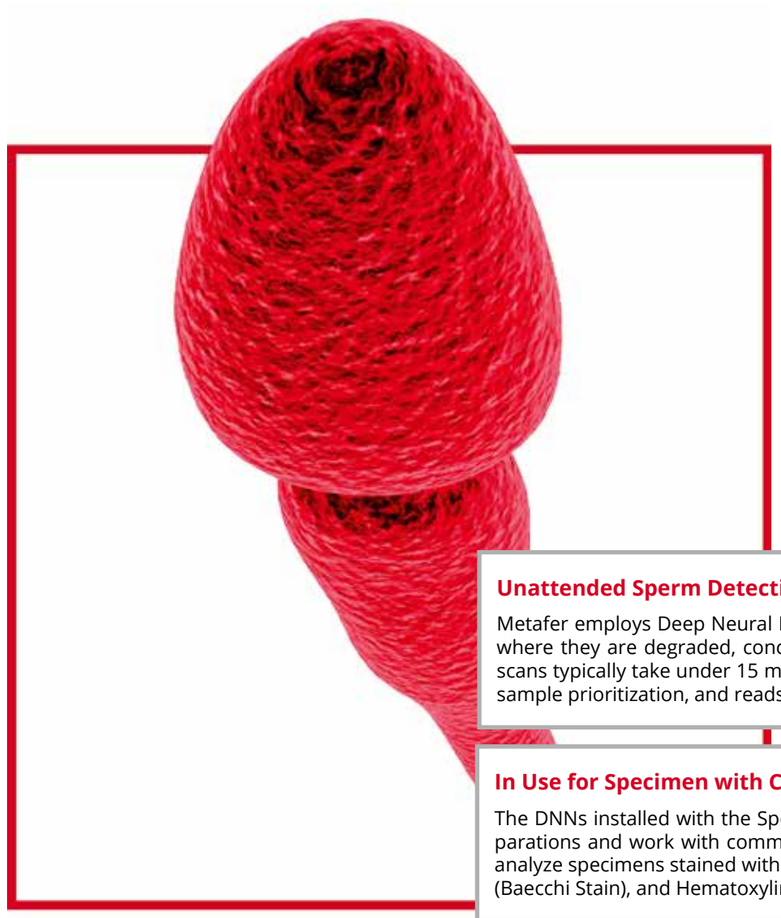
Image Left: Gallery of detected spermatozoa in Metafer.

Image Right: Cryptic sperm cell detected with Metafer.

Sperm cell identification serves as a widely utilized forensic analytical technique in the examination of sexual offenses. Nevertheless, manually detecting sperm cells in a sample proves to be a laborious and intricate task. Furthermore, this method is notably time-consuming and challenging to standardize. Consequently, numerous forensic laboratories around the globe suffer from a backlog of cases, hindering timely processing.

To address these challenges, automated sperm detection through microscope-based systems is often considered a viable solution. This approach has the potential to efficiently overcome the aforementioned issues, allowing for the immediate evaluation, assessment, and documentation of crucial evidence.

In response to this need, MetaSystems has put together a workflow incorporating Deep Neural Networks (DNN) technology within the Metafer scanning software. This customization has the potential to speed up and simplify sperm detection in forensic examinations.



METAFER-BASED SPERM DETECTION

YOUR BENEFITS

Unattended Sperm Detection in Forensic Samples with Artificial Intelligence

Metafer employs Deep Neural Networks (DNN) to identify sperm cells in forensic samples, even in cases where they are degraded, concealed beneath other materials, or lacking their tails. Standard specimen scans typically take under 15 minutes. Metafer supports unattended searches on up to 800 slides, allows sample prioritization, and reads barcodes.

In Use for Specimen with Christmas Tree Stain, Baecchi Stain, and H&E

The DNNs installed with the Sperm Detection Customization Package are trained with thousands of preparations and work with commonly used staining methods. They are applied in routine forensic labs to analyze specimens stained with Nuclear Fast Red/PIC (Christmas Tree Stain), Acid Fuchsin/Methylene Blue (Baecchi Stain), and Hematoxylin/Eosin (H&E Stain).

Easy Reviewing, Swift Relocation, and Coordinate Transfer

Metafer, configured with the Sperm Detection Customization Package, generates gallery images for each object, including quality scores and exact coordinates on the slide. These scores aid in sorting during review, and a single click retrieves objects under the microscope, with coordinates easily transferred to external microdissection systems.

Comprehensive Documentation, and Protection of Parameters and Data

Recognizing the sensitivity of forensic work, Metafer, with the Sperm Detection Customization Package, treats data with utmost care. Neon, the integrated case and data management technology in Metafer, ensures traceability, multi-level user accounts, and guards against unauthorized changes to settings and data.

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METAFER-BASED SPERM DETECTION

MAGAZINES

Metafer supports the SlideFeeder x80 slide frame changer, featuring magazines that accommodate 16 frames, each holding 5 slides (for a total of 80 slides).

A fully equipped device has 10 magazines and a bar code reader. The portable magazines can be easily taken to the workbench for loading.

FEEDER MODULE

The SlideFeeder x80's rotating module delivers slide frames to the Metafer-supported motorized stage.

The device operates unattended and is configured for continuous 24/7 operation, incorporating intelligent sample prioritization.

MICROSCOPE

A high-precision, research-grade, fully motorized microscope with a stepping motor stage allows for accurate recording and relocation of identified objects.

- **Magnification:** 20x
- **Illumination:** Transmitted light LED
- **Focus:** Intelligent autofocus and focus stacking option

CAMERA

The CoolCube 4 cameras recommended by MetaSystems are designed with excellent imaging and automation in mind.

The cameras provide seamless automated integration with the Metafer software enabling optimal performance.

SOFTWARE

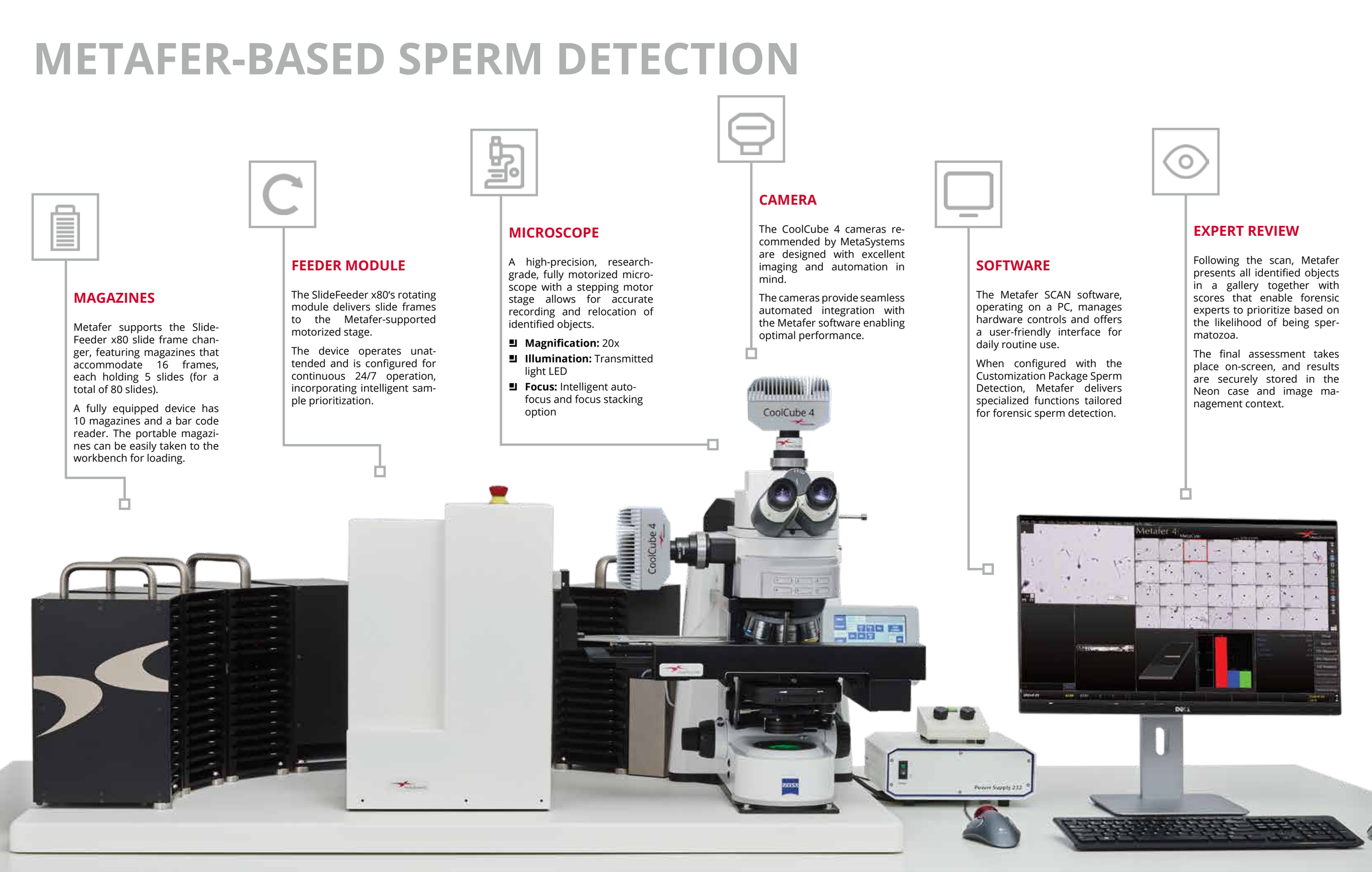
The Metafer SCAN software, operating on a PC, manages hardware controls and offers a user-friendly interface for daily routine use.

When configured with the Customization Package Sperm Detection, Metafer delivers specialized functions tailored for forensic sperm detection.

EXPERT REVIEW

Following the scan, Metafer presents all identified objects in a gallery together with scores that enable forensic experts to prioritize based on the likelihood of being spermatozoa.

The final assessment takes place on-screen, and results are securely stored in the Neon case and image management context.



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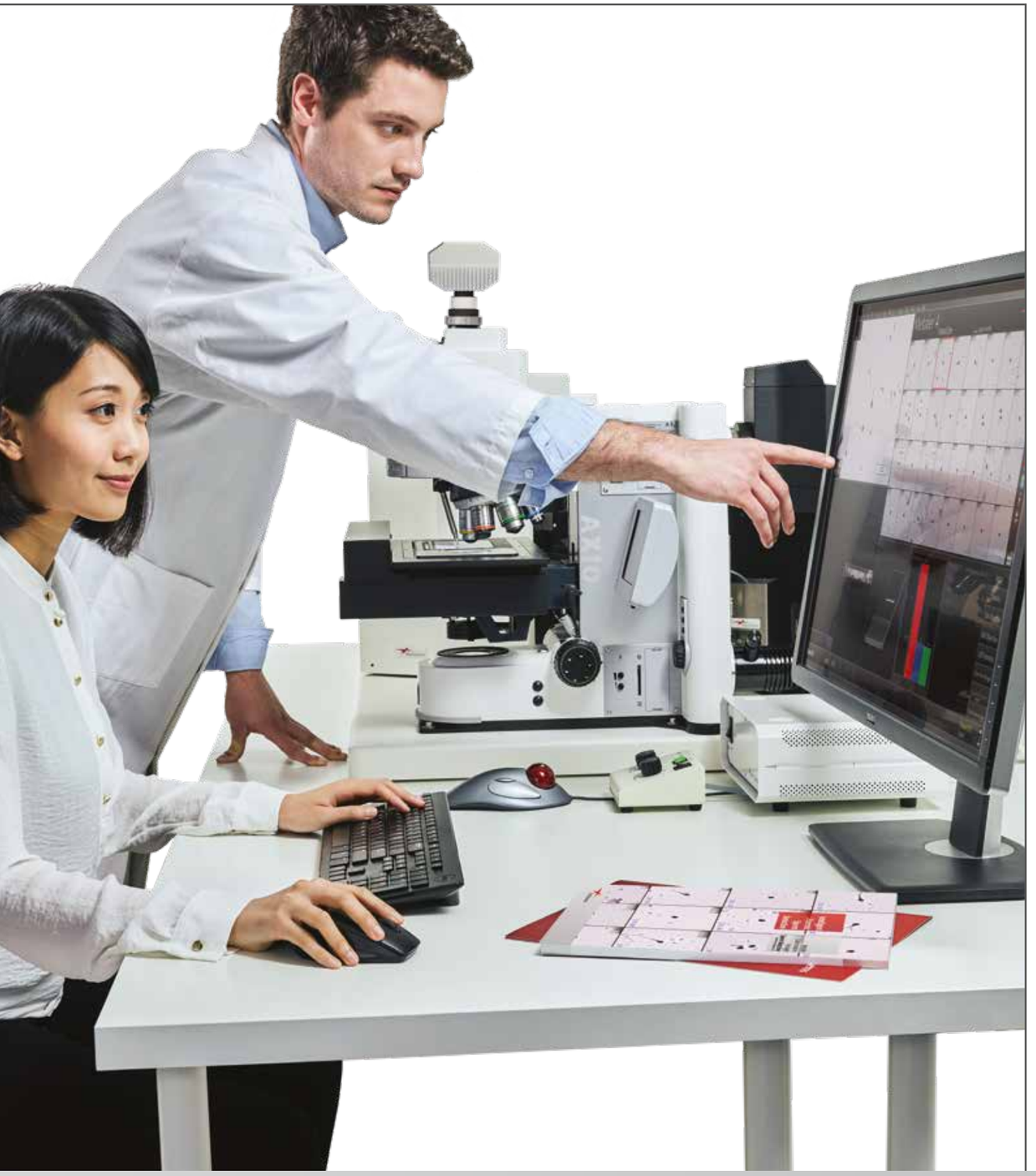
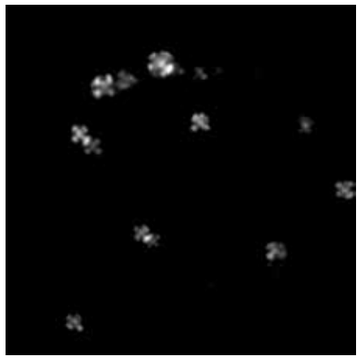


Image Right: Starch granules are indicators of condom use. In polarized light, they can be automatically detected.

Image Far Right: Neon's security settings allow the Metafer SpermFinder DNN to be thoroughly and reliably protected against unauthorized access.



Scalability

Systems operated by Metafer and configured with the Customization Package Sperm Detection can be tailored to suit laboratories of diverse sizes. Various supplementary options are accessible for small, medium, and large-scale facilities.

Should continuous 24/7 microscopy operation and the capability to prioritize time-sensitive slides become necessary, MetaSystems offers an automated slide feeder for microscope integration. This enables the scanning of slides without the need for manual intervention, allowing for overnight or weekend operations. A Metafer installation has a flexible capacity ranging from 8 (without slide feeder) or 80 up to 800 slides (with slide feeder), making it ideal for users engaged in high-throughput applications.

Documentation

Conventional microscopy offers minimal capacity for documenting results. However, with a Metafer-controlled fully automated imaging system, this limitation is overcome.

Forensic findings represent sensitive information that may need to be presented in a legal setting. A thorough documentation encompassing all captured images, processing stages, and outcomes ensures the ability to substantiate one's conclusions at any given moment, offering a heightened level of security.

Another significant benefit that should be duly acknowledged is the implementation of the dual control principle. When all data is consistently accessible in digital format, seeking a second opinion from another expert in moments of uncertainty becomes readily achievable. Moreover, experts can remotely access data through a variety of secure network options facilitated by Metafer, designed to prevent unauthorized access.

Versatility

The Metafer product family is designed with a modular approach, enabling the use of different Customization Packages on the same instrumentation. This versatility allows for the application of the exact setup for tasks like, for instance, imaging of starch granule in polarized light or the digitization and documentation of various specimens, including tissue sections.

Neon management technology efficiently consolidates all findings under a unified header, typically a case, study, or specimen number, ensuring continuous accessibility for authorized users. Neon is both secure and adaptable, allowing for the inclusion of additional content, attachment of digital documents, and the creation of customized, digitally signed reports summarizing the findings.

In larger laboratories, the option to delegate case review and results editing to separate workstations is available, with Neon overseeing data security throughout the network.

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The described functions are not intended for diagnostic use.

MetaSystems software provides, among other functions, features to assist users with image processing. These include, but are not limited to, the use of machine and deep learning algorithms for pattern recognition. The output generated in this process should be regarded as preliminary suggestions and, in any case, mandatorily requires review and assessment by trained experts.

MetaSystems offers **Customization Packages** for application workflows that have been successfully implemented for customer labs using standard Metafer platform functionality. It is expected that they can be implemented for other customer labs using similar workflows and slide preparation procedures. If a Customization Package is purchased, MetaSystems product specialists will - based on their experience from other similar application cases - support the customer lab in adapting the Metafer software configuration to their needs. The performance of the solution will depend on the quality of the customer slides and the expertise of the users, MetaSystems cannot specify or guarantee any performance parameters. The validation of the solution for clinical use is the sole responsibility of the customer lab.

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