Medical technology | Medical imaging | Technology offer

Marker-free chromosome screening

Field of application

Prenatal diagnosis is playing an increasingly important role for future parents. Today, women become pregnant later in life and therefore opt for prenatal diagnosis to recognize possible genotype damage (e.g. trisomy 21) at an early stage. Furthermore, there are families that know of a genetic predisposition and want to be informed of a possible illness. Chromosome analyses are performed on different levels. Changes in both the number of chromosomes and their structure (caused e.g. through translations) are examined. In addition to prenatal diagnosis, there are the methods of postnatal chromosome analysis and preimplantation analysis. The variety of methods indicates a growing demand for quick, easy to perform and safe methods for karyotyping.

State of the art

The current state of the art method for visualization of chromosome bands is to stain the chromosomes with methylene blue (giemsa staining). This and similar methods, e.g. FISH (fluorescent in situ hybridization) and SKY (spectral karyotyping), require time consuming staining. Moreover, the quality of the results depends on the degree of condensation and chromosome spreading. These methods are thus prone to error. Consequently, repeated staining or double staining is frequently necessary.

Innovation

Researchers at Reutlingen University have succeeded in developing a label-free method that allows for the characterization of metaphase chromosomes through both their chemical properties (absorption) and their morphological properties (stray light). The multivariate analysis algorithm for spectral imaging enables the recognition of spectral key factors (interference patterns) that are substantiated through local differences in the refraction index, variations in layer thickness or the geometrical alignment of stray light centers. For chromosomes, interference patterns are very distinct - similar to a fingerprint - and can be correlated with the DNA and the percentage of protein in the chromosomes. Measurement can be carried out in visible light, with a spectrometer that can easily and inexpensively be built into a standard microscope.
The results can be verified through the FISH method. Classification of the chromosomes can be demonstrated with a prototype. The method may also be combined with the use of an optical near-field microscope. Through chromosome scanning with different wavelengths, spectral characterization of the bands on chromosomes becomes more precise.
This, in turn, leads to a higher resolution of the bands and sub-bands (30 nm). Using this method, no staining is required for unambiguous identification of the chromosomes.

Your benefits at a glance

- ✓ Label-free technology
- ✓ Easy to use, quick and inexpensive
- ✓ No special training required
- ✓ Can be integrated into all imaging methods (e.g. microscopy)
- ✓ May be combined with high-resolution methods

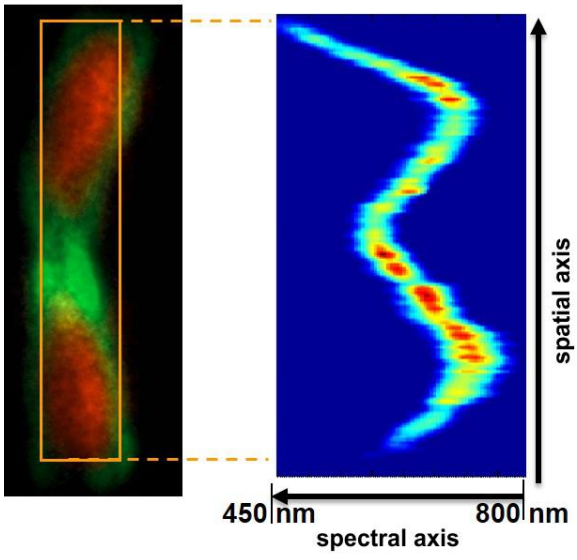

Figure 1: Microscopic image of a chromsome (left) and the corresponding marker-free, spectroscopic image of interfering stray light (right). The spectra include global interference (the chromosome's size and morphology) and local interference (banding pattern). Thus, they can be classified chemically as well as morphologically.

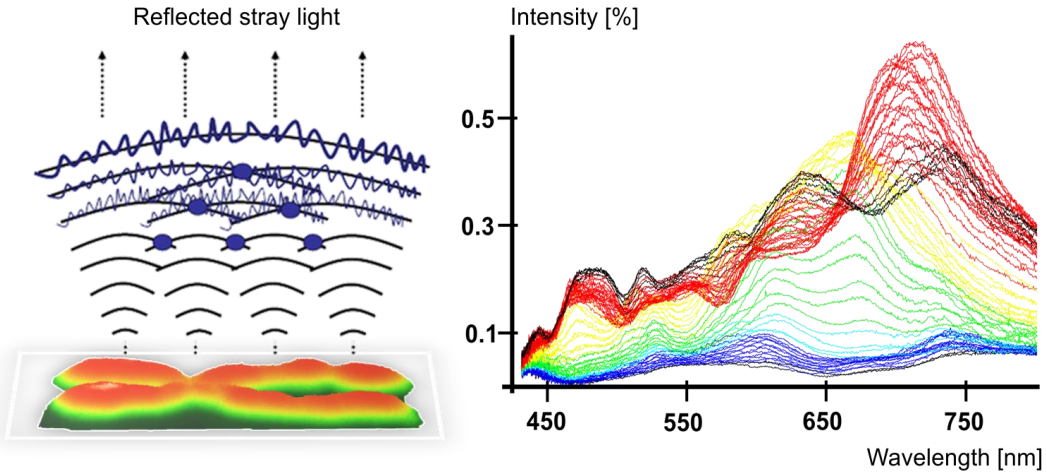

Figure 2: Interference spectra of an unstained chromosome

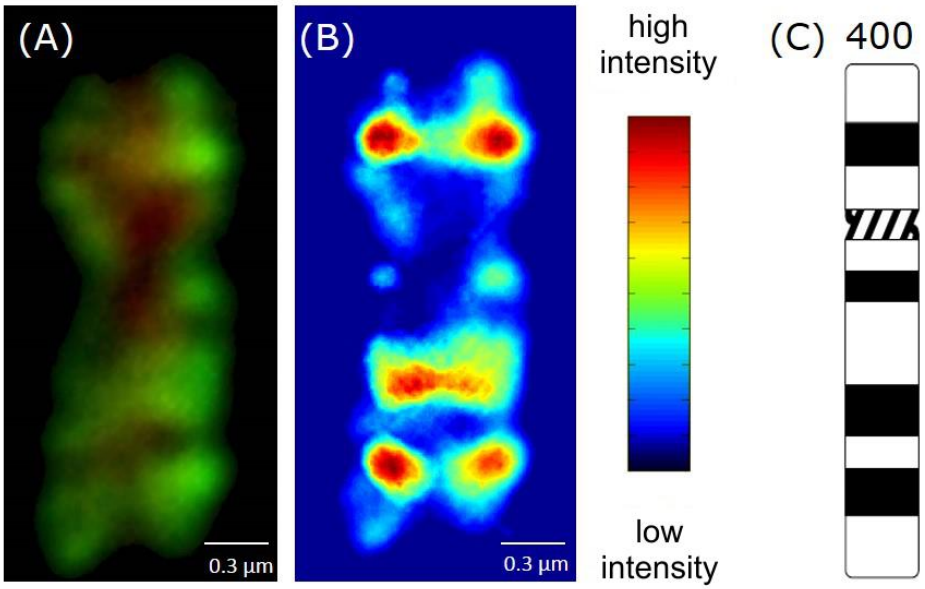

Figure 3: Depictions of the same chromosome: (A) microscopic image,
(B) visualization obtained by spectroscopic measurement of stray light with corresponding intensity scale and
(C) schematic of the chromosome.

Technology transfer

Technologie-Lizenz-Büro GmbH is responsible for the exploitation of this technology and assists companies in obtaining licences.

Patent portfolio

Patents granted in Germany, France, Great Britain and the United States.

Contact

Anne Böse, Business Development
boese@tlb.de
Technologie-Lizenz-Büro (TLB)
der Baden-Württembergischen Hochschulen GmbH
Ettlinger Straße 25, D-76137 Karlsruhe
Tel. +49 (0)721 79004-0, Fax +49 (0)721 79004-79
www.tlb.de

Reference number: 044/07TLB