Was ist Genommedizin?

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Genetik vs. Genomik

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Genetik umfasst die Untersuchung **bestimmter, in ihrer Anzahl begrenzter Gene** oder Teile von Genen mit **bekannter Funktion**.

Genomik bezeichnet die Untersuchung der **Gesamtheit aller Gene eines Organismus**, d.h. des sogenannten **„Genoms“**. Mit Hochleistungsrechnern und speziellen mathematischen Techniken (Bioinformatik) werden dabei umfangreiche DNA-Sequenzdaten nach **Veränderungen durchsucht, die sich auf Gesundheit, Krankheit oder Medikamentenansprechen auswirken**.

https://www.jax.org/personalized-medicine/precision-medicine-and-you/genetics-vs-genomics

Medizinische Genetik

WIKIPEDIA
The Free Encyclopedia

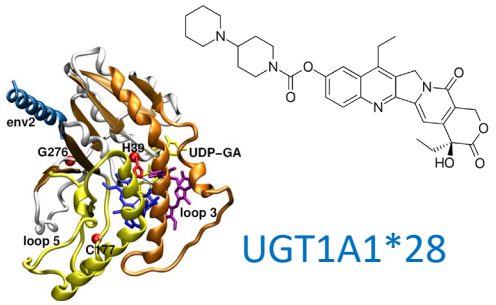
Die **medizinische Genetik** ist der Zweig der Medizin, der sich mit der **Diagnose und Behandlung von Erbkrankheiten** befasst. […] Genetische Medizin ist ein neuerer Begriff für medizinische Genetik.

https://en.wikipedia.org/wiki/Medical_genetics

Phenylkenoturie

Erblicher Brustkrebs

Irinotecan



Darmkrebs

Definition

National Human Genome Research Institute

Die **Genommedizin** ist eine aufstrebende medizinische Disziplin, die die **Nutzung genomischer Informationen in der klinischen Versorgung** (z.B. für diagnostische oder therapeutische Entscheidungen) zum Gegenstand hat.

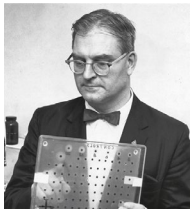
Genommedizin hat bereits große Bedeutung für **Onkologie, Pharmakologie, Seltene Erkrankungen und Infektionskrankheiten**.

https://www.genome.gov/health/Genomics-and-Medicine

Entwicklung

1866
Mendelsche
Regeln

1953
DNA
Struktur



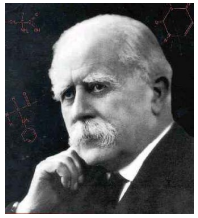
1961
Guthrie-
Test

1973
DNA
Klonierung

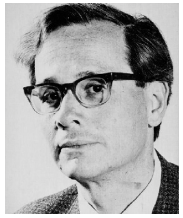
1983
PCR

2005
NGS

2009
WES

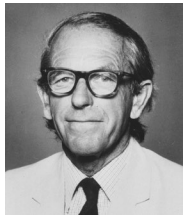


1902
Alkaptonurie



1956
Sichelzell-
Anämie

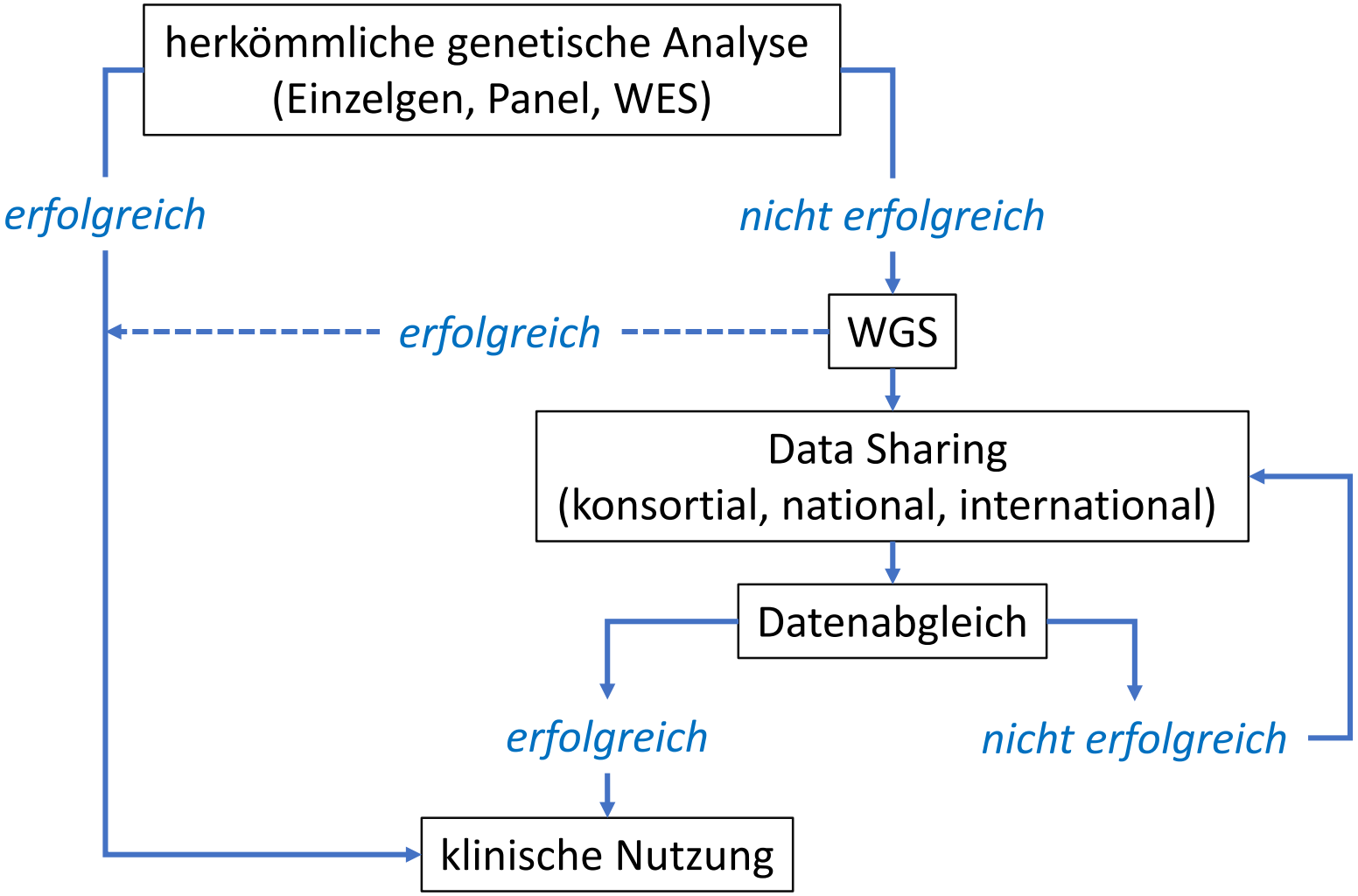
1968
Restriktions-
Enzyme



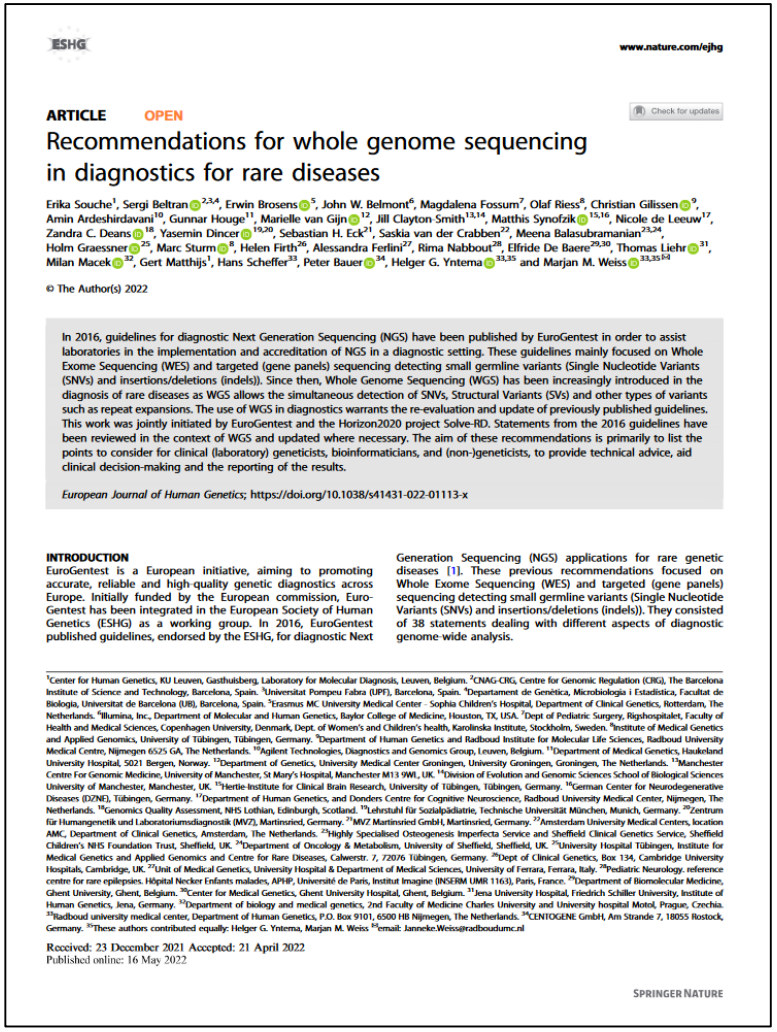
1977
Sanger
Sequenzierung

1990-2003
Human-
Genomprojekt

Use Case (generisch)



Eckpfeiler (1)



ESHG

www.nature.com/ejhg

ARTICLE OPEN

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Recommendations for whole genome sequencing in diagnostics for rare diseases

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In 2016, guidelines for diagnostic Next Generation Sequencing (NGS) have been published by EuroGentest in order to assist laboratories in the implementation and accreditation of NGS in a diagnostic setting. These guidelines mainly focused on Whole Exome Sequencing (WES) and targeted (gene panels) sequencing detecting small germline variants (Single Nucleotide Variants (SNVs) and insertions/deletions (indels)). Since then, Whole Genome Sequencing (WGS) has been increasingly introduced in the diagnosis of rare diseases as WGS allows the simultaneous detection of SNVs, Structural Variants (SVs) and other types of variants such as repeat expansions. The use of WGS in diagnostics warrants the re-evaluation and update of previously published guidelines. This work was jointly initiated by EuroGentest and the Horizon2020 project Solve-RD. Statements from the 2016 guidelines have been reviewed in the context of WGS and updated where necessary. The aim of these recommendations is primarily to list the points to consider for clinical (laboratory) geneticists, bioinformaticians, and (non-)geneticists, to provide technical advice, aid clinical decision-making and the reporting of the results.

European Journal of Human Genetics; https://doi.org/10.1038/s41431-022-01113-x

INTRODUCTION

EuroGentest is a European initiative, aiming to promoting accurate, reliable and high-quality genetic diagnostics across Europe. Initially funded by the European commission, EuroGentest has been integrated in the European Society of Human Genetics (ESHG) as a working group. In 2016, EuroGentest published guidelines, endorsed by the ESHG, for diagnostic Next Generation Sequencing (NGS) applications for rare genetic diseases [1]. These previous recommendations focused on Whole Exome Sequencing (WES) and targeted (gene panels) sequencing detecting small germline variants (Single Nucleotide Variants (SNVs) and insertions/deletions (indels)). They consisted of 38 statements dealing with different aspects of diagnostic genome-wide analysis.

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SPRINGER NATURE

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Eckpfeiler (2)

1

Einführung der WGS in die Diagnostik zur **relevanten Verbesserung von Qualität, Effizienz oder diagnostischem Ertrag**

2

Durchführung von diagnostischer WGS nur in **akkreditierten Laboren**

8

Ausrichtung diagnostischer WGS auf die **Beantwortung der klinischen Frage**

11

Analyse und Mitteilung **extra-exomischer Varianten** nur, wenn diese (wahrscheinlich) pathogen sind

14

Übermittlung von Varianten an breit zugängliche (föderierte, nationale, internationale) Datenbanken

Eckpfeiler (3)

20

Validierung der Bioinformatik-Pipelines, regelmäßig und bei relevanten Änderungen

25

Sicherstellung der **langfristigen Speicherung aller relevanten Daten**

31

Implementierung eines Protokolls für den **Umgang mit Zusatzfunden**

32

Angebot zur genetischen Beratung und Einholung einer **Einverständniserklärung** vor Durchführung einer diagnostischen WGS

36

Forschungsnutzung diagnostischer WGS-Daten nur mit angemessener informierter Einwilligung der Betroffenen

TMF Workshop

Genomic Medicine in Europe – Blueprints for Germany

After the recent completion of its landmark Genomics England project, the United Kingdom has now started to implement whole genome sequencing (WGS) as a universal diagnostic test in routine healthcare. Other countries are about to follow suit. Being the most populous and economically powerful state in Europe, Germany cannot afford to lag behind in this development, which is of the utmost importance for the future of medical care, research and industry.

At the TMF workshop, renowned experts from England, France, Sweden and the Netherlands will report upon their experience regarding the medical, technical, organizational and economic aspects of WGS-based diagnostics. A subsequent panel discussion will draw upon these insights in order to work out how WGS can be introduced successfully into the German healthcare system to facilitate the diagnosis, prevention and personalized treatment of genetically determined disease.

Yours sincerely

Michael Krawczak (TMF Berlin, UKSH Campus Kiel)

Roman Siddiqui (TMF Berlin)

Hans-Hilger Ropers (MPIMG Berlin)

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