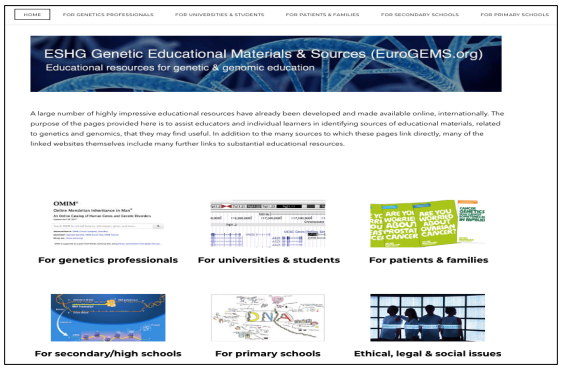
Prof Edward Tobias
Univ. of Glasgow,
Scotland, UK

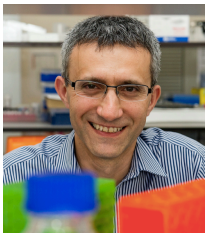
The ESHG's dedicated website for educational resources



www.eurogems.org
(ESHG Genetic Educational Materials & Sources)

- **A new website with >100 categorised & fully up-to-date links (& summaries) to carefully selected online resources from around the world, for education & reference**

by Prof Edward Tobias
BSc MBChB PhD FRCP FHEA
Professor of Genetic Medicine &
Hon. NHS Consultant in Clinical Genetics,
Queen Elizabeth University Hospital
and University of Glasgow, Scotland, UK.



(Also: author of free Clinical Genomics smartphone apps, at: **www.genomicsapps.org**)

University of Glasgow

Overview of presentation

1. **Background to the creation of the EuroGEMS.org website**
2. **Website content (as screenshots)**
3. **Analytics – showing an exponential increase in use, internationally, over the past year**
4. **Testimonials/feedback from users**
5. **Thanks and request for assistance (final slide)**

Prof Edward Tobias
Univ. of Glasgow,
Scotland, UK

Background: personal teaching responsibilities

TEACHING

IN U.K.

- **Clinical Director of 3 large postgraduate Masters (MSc) programmes at Glasgow University** (with >800 ex-students around the world)

– MSc in Medical Genetics & Genomics (UK-award-winning)

– MSc in Genetic & Genomic Counselling & MSc in Molec. Pathology.

- **Winner of 11 teaching awards (including 4 from students, team awards and two national awards)**

– Lead for Clinical Genomics course with computer workshops for data analysis, training students and staff

– Lead for Medical Genetics teaching to 300 medical students / year

– External advisor & examiner at 4 other universities (1 overseas)

INTERNATIONAL CONTRIBUTIONS:

- **Member of exam. committee establishing the new UEMS European Diploma in Med. Genetics & Genomics (EDMGG exam: 14th June 2019)**
- **A presenter on international MOOC** ("Cancer in 21st Century: Genomic Revolution)
- **Author of 2 textbooks on Medical Genetics (with translations)**
- **Author of Clinical Genomics Apps** (expanded in Feb 2019 & released free on the App stores; see genomicsapps.org) Link: www.genomicsapps.org

Prof Edward Tobias
Univ. of Glasgow,
Scotland, UK

Background: other work-related roles

RESEARCH

- One of principal investigators on the Scottish Genomes Partnership whole genome sequencing (WGS) project (which now has received £10.2 million of funding)
- Supervising post-grad. Research on:
  - Whole exome sequence (WES) data analysis
  - Small ncRNA analyses and
  - Collaborations with: Deciphering Developmental Disorders (DDD) (Cambridge), MRC Harwell (Oxford) & Crick Institute (London)

University of Glasgow, Scotland, UK. Fourth-oldest university in English-speaking world.

CLINICS (as Honorary NHS consultant)

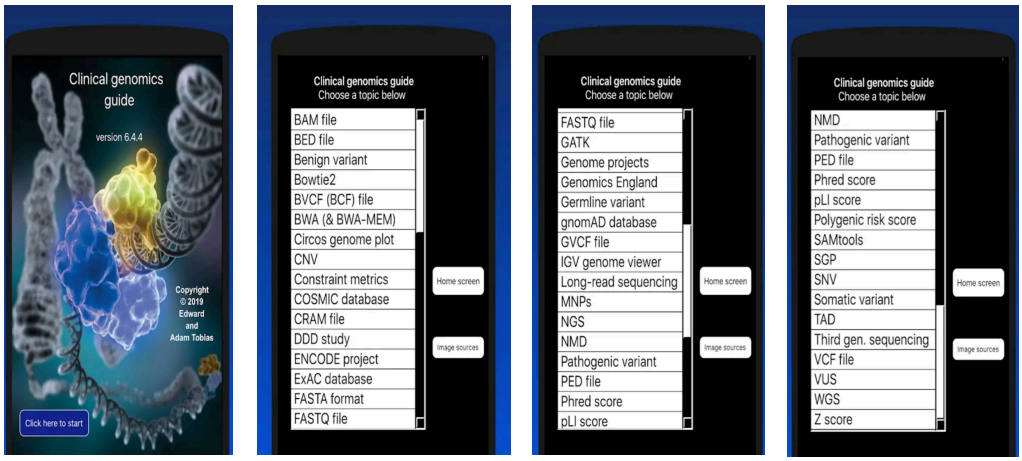
- General clinical genetics clinics in South-west Scotland, UK.
- Multi-disciplinary team meetings discussing clinical cases and variants

Queen Elizabeth University Hospital, Glasgow, UK. With 14 floors, is one of the largest UK acute hospitals.

Prof Edward Tobias
Univ. of Glasgow,
Scotland, UK

Clinical Genomics apps for smartphones

- **New expanded version of Clinical Genomics glossary app was launched in Feb 2019 on both App stores. Quickly explains complex genomics terminology. Free to download.**
  - Accompanied by a self-assessment quiz app.
- **New version has over 40 definitions of e.g. BED, FASTQ & GVCF files, NMD & TADs**
- **See www.genomicsapps.org (or search App store for Edward Tobias)**



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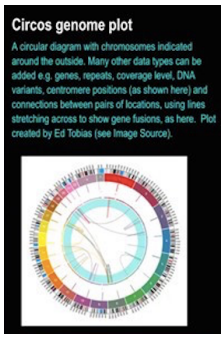
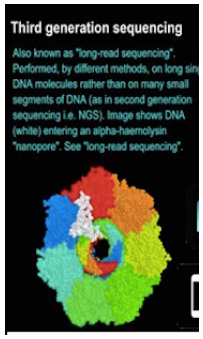
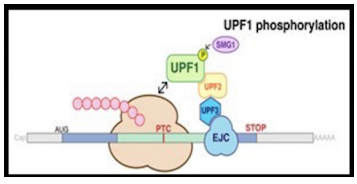
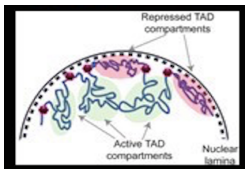
Univ. of Glasgow,
Scotland, UK

Additional screenshots from App









Now used by approx. 5000 individuals, in >70 countries

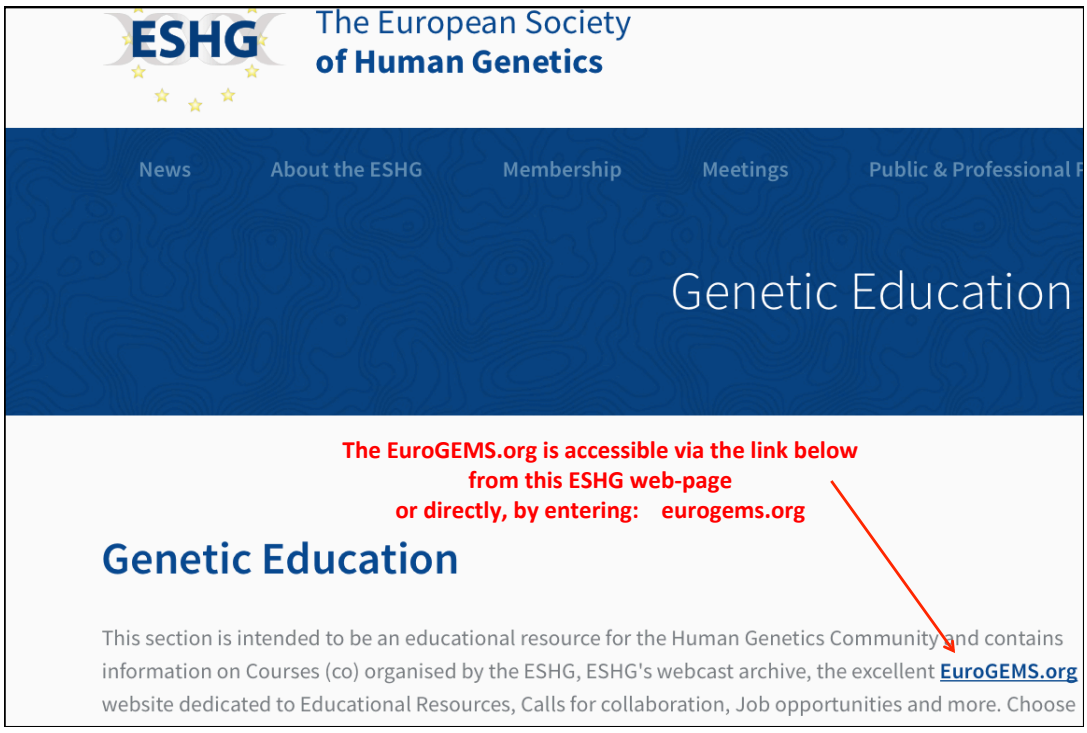
Prof Edward Tobias
Univ. of Glasgow,
Scotland, UK

Creation of www.EuroGEMS.org website for ESHG

- **Criteria for inclusion**
  - Links to sites (approx. 100 to date) that provide useful, high-quality, readable free information
- **Content discussed with**
  - Many ESHG committee members
  - Local professional colleagues
  - Students
  - School teachers
- **Technical aspects of website**

include:

  - Unlimited bandwidth
  - Fast page-loading



Prof Edward Tobias
Univ. of Glasgow,
Scotland, UK

Website content: screenshots

The following slides contain screenshots of selected web-pages from EuroGEMS.org

Prof Edward Tobias
Univ. of Glasgow,
Scotland, UK

Screenshot of the EuroGEMS.org home-page

Screenshots from EuroGEMS web-page "For Genetics Professionals"

ESHG Genetic Educational Materials and Sources (EuroGEMS)

For genetics professionals

This page provides information that is likely to be useful to professionals in clinical genetics/genomics e.g. information about individual clinical conditions (GeneReviews, OMIM and Orphanet), individual genetic variants (DECIPHER, LOVD, ClinVar, HGMD, VarSome, CanVar & VEP), transcript identification (LRG) and variant nomenclature (HGVS). Professionals are also likely to find sources that are listed on other pages here to be of relevance and interest, particularly the Universities page (including the genome browsers) and the Ethical, Legal and Social Implications page. On this page:

CLINICAL INFO | GENOME BROWSERS | VARIANT ANALYSIS | GENERAL | LOCAL INITIATIVES

CLINICAL INFORMATION

GeneReviews

This database contains a large number of reasonably comprehensive, disease-orientated, reviews. They are generally expert-authored and easy to read, containing clinical features, differential diagnoses and molecular details.

OMIM

An online, highly detailed, reference catalogue, listing human genetic conditions & their related genes. Initially compiled by the late Victor McKusick it now contains >24,000 entries & includes valuable links to other databases e.g. ClinVar.

Orphanet

A portal for rare diseases & orphan drugs. Database of numerous short articles regarding rare diseases and disease genes.
Organisation is based in Paris.

Screenshots (continued) from EuroGEMS web-page "For Genetics Professionals"

GENOME BROWSERS

DECIPHER

An interactive database with a suite of tools to aid interpretation of genomic variants. It retrieves information from a variety of bioinformatics resources. To help interpretation, a patient's variant is displayed together with levels of normal variation and pathogenic variation at that locus.

Ensembl Genome Browser

A powerful genome browser, based at the Wellcome Trust Sanger Institute, UK. Contains a link to Variant Effect Predictor (VEP), for analysis of likely consequences of DNA variants.

UCSC Genome Browser

The Genome Browser of the University of California Santa Cruz. An easy-to-use website that displays all the options on a single configurable web page.

VARIANT ANALYSIS & INTERPRETATION

DECIPHER

An interactive database with a suite of tools to aid interpretation of genomic variants. It retrieves information from a variety of bioinformatics resources. To help

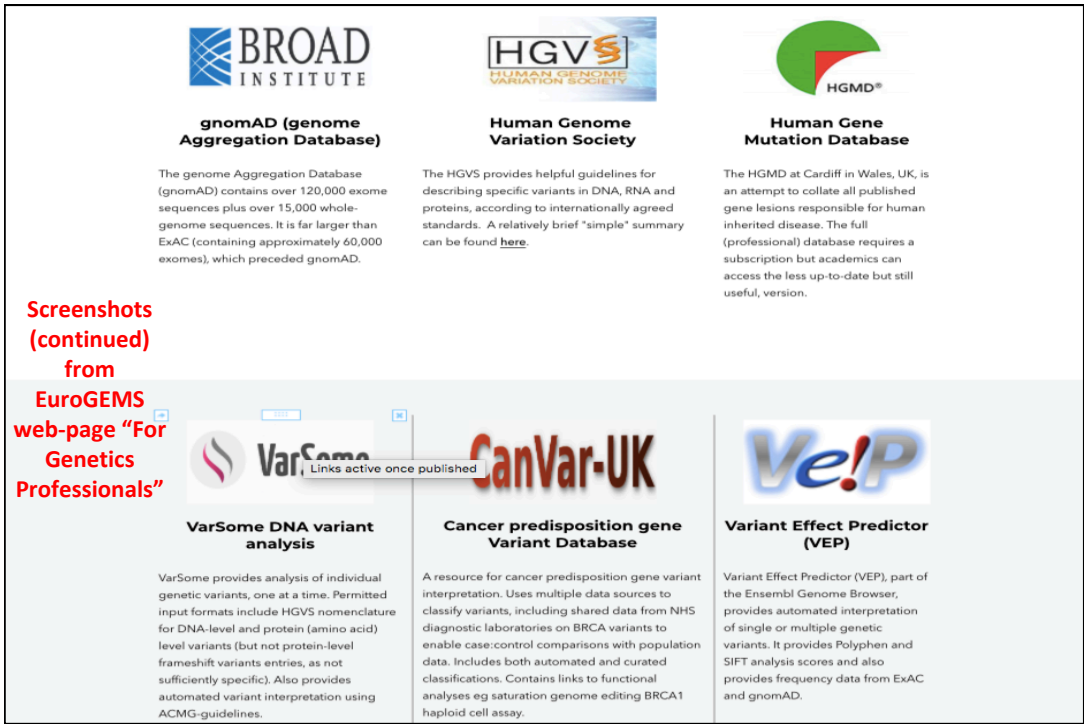
LOVD

Leiden Open Variation Database (LOVD): an online gene-centered collection and display of DNA variations. Contains a large body of variant data plus valuable updated

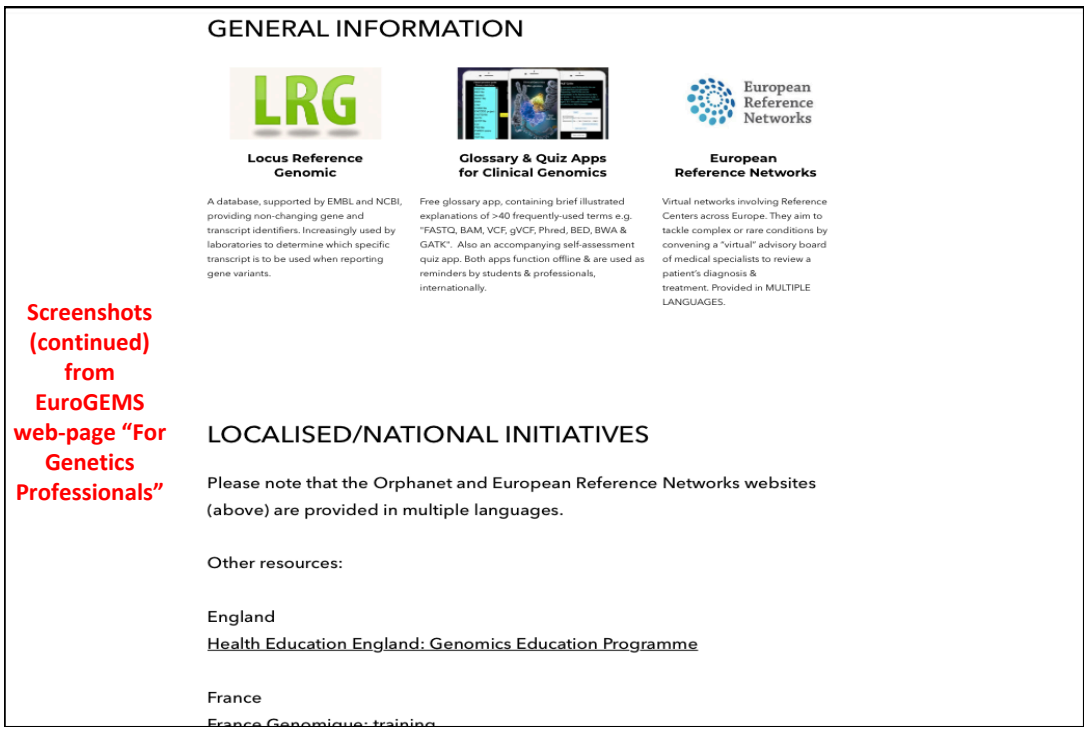
ClinVar

A database of genetic variants, based at the NCBI in USA, containing in a single database, hundreds of thousands of records, regarding specific gene variants,

Screenshots (continued) from EuroGEMS web-page "For Genetics Professionals"



Screenshots (continued) from EuroGEMS web-page "For Genetics Professionals"



Screenshots (continued) from EuroGEMS web-page "For Genetics Professionals"

LOCALISED/NATIONAL INITIATIVES

Please note that the Orphanet and European Reference Networks websites (above) are provided in multiple languages.

Other resources:

England
Health Education England: Genomics Education Programme

France
France Genomique: training

Germany
Mediathek Humangenetik

First German Academy for Further Medical Training on Rare Diseases (FAKSE)

Netherlands
Cancer genetics referral (Dutch guidelines)

Scotland
Scottish Genetics Education Network (ScotGEN)

Scottish Genomes Partnership

EuroGEMS.org includes additional links to several excellent localised/ foreign-language online resources

ETHICAL, LEGAL & SOCIAL IMPLICATIONS

Ethical, legal, social implications of genetics & genomics

This page contains websites that provide information or discussion, relating to the complex ethical, legal and social implications of the latest technological developments.

ESHG

Public & Professional Policy Committee

This page contains details and links for several recommendations of this expert committee of the European Society of Human Genetics.

Progress Educational Trust

Progress Educational Trust

Informing debate on assisted conception and genetics, the Progress Educational Trust's website contains downloadable documents on topics such as genome editing & mitochondrial donation.

THE HUMAN VARIOME PROJECT

Human Variome Project: ethics resources

This page provides many resources relating to ethical, legal and social issues related to the storage and sharing of human genetic data.

ELSI (continued)

Nuffield Council on Bioethics

An independent body that examines and reports on ethical issues in biology & medicine. Downloadable ethical reviews, reports & briefings on e.g. NIPT, genome editing & mitochondrial DNA disorders.

Clin. Ethics & Law Unit Southampton

Several highly thought-provoking pages, including: Ethics of Genomics. Research at the Clinical Ethics and Law Unit at Southampton (CELS) is bridging the gap between current clinical practice and emerging ethical dilemmas.

HFEA UK

The Human Fertilisation and Embryology Authority (HFEA) is the UK Government's independent regulator overseeing fertility treatment and research

ASHG Policy & Advocacy Overview

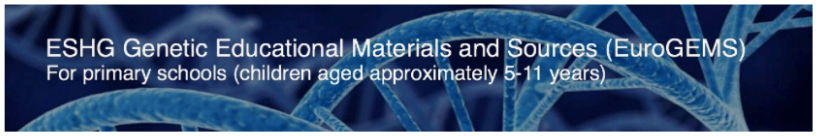
A large set of policy documents relating to ethical & legal issues in e.g. Conduct in Genetic Research & Societal Uses of Genetics. Pages provided by the American Society of Human Genetics.

Global Alliance for Genomics & Healthcare

Regulatory and ethics "toolkit" - a set of ethics documents related primarily to genomic data sharing, that are said to be "ready-to-use". Downloadable PDFs with over 12 foreign language translations.

ELSI program at NIH, USA

The Ethical, Legal and Social Implications research program information page at the National Institutes for Health in the USA.



Primary schools page

This page contains useful sources of teaching materials for primary school teachers, involving many innovative and enjoyable interactive activities in connection with several topics relating to DNA, inheritance and cell biology.

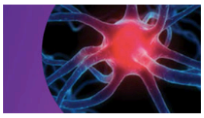
A range of exciting & innovative resources

Downloadable teaching plans and interactive activities

e.g. "Build your own cell ! " and "DNA Origami "

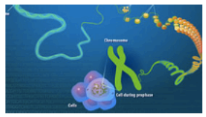
Science Education Hub - Radboud University

Based in the The Netherlands, this provides innovative, exciting teaching materials, interactive activities, videos & a book series- for primary schools & teachers, encouraging inquisitive & explorative thinking, e.g. on DNA, replication & inheritance. In English & Dutch.



BBSRC Bioscience for the Future

The BBSRC Bioscience for the Future website contains a section (Resources for Primary Schools) that includes downloadable activities, including Discovering DNA, DNA in the Garden and Build your own cell



NIH - NHGRI Education

This Education section of the NIH National Human Genome Research Institute contains a wealth of relevant online resources, including DNA Day primary school activities, fact sheets, teaching plans for teachers and an online education kit.

Primary schools page (continued)

Videos & factsheets

Jeans for Genes - educational resources

This fund-raising but also educational UK website provides professionally recorded videos of children (of different ages), each talking about their rare condition. It also includes general videos on genes and inheritance, with accompanying downloadable factsheets for teachers.

Animated videos

Learn Genetics University of Utah

A range of resources for the classroom with a set of very attractive animated videos (within the section "Tour of Basic Genetics"), including: "What are traits?", "What are DNA and genes?" and "What are proteins?"

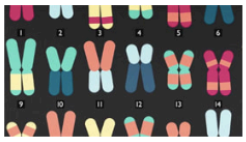
Includes "DNA Origami "

Classroom - Genetics Home Reference (NIH)

A large mixed list of resource links for teachers, including a few suitable for primary schools (including "Origami DNA", "Yummy Gummy DNA" i.e. making an edible double helix with sweets and also "Sequence Bracelets"). The list is alphabetical but sub-divided by topic to make it easier to find relevant resources.

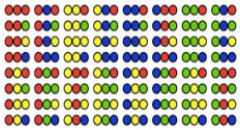
Unlocking Life's Code & the Animated Genome

This site (Unlocking Life's Code) was created in association with the National Institutes of Health, USA. In addition to the film entitled The Animated Genome, it contains other animations and resources for school teachers.



DNA & chromosomes explanatory animation

Relatively simple but wide-ranging animated video commissioned by the BBC, discussing the structure of DNA, chromosomes and even a little about the mysteries of intergenic DNA. Suitable for older primary school children.



Teacher's toolbox Arizona State University

A range of activities, explanations, podcasts, word-search sheets & crosswords, relating to biology, including DNA, genes & cells. It includes DNA pages encouraging children to think about e.g. triplet combinations. Resources are searchable.

Primary schools Page (continued)

Localized/national initiatives

Nederland

LeveDNA!

ESHG Genetic Educational Materials and Sources (EuroGEMS)

For secondary (high) schools (pupils aged approximately 12-18)

On this page, a wide range of useful sources of teaching materials are provided. The numerous information sources that are accessible via the pages described below include many that are highly suitable for use by secondary school teachers. Please click **here** for information regarding the European DNA Day Essay Contest.

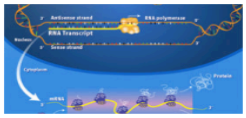
Page for secondary / high schools

University of Leicester (UK) VGEC

The Virtual Genetics Education Centre (VGEC) provides many topic summaries and lists of linked teaching resources. Resources can be selected by age-range (e.g 11-14, 14-16 & 16-18).

Wellcome Campus: Your genome

This is a large educational website that includes multiple educational 3D animations on DNA replication, gene expression, NGS, sequence data interpretation, gene editing & ethical issues.

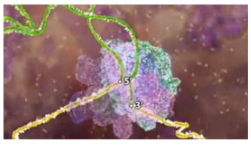


NHGRI-Education (secondary)

The NIH National Human Genome Research Institute's Education Section contains many resources that are suitable for secondary school education including materials on transcriptome, translation, PCR, cloning, DNA sequencing and GWAS.

Genetics Education Centre Univ. of Kansas

An impressively long list of links to genetics educational resources. A varied collection that includes videos and is displayed largely alphabetically.



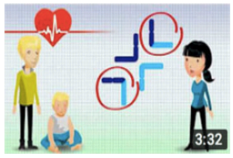
DNA Learning Center Cold Spring Harbor Labs

This website includes 3D-animations that relate to transcription, translation and DNA packaging plus the "Gene Screen" app for learning about recessive disorders

BBSRC - secondary schools

This section of the BBSRC Bioscience for the Future website, designed for older school pupils, includes DNA in the Garden (ages 14-16 and post-16) and Stem Cells- Science and Ethics (14-16 years)

Secondary / high schools Page (continued)



Understanding genetics and rare diseases

A set of carefully-prepared animations explaining genetics concepts including inheritance mechanisms and various types of chromosome abnormalities. The link provided here is to the full list of animations. Provided by a consultant Clinical Geneticist and University College Dublin, in MULTIPLE LANGUAGES (& most extensively in Maltese).

Teach.Genetics

University of Utah: Epigenetics

Source of information and teaching resources relating to epigenetics, including a downloadable self-assembly model of DNA with histones

BigPicture
Bringing cutting-edge science into the classroom

BigPicture Education Resources

Wide variety of articles, debates, quizzes, animations and videos relating to genetics (& other fields). High-quality articles. Can filter by resource type & educational level. Funded by Wellcome.

Secondary / high schools Page (continued)

Jeans for Genes Day

Jeans for genes - including videos

This website includes professionally recorded videos of older children with rare conditions, with accompanying downloadable factsheets and classroom activities. It includes resources for KS3 and KS4 (ages approximately 11-16).

Genetics Home Reference

Classroom - Genetics Home Reference

A varied collection of resource links, especially for high school teachers categorised by topic (e.g. "DNA Structure", "RNA Basics", "Precision Medicine", "Gene Therapy & Gene Editing" and "Epigenetics"). Many US resources e.g. at Cold Spring Harbor.

Secondary / high schools Page (continued)

Localised/national initiatives

Please note that the "Understanding genetics and rare diseases" animations/videos (above) are provided in multiple languages.

Other resources:

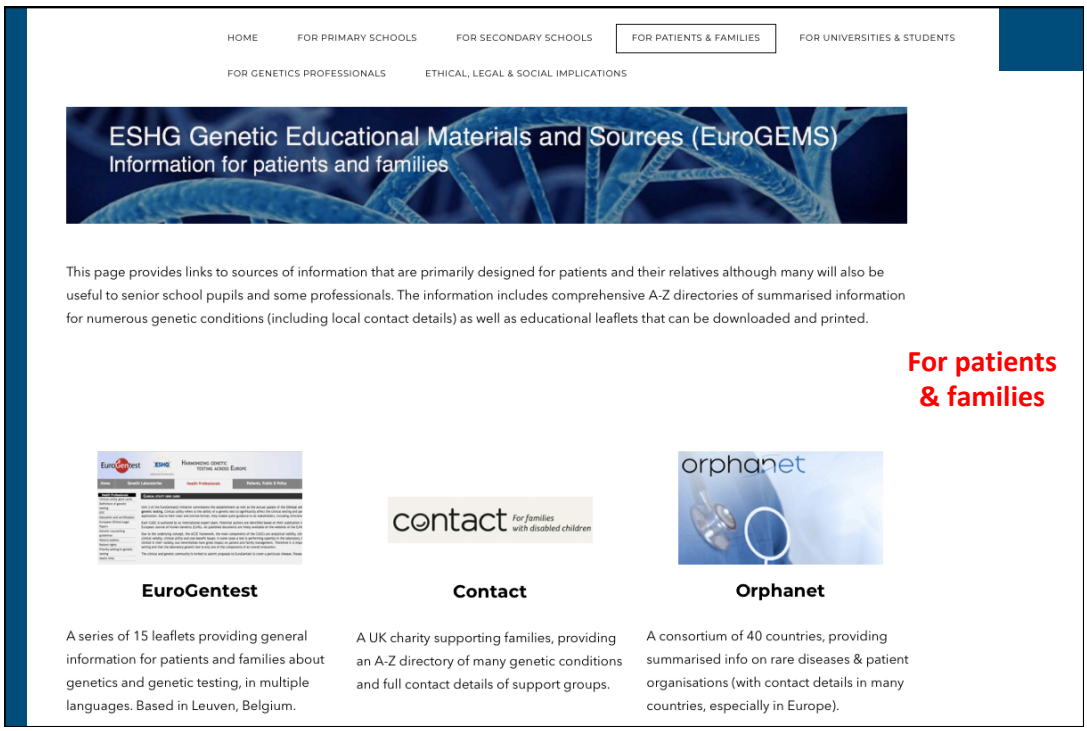
Nederland
LeveDNA!

Malta
Understanding genetics - animations (Maltese narrations)

Wales
Wales Gene Park: Genetic Education

Secondary / high schools Page (continued)

Educational videos on High-schools page



HOME | FOR PRIMARY SCHOOLS | FOR SECONDARY SCHOOLS | FOR PATIENTS & FAMILIES | FOR UNIVERSITIES & STUDENTS | FOR GENETICS PROFESSIONALS | ETHICAL, LEGAL & SOCIAL IMPLICATIONS

For patients & families (continued)

Antenatal Results & Choices

This organisation offers non-directive information & support to parents, before, during & after antenatal screening.

Unique support group

A support group especially for chromosome disorders but also for single gene disorders. Numerous family-friendly, medically-verified, disorder-specific information guides, in several languages.

Genetics Home Reference

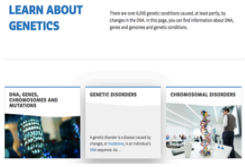
A large guide to genetic conditions hosted by the US National Library of Medicine. See the section: "Health Conditions A-Z"

HOME | FOR PRIMARY SCHOOLS | FOR SECONDARY SCHOOLS | FOR PATIENTS & FAMILIES | FOR UNIVERSITIES & STUDENTS | FOR GENETICS PROFESSIONALS | ETHICAL, LEGAL & SOCIAL IMPLICATIONS

For patients & families (continued)

Leaflets on cancer genetics

Source of hospital leaflets on cancer genetics with referral guidelines, from the West of Scotland Genetic Services.

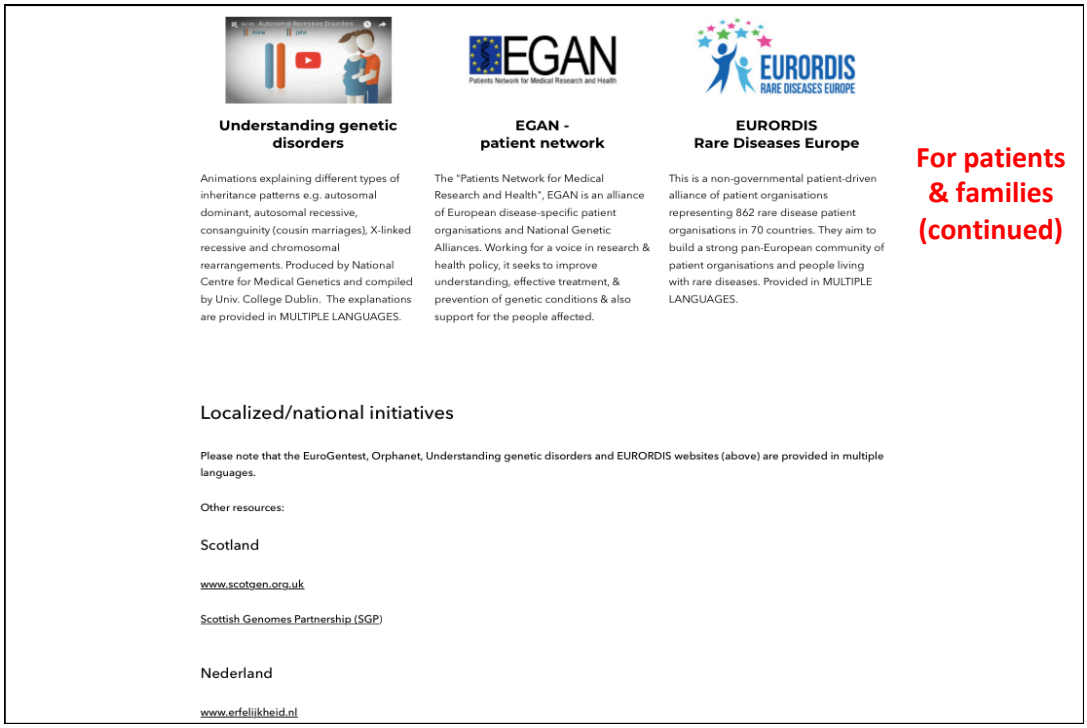


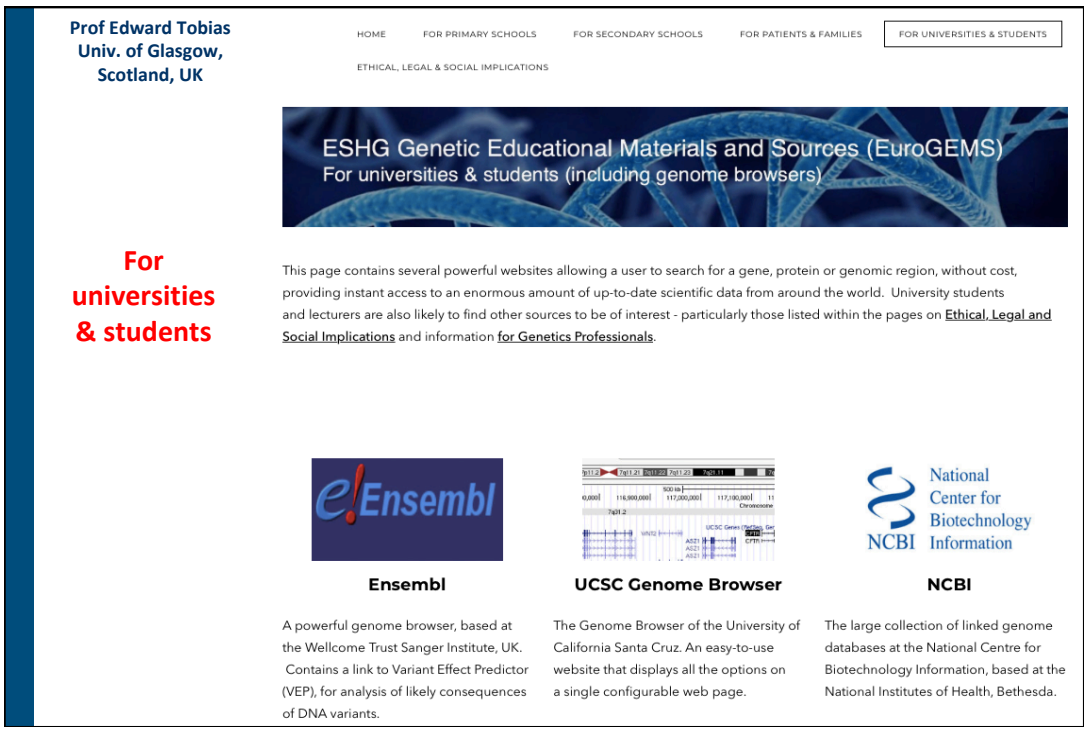
Genetic Alliance

This UK charity provides information for patients, families and other individuals who may be interested in genetic conditions.

Clinical genetics leaflets

Source of many leaflets on clinical genetic conditions and genetic testing, from ScotGEN and the South-East Scotland Genetic Service.


Understanding genetic disorders
Animations explaining different types of inheritance patterns e.g. autosomal dominant, autosomal recessive, consanguinity (cousin marriages), X-linked recessive and chromosomal rearrangements. Produced by National Centre for Medical Genetics and compiled by Univ. College Dublin. The explanations are provided in MULTIPLE LANGUAGES.
EGAN - patient network
The "Patients Network for Medical Research and Health", EGAN is an alliance of European disease-specific patient organisations and National Genetic Alliances. Working for a voice in research & health policy, it seeks to improve understanding, effective treatment, & prevention of genetic conditions & also support for the people affected.
EURORDIS Rare Diseases Europe
This is a non-governmental patient-driven alliance of patient organisations representing 862 rare disease patient organisations in 70 countries. They aim to build a strong pan-European community of patient organisations and people living with rare diseases. Provided in MULTIPLE LANGUAGES.
For patients & families (continued)
Localized/national initiatives
Please note that the EuroGentest, Orphanet, Understanding genetic disorders and EURORDIS websites (above) are provided in multiple languages.
Other resources:
Scotland
www.scotgen.org.uk
Scottish Genomes Partnership (SGP)
Nederland
www.erfelijkheid.nl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HOME
FOR PRIMARY SCHOOLS
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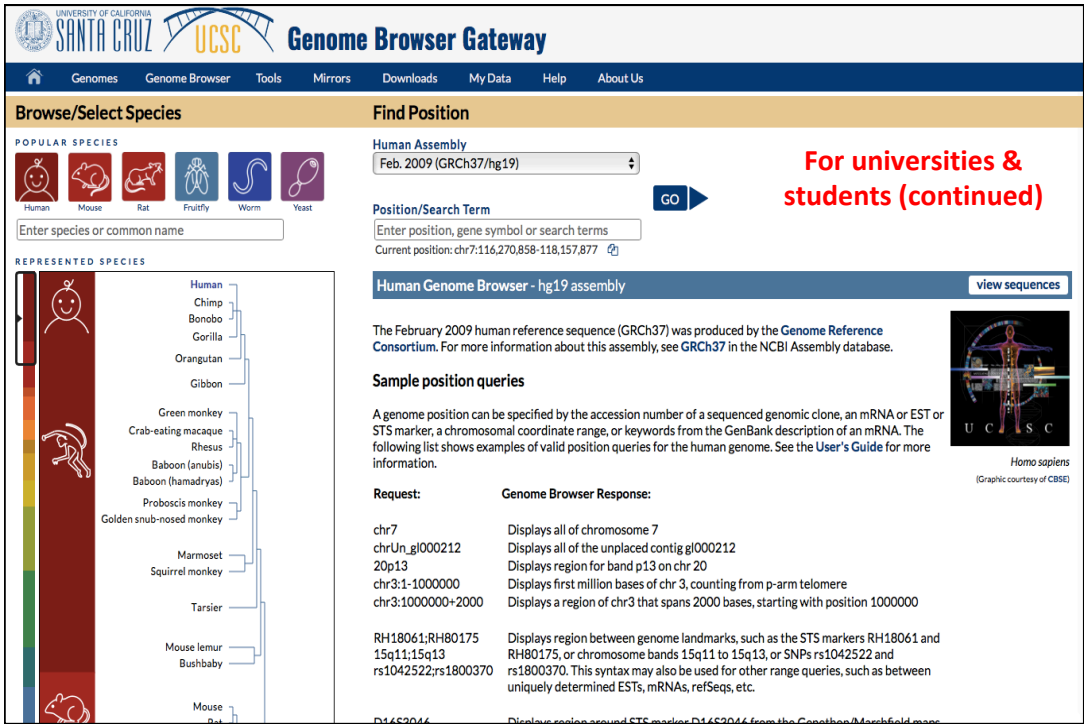
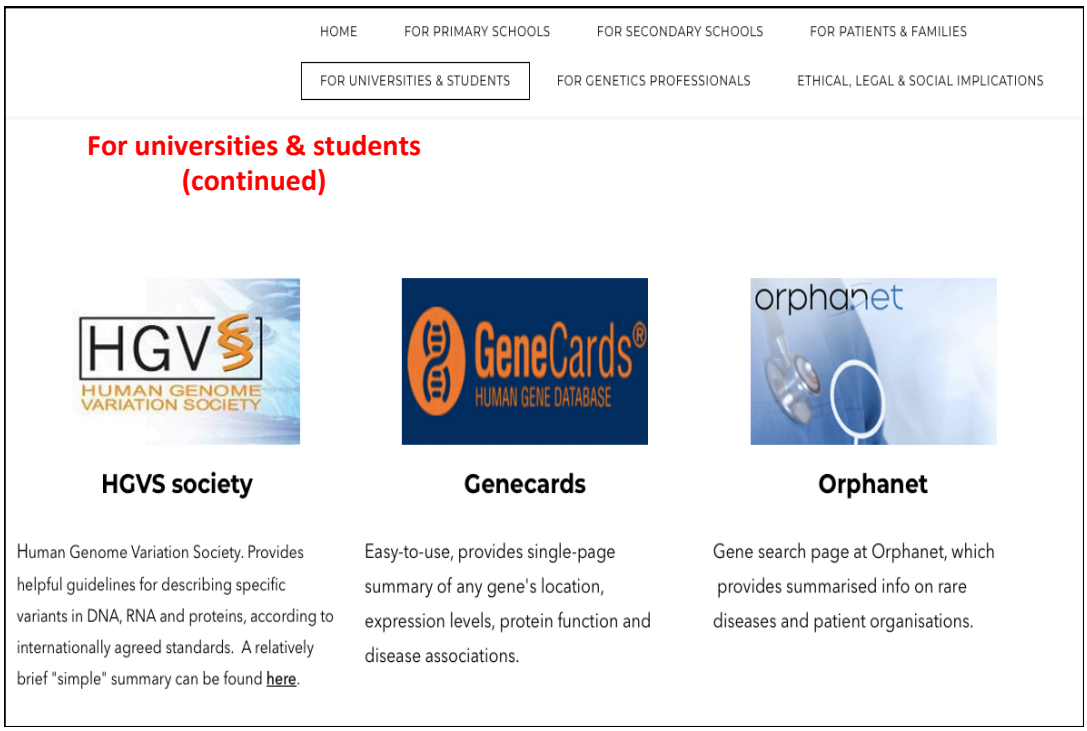
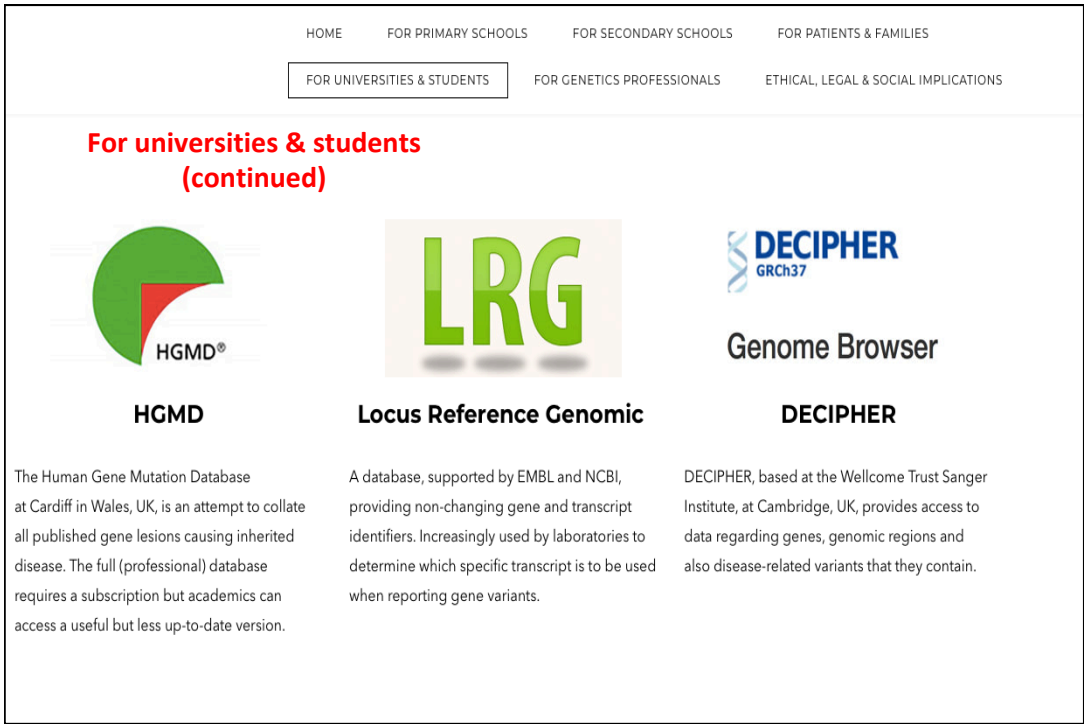
FOR PATIENTS & FAMILIES
FOR UNIVERSITIES & STUDENTS
ETHICAL, LEGAL & SOCIAL IMPLICATIONS
ESHG Genetic Educational Materials and Sources (EuroGEMS)
For universities & students (including genome browsers)
For universities & students
This page contains several powerful websites allowing a user to search for a gene, protein or genomic region, without cost, providing instant access to an enormous amount of up-to-date scientific data from around the world. University students and lecturers are also likely to find other sources to be of interest - particularly those listed within the pages on Ethical, Legal and Social Implications and information for Genetics Professionals.
Ensembl
A powerful genome browser, based at the Wellcome Trust Sanger Institute, UK. Contains a link to Variant Effect Predictor (VEP), for analysis of likely consequences of DNA variants.
UCSC Genome Browser
The Genome Browser of the University of California Santa Cruz. An easy-to-use website that displays all the options on a single configurable web page.
NCBI
The large collection of linked genome databases at the National Centre for Biotechnology Information, based at the National Institutes of Health, Bethesda.


UNIVERSITY OF CALIFORNIA SANTA CRUZ UCSC Genome Browser Gateway
Genomes
Genome Browser
Tools
Mirrors
Downloads
My Data
Help
About Us
Browse/Select Species
POPULAR SPECIES
Human
Mouse
Rat
Fruitfly
Worm
Yeast
Enter species or common name
REPRESENTED SPECIES
Human
Chimp
Bonobo
Gorilla
Orangutan
Gibbon
Green monkey
Crab-eating macaque
Rhesus
Baboon (anubis)
Baboon (hamadryas)
Proboscis monkey
Golden snub-nosed monkey
Marmoset
Squirrel monkey
Tarsier
Mouse lemur
Bushbaby
Mouse
Find Position
Human Assembly
Feb. 2009 (GRCh37/hg19)
GO
Position/Search Term
Enter position, gene symbol or search terms
Current position: chr7:116,270,858-118,157,877
For universities & students (continued)
Human Genome Browser - hg19 assembly
view sequences
The February 2009 human reference sequence (GRCh37) was produced by the Genome Reference Consortium. For more information about this assembly, see GRCh37 in the NCBI Assembly database.
Sample position queries
A genome position can be specified by the accession number of a sequenced genomic clone, an mRNA or EST or STS marker, a chromosomal coordinate range, or keywords from the GenBank description of an mRNA. The following list shows examples of valid position queries for the human genome. See the User's Guide for more information.
Request:
Genome Browser Response:
chr7
Displays all of chromosome 7
chrUn_gl000212
Displays all of the unplaced contig gl000212
20p13
Displays region for band p13 on chr 20
chr3:1-1000000
Displays first million bases of chr 3, counting from p-arm telomere
chr3:1000000+2000
Displays a region of chr3 that spans 2000 bases, starting with position 1000000
RH18061;RH80175
15q11;15q13
rs1042522;rs1800370
Displays region between genome landmarks, such as the STS markers RH18061 and RH80175, or chromosome bands 15q11 to 15q13, or SNPs rs1042522 and rs1800370. This syntax may also be used for other range queries, such as between uniquely determined ESTs, mRNAs, refSeqs, etc.
Homo sapiens
(Graphic courtesy of CBSE)


HOME
FOR PRIMARY SCHOOLS
FOR SECONDARY SCHOOLS
FOR PATIENTS & FAMILIES
FOR UNIVERSITIES & STUDENTS
FOR GENETICS PROFESSIONALS
ETHICAL, LEGAL & SOCIAL IMPLICATIONS
For universities & students (continued)
HGVS
HUMAN GENOME VARIATION SOCIETY
GeneCards®
HUMAN GENE DATABASE
orphanet
HGVS society
Genecards
Orphanet
Human Genome Variation Society. Provides helpful guidelines for describing specific variants in DNA, RNA and proteins, according to internationally agreed standards. A relatively brief "simple" summary can be found here.
Easy-to-use, provides single-page summary of any gene's location, expression levels, protein function and disease associations.
Gene search page at Orphanet, which provides summarised info on rare diseases and patient organisations.



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Now:

- Re-checking all links regularly (& updating as required)
- Adding new content e.g. new page for primary care & non-genetic specialists, sub-headings in professionals' page (both now done), & continuing to add more links
- Hoping to add translations of website in the future

New page:

For primary care and non-genetics specialists

This page provides links to sources of information that are selected for usefulness to primary care health practitioners. The information includes educational modules (e.g. in Gen-Equip), comprehensive A-Z directories of summarised information for numerous genetic conditions, including local contact details (e.g. in Contact, Orphanet and, in more detail, in GeneReviews) as well as educational leaflets that can be downloaded and printed and apps to assist with cancer genetics referrals.

Gen-Equip | **Contact** | **Orphanet**

GeneReviews

This database contains a large number of reasonably comprehensive, disease-orientated, reviews. They are generally expert-authored and easy to read, containing clinical features, differential diagnoses and molecular details.

Unique

A support group especially for chromosome disorders but also for single gene disorders. Numerous family-friendly, medically-verified, disorder-specific information guides, in several languages.

Antenatal results & choices

This organisation offers non-directive information & support to parents, before, during & after antenatal screening.

For Primary Care & non-genetics specialists (continued)

Inherited cancers

Information on genetic conditions and inherited cancers, provided by Macmillan. It includes information relating to the causes, the risk factors and the possible consequences of test results.

Cancer genetics referrals

Information, web interface and free smartphone apps from Guy's & St Thomas' Hospital, UK designed to assist primary care doctors (GPs) in deciding which individuals should be referred to the hospital Clinical Genetics service.

Clinical genetics leaflets

Source of many leaflets on clinical genetic conditions and genetic testing, from ScotGEN and the South-East Scotland Genetic Service.

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Additional links for non-genetics specialists

Localized/national initiatives

Please note that the Gen-Equip and Orphanet websites (above) are provided in multiple languages.

Other resources:

For Primary Care & non-genetics specialists (continued)

England

Health Education England: Genomics Education Programme

Nederland

www.erfelijkheid.nl

Huisarts en Genetica

Scotland

Scottish Genetics Education Network (ScotGEN)

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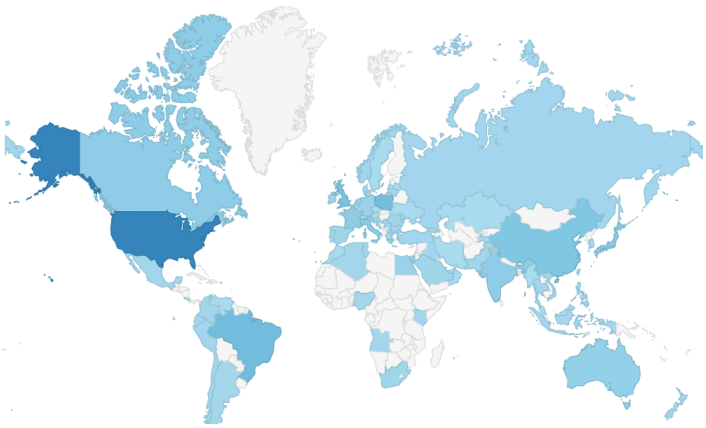
VISITS

Thousands of visits to website, so far (in 1st year)…
from **92 countries**



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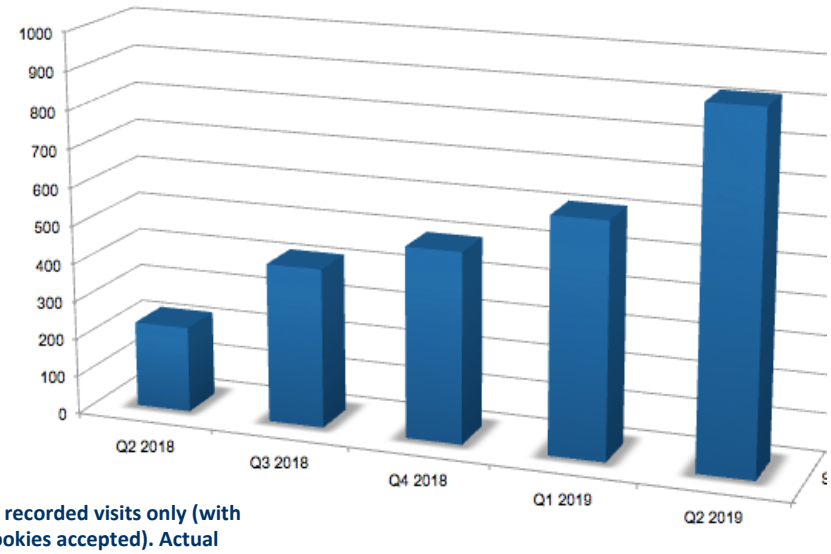
Visits (in each quarter-year): increasing



Showing recorded visits only (with e.g. cookies accepted). Actual numbers are approx 8x greater.

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Returning visits: *exponential* increase

Showing recorded visits only (with e.g. cookies accepted). Actual numbers are approx 8x greater.

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92 countries. Only 12% of total visits are shown

United Kingdom (285 visitors)	Hong Kong (14 visitors)	Mexico (5 visitors)
United States (128 visitors)	Egypt (13 visitors)	Slovakia (5 visitors)
Italy (113 visitors)	Austria (12 visitors)	United Arab Emirates (5 visitors)
France (75 visitors)	Croatia (10 visitors)	Georgia (4 visitors)
Spain (74 visitors)	Sweden (10 visitors)	Macedonia (4 visitors)
Belgium (70 visitors)	Saudi Arabia (10 visitors)	Japan (4 visitors)
Portugal (64 visitors)	Iceland (9 visitors)	New Zealand (4 visitors)
Germany (63 visitors)	Israel (9 visitors)	Philippines (4 visitors)
Turkey (56 visitors)	South Africa (8 visitors)	Chile (3 visitors)
Norway (53 visitors)	Bosnia and Herzegovina (8 visitors)	Algeria (3 visitors)
Canada (53 visitors)	Serbia (8 visitors)	Taiwan (3 visitors)
Romania (44 visitors)	Russian Federation (7 visitors)	Vietnam (3 visitors)
Greece (36 visitors)	Cyprus (7 visitors)	Moldova, Republic of (2 visitors)
Netherlands (32 visitors)	Slovenia (7 visitors)	Peru (2 visitors)
Lithuania (29 visitors)	Hungary (7 visitors)	Kenya (2 visitors)
China (27 visitors)	Latvia (7 visitors)	Iran, Islamic Republic of (2 visitors)
Poland (26 visitors)	Nigeria (7 visitors)	Tunisia (2 visitors)
Switzerland (25 visitors)	Denmark (7 visitors)	Qatar (2 visitors)
Australia (23 visitors)	Argentina (6 visitors)	** (2 visitors)
Bulgaria (22 visitors)	Estonia (6 visitors)	Europe (2 visitors)
Ireland (20 visitors)	Pakistan (6 visitors)	Reunion (2 visitors)
India (19 visitors)	Korea, Republic of (6 visitors)	Ecuador (2 visitors)
Brazil (17 visitors)	Thailand (6 visitors)	Colombia (1 visitor)
Finland (17 visitors)	Czech Republic (6 visitors)	Oman (1 visitor)
		Malaysia (1 visitor)
		Angola (1 visitor)

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Most recent 4% of the (recorded) visits from Europe

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4% of the total (recorded) visitors to date

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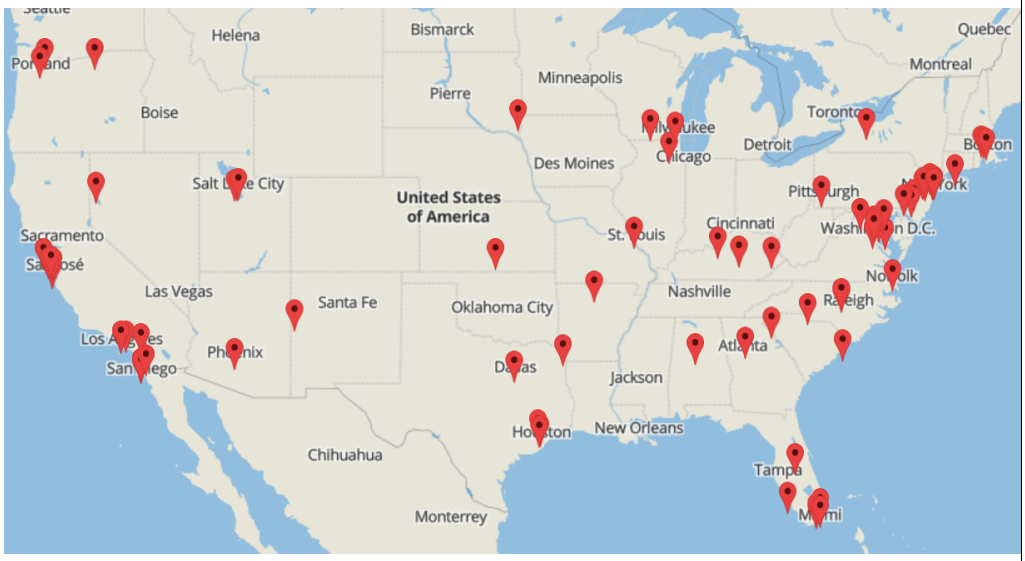
The most recent 30% of visits from USA



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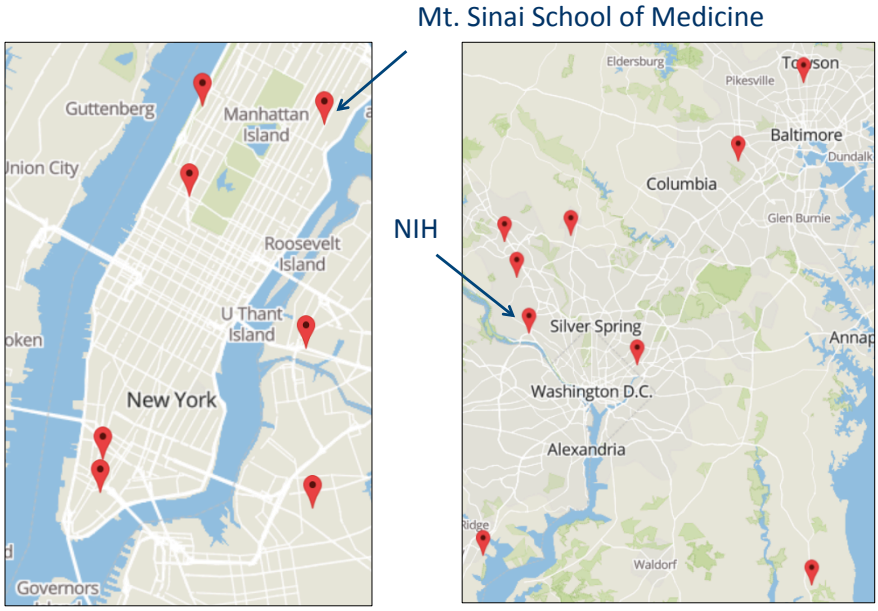
Most recent visits from New York & Washington DC



New York City **Washington DC**

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Examples of university students' (anonymous) feedback comments 2018-2019

- "The website was wonderful for accessing genetics databases and looking up relevant genetic conditions."
- "The EuroGEMS website was particularly useful."
- "We were all very grateful for all of the additional resources"
- "Thank you for igniting my passion for genetics."
- "Excellent. All links have been really useful."
- "If more topics were taught like this then it would make a big difference"
- "It has made me consider pursuing further learning opportunities in this area of medicine."
- "Informative, amazing … sparked my interest in genetics"
- "Haven't considered it as a career before. Certainly do now"

Written feedback from a secondary school's head of biology department:

- "This website looks terrific. I will certainly share the website within the department and I am confident that it will be very useful indeed."

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Examples of emails from professionals (on ESHG Board & also representatives of National Hum. Genet. Societies)

- "I am really impressed by your terrific work."
- "Congratulations on making EuroGEMS.org truly beautiful, and comprehensive. I can clearly see how much effort has gone into this."
- "Thank you once again for the excellent web resource overview you have made!"
- "EuroGEMS.org is great! I think this is absolutely brilliant."
- "I was amazed! …How much we can profit from your amazing site.
- "Congratulations on creating an excellent, comprehensive and highly useful resource for education on the ESHG webpage!"

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and finally….

EuroGEMS.org is a completely free resource (as are the Clinical Genomics apps)

Thank you to (my son) Adam Tobias, to colleagues on the ESHG Education Committee and to Jerome del Picchia & his colleagues who helped with the website's creation, thank you to the many members of the ESHG Board and the National Human Genetics Societies Committee who contributed to the website's further development and thanks to all NHS & university colleagues in Glasgow (UK) for all of their help and support.

Many individuals on the committees mentioned above have stated that it would be very helpful to raise awareness of these resources. Therefore please, if possible, mention eurogems.org (& also genomicsapps.org)

- to other members of your own national societies,
- to other educational organisations
- and to colleagues and students.

Thank you.

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