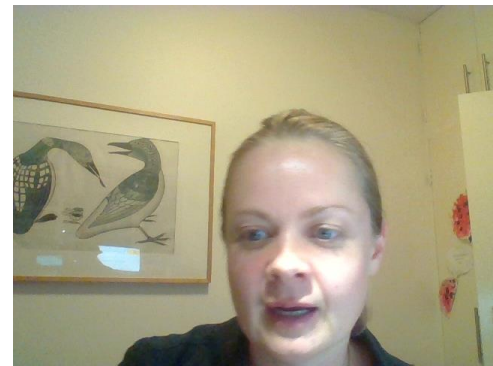


An approach to dysmorphology for the fellowship paediatric examination (Australia)

Elizabeth.palmer@health.nsw.gov.au



Why bother – don't we all just do an exome now?



Funding for genetic testing to affect thousands of families.

Around 3000 Australian families are expected to benefit each year from the Federal Government's listing of genetic testing for childhood syndromes and intellectual disability on the Medicare Benefits Schedule.

From May 1 the newly-announced MBS item numbers will reimburse:

- Whole exome or genome sequencing to identify the genetic cause of syndromic and non-syndromic intellectual disability
- The re-analysis of data in certain circumstances
- Cascade testing for certain purposes, such as diagnosis of a biological sibling or to inform reproductive decision making

The new items also support trio testing of affected individuals, with an upper limit of \$2,900 for this fee item.

The listing, which makes genetic tests more affordable, comes after Australian Genomics applied to the Medical Services Advisory Committee (MSAC) for whole exome analysis for childhood syndromes – the first in a 'pipeline' of MSAC applications established by Australian Genomics and partners.

Results 1 to 6 of 6 matches

1

73358 ⓘ

Characterisation, via whole exome or genome sequencing and analysis, of germline variants known to cause monogenic disorders, if:

(a) the characterisation is:

(i) requested by a consultant physician practising as a clinical geneticist; or

(ii) requested by a consultant physician practising as a specialist paediatrician, following consultation with a clinical geneticist; and

(b) the patient is aged 10 years or younger and is strongly suspected of having a monogenic condition, based on the presence of:

(i) dysmorphic facial appearance and one or more major structural congenital anomalies; or

(ii) intellectual disability or global developmental delay of at least moderate severity, as determined by a specialist paediatrician; and

(c) the characterisation is performed following the performance for the patient of a service to which item 73292 applies for which the results were not available at the time of the characterisation; and

(d) the characterisation is not performed in conjunction with a service to which item 73359 applies

Applicable only once per lifetime

Fee: \$2,100.00 Benefit: 75% = \$1,575.00 85% = \$2,015.30

Group P7 - Genetics

Category 6 - PATHOLOGY SERV



Detailed phenotyping improves the diagnostic yield of genomic testing

- Why does exome sequencing not get an answer

Technological limitations

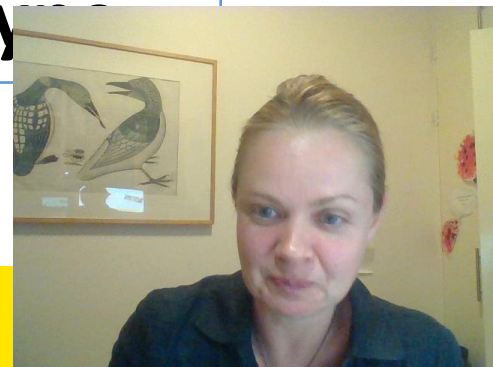
(noncoding or expansion mutations, incomplete coverage, uniparental disomy, large indels, chromosomal rearrangements, and copy-number variants)

Unknown gene-disease associations

More complex genetics (polygenic, epigenetic, multi-factorial,.... Non-genetic – yes it happens!!!!)

Incomplete recognition of the patient's phenotype

Reanalysis of exome data with collaboration with referring physician can boost diagnosis by ~12% (Salmon et al. 2018)



And it might just help you describe new genetic conditions for your patients!



REPORT

De Novo Variants Disrupting the HX Repeat Motif of ATN1 Cause a Recognizable Non-Progressive Neurocognitive Syndrome

Elizabeth E. Palmer,^{1,2,3,4,25} Seungbeom Hong,^{5,25} Fatema Al Zahrani,⁶ Mais O. Hashem,⁶ Fajr A. Aleisa,⁵ Heba M. Jalal Ahmed,⁵ Tejaswi Kandula,^{1,2} Rebecca Macintosh,¹ Andre E. Minoche,³ Clare Puttick,³ Velimir Gayevskiy,³ Alexander P. Drew,³ Mark J. Cowley,^{3,7} Marcel Dinger,^{3,7} Jill A. Rosenfeld,⁸ Rui Xiao,^{8,9} Megan T. Cho,¹⁰ Suliat F. Yakubu,⁵ Lindsay B. Henderson,¹⁰ Maria J. Guillen Sacoto,¹⁰ Amber Begtrup,¹⁰ Muddathir Hamad,¹¹ Marwan Shinawi,¹² Marisa V. Andrews,¹² Marilyn C. Jones,¹³ Kristin Lindstrom,¹⁴ Ruth E. Bristol,¹⁵ Saima Kayani,¹⁶ Molly Snyder,¹⁷ María Mercedes Villanueva,¹⁸ Angeles Schteinschnaider,¹⁸ Laurence Faivre,^{19,20} Christel Thauvin,¹⁹ Antonio Vitobello,¹⁹ Tony Roscioli,^{1,21,22} Edwin P. Kirk,^{1,2,21} Ann Bye,^{1,2} Jasmeen Merzaban,²³ Łukas Jaremko,⁵ Mariusz Jaremko,²³ Rani K. Sachdev,^{1,2} Fowzan S. Alkuraya,^{6,24,25,*} and Stefan T. Arold^{5,25,*}



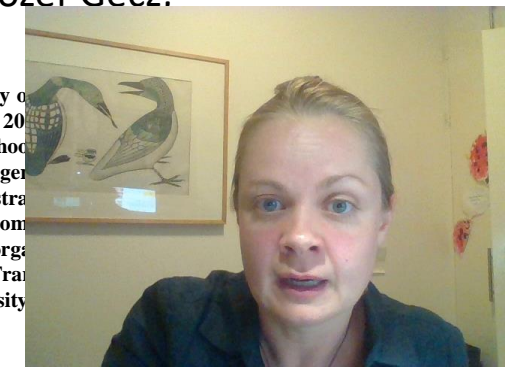
Figure 1. Clinical Images of Affected Individuals with CHEDDA

- ***RLIM*** is a candidate dosage sensitive gene for individuals with varying duplications of Xq13, intellectual disability and recognizable facial features



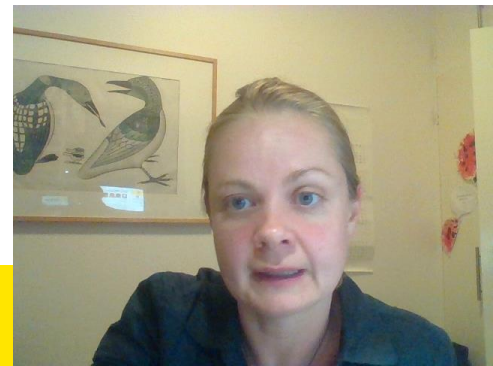
Elizabeth E. Palmer,^{1,2,3,4,20*} Renee Carroll,^{5,20} Marie Shaw,⁵ Raman Kumar,⁵ Andre E. Minoche,⁴ Melanie Leffler,¹ Lucinda Murray,¹ Rebecca Macintosh,³ Dale Wright,^{7,8} Chris Troedsen,⁹ Fiona McKenzie,^{10,11} Sharron Townshend,¹¹ Michelle Ward,¹¹ Urwah Nawaz,⁵ Anja Ravine,¹² Cassandra K. Runke,¹³ Erik C. Thorland,¹³ Marybeth Hummel,¹⁴ Nicola Foulds,¹⁵ Olivier Pichon,¹⁶ Bertrand Isidor,¹⁶ Cédric Le Caignec,¹⁷ Ann Bye,^{2,3} Rani Sachdev,^{2,3} Edwin P. Kirk,^{2,3} Mark J. Cowley,¹⁸ Mike Field,¹ and Jozef Gecz.^{5,19**}

¹ Genetics of Learning Disability Service, Waratah, NSW 2298, Australia. ² School of Women's and Children's Health, UNSW Medicine, University of Sydney Children's Hospital, Randwick, NSW 2031, Australia ⁴ Kinghorn Centre for Clinical Genomics, Garvan Institute, Darlinghurst, Sydney, NSW 2015, Australia ⁵ Adelaide Medical School and the Robinson Research Institute, University of Adelaide, Adelaide, SA5000, Australia ⁶ St Vincent's Clinical School, University of Melbourne, Melbourne, Victoria, Australia ⁷ Discipline of Genomic Medicine and Discipline of Child & Adolescent Health, University of Sydney, Sydney, Australia ⁸ Department of Cytogenetics, University of Western Australia, Perth, Western Australia, Australia ⁹ Children's Hospital at Westmead, Sydney, Australia ¹⁰ School of Paediatrics and Child Health, University of Western Australia, Perth, Western Australia, Australia ¹¹ Genetic Services of Western Australia, Perth, Western Australia, Australia ¹² Pathwest Laboratory Medicine WA, Perth, WA, Australia ¹³ Genomics Research, Mayo Clinic, USA ¹⁴ West Virginia University School of Medicine, Department of Pediatrics, Section of Medical Genetics Morgantown, West Virginia, USA ¹⁵ Genetic Services of Western Australia, Perth, Western Australia, Australia ¹⁶ Service de génétique médicale - Unité de Génétique Clinique, CHU de Nantes - Hôtel Dieu, 44093 Nantes CEDEX 1, France ¹⁷ Service de génétique médicale - Unité de Génétique Clinique, CHU de Nantes - Hôtel Dieu, 44093 Nantes CEDEX 1, France ¹⁸ Children's Cancer Institute, Lowy Cancer Research Centre, University of New South Wales, Australia ¹⁹ Healthy Mothers, Babies and Children, South Australian Health and Medical Research Institute, Adelaide, SA 5000, Australia •



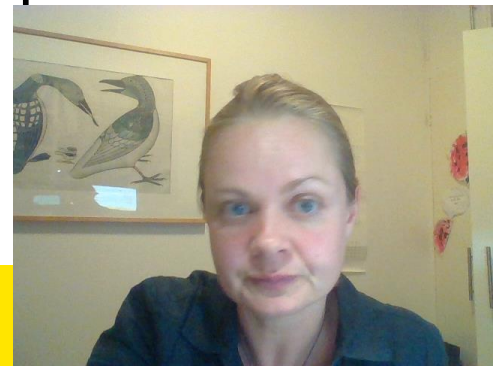
Dys (disordered) morph (shape, form)

- Try and study and attempt to interpret patterns of human growth and structural defects
- **Malformation** (an intrinsic developmental anomaly, e.g., spina bifida),
- **Disruption** (an event disrupting intrinsically normal development, e.g., amniotic bands),
- **Deformation** (an external force altering the shape of development, e.g., face shape due to severe oligohydramnios) and
- **Dysplasia** (abnormal growth and maturation of cells, e.g., achondroplasia).
- **Syndrome** "a recognizable pattern of dysmorphic signs that have a common cause"



Dysmorphology is just part of the puzzle

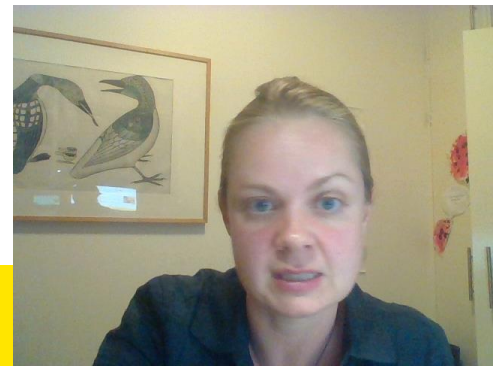
- 3 generation pedigree
- Look at the parents and sibs – ideally parent baby/child photos
- What is the pattern of functional/ congenital anomalies
- First line tests ... [now will be CMA and exome]



Terminology is important



- We are all dysmorphic to some extent
- Be gentle
- ‘distinctive’ ...
- ‘ features that are unique to them/ not similar to the rest of the family’



Some good resources

Elements of Morphology: Standard Terminology for the
(ACMG series: Allanson et al....2009)

Genetics Home Reference
Your Guide to Understanding Genetic Conditions

Search

Health Conditions Genes Chromosomes & mtDNA Classroom Help Me Understand Genetics


Marfan syndrome

Printable PDF Open All Close All

Description

Marfan syndrome is a disorder that affects the [connective tissue](#) in many parts of the body. Connective tissue provides strength and flexibility to structures such as bones, ligaments, muscles, [blood vessels](#), and [heart valves](#). The signs and symptoms of Marfan syndrome vary widely in severity, timing of onset, and rate of progression.

Because connective tissue is found throughout the body, Marfan syndrome can affect many systems, often causing abnormalities in the heart, blood vessels, eyes, bones, and joints. The two primary features of Marfan syndrome are vision problems caused by a dislocated lens ([ectopia lentis](#)) in one or both eyes and defects in the large blood vessel that distributes blood from the heart to the rest of the body ([the aorta](#)). The aorta can weaken and stretch, which may lead to a bulge in the blood vessel wall (an aneurysm). Stretching of the aorta may cause the aortic valve to



GeneReviews™ [Internet].

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Silver-Russell Syndrome

Synonym: Russell-Silver Syndrome

Howard M Saal, MD, Madeleine D Harbison, MD, and Irene Netchine, MD, PhD.

Author Information

Initial Posting: November 2, 2002, Last Update: October 21, 2019.

Estimated reading time: 33 minutes

Summary

Go to: ☺

Clinical characteristics. Silver-Russell Syndrome (SRS) is typically characterized by asymmetric gestational growth restriction resulting in affected individuals being born small for gestational age, with relative macrocephaly at birth (head circumference ≥ 1.5 SD above birth weight and/or length), prominent forehead usually with frontal bossing, and frequently body asymmetry. This is followed by postnatal growth failure, and in some cases progressive limb length discrepancy and feeding difficulties. Additional clinical features include triangular facies, fifth-finger clinodactyly, and micrognathia with narrow chin. Except for the limb length asymmetry, the growth failure is proportionate and head growth normal. The average adult height in untreated individuals is -3.1 ± 1.4 SD below the mean. The Netchine-Harbison Clinical Scoring System (NH-CSS) is a sensitive diagnostic scoring system. Clinical diagnosis can be established in an individual who meets at least four of the NH-CSS clinical criteria – prominent forehead/frontal bossing and relative macrocephaly at birth plus two additional findings – and in whom other disorders have been

Views

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- Print View
- Cite this Page
- PDF version of this page (1.0M)

In this GeneReview

- Summary
- Diagnosis
- Clinical Characteristics
- Genetically Related (Allelic) Disorders
- Differential Diagnosis
- Management
- Genetic Counseling
- Resources
- Molecular Genetics
- References
- Chapter Notes

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Clinical Genetics and Genomics (Oxford Desk Reference) (2 ed.)

Helen V. Firth and Jane A. Hurst

Previous Edition (1 ed.)

Abstract

This book on clinical genetics and genomics includes many common-sense approaches, useful standards and definitions, suggestions for appropriate testing, and excellent references. It is meant to be "first-line" support. It is designed to provide a basic guide to the clinical consultation, be it in outpatients or on the ward, and is intended to be used with other data sources, web resources, and texts. Blank pages are distributed throughout the book to enable the reader to update and personalize the copy with notes from current journals, guidelines, seminars, and lectures. Medical genetics ... More

Bibliographic Information

NIH National Human Genome Research Institute
Advancing human health through genomics research

Search Genome.gov

Research Funding Research at NHGRI Health Education Issues in Genetics Newsroom Careers & Training About Español f t y

Atlas of Human Malformation Syndromes in Diverse Populations


Atlas of Human Malformation Syndromes

Atlas Home Page
Browse by Condition
Browse by Geography
Consent Form
Advisory Board
References
Contact Information

An international group of clinical geneticists, dysmorphologists, and other medical specialists have come together to create an atlas of human malformation syndromes in diverse populations. The purpose of this website is to provide a tool that is easy to use and helpful for the clinician in diagnosing syndromic disorders across varied populations. Photographs of the face and other relevant body areas are the main focus of the website. The website will include photographs and the molecular diagnoses of individuals from geographically diverse locations including multiple locations in Asia, the Indian subcontinent, the Middle-East, South America, and sub-Saharan Africa. We anticipate that our electronic atlas will assist clinicians in associating congenital malformations with syndromes, allowing for earlier diagnosis and addressing the potential multiple associated medical issues.

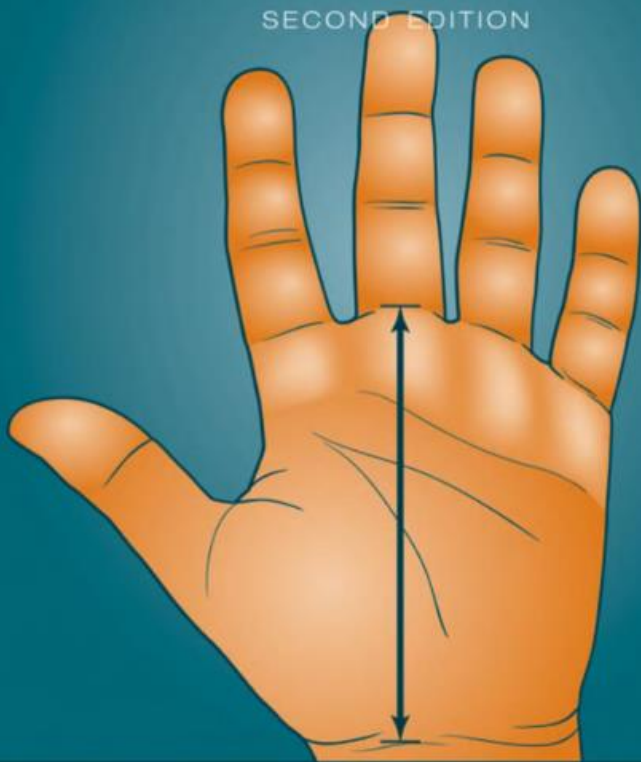
Birth defects remain a leading cause of infant mortality and childhood morbidity throughout the world. An accurate and early syndromic diagnosis is paramount, as late diagnosis can result in a delay in intervention and treatment of accompanying anomalies such as congenital heart defects or endocrine disorders. In 2010, the World Health Organization began a focus on congenital malformations and announced support for public health policy directed at preventing congenital malformations through various measures and recognizing birth defects as a public health priority. As laboratory sequencing technologies become more available, recognition of malformation syndromes will become increasingly important in all parts of the globe. Recognizing the global importance of congenital malformations and that most clinicians have trained with clinical genetic resources that used patients of northern European descent as the standard of reference, in this website we present patients from other parts of the world.

There is no identifying personal information on this website. There is a remote chance that one's private gene mutation could function as a unique identifying



HANDBOOK OF PHYSICAL MEASUREMENTS

SECOND EDITION



JUDITH G. HALL • JUDITH E. ALLANSON
KAREN W. GRIPP • ANNE M. SLAVOTINEK

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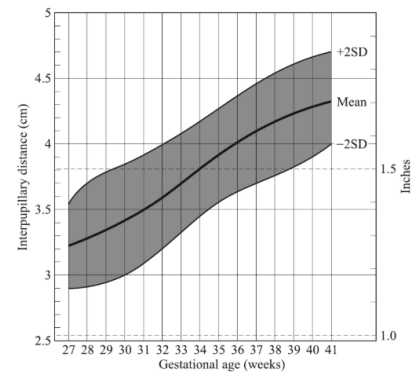
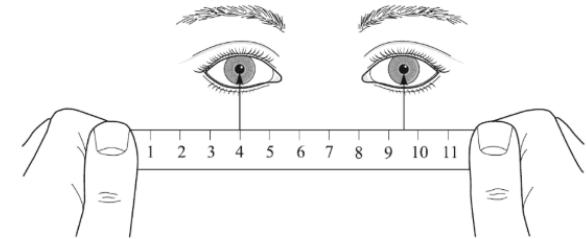


Figure 7.40 Interpupillary distance, both sexes, at birth. From Merlob et al. (1984), by permission.

Figure 7.39 Measuring interpupillary distance.



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Copyright

Chapter 7 Craniofacies

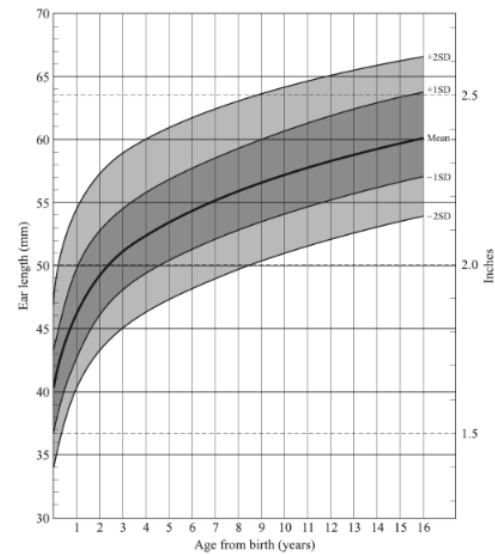
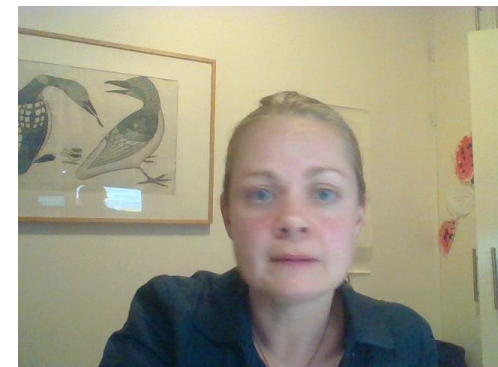


Figure 7.57 Ear length, both sexes, birth to 16 years. From Farkas (1981) and Feingold and Bossert (1974), by permission.



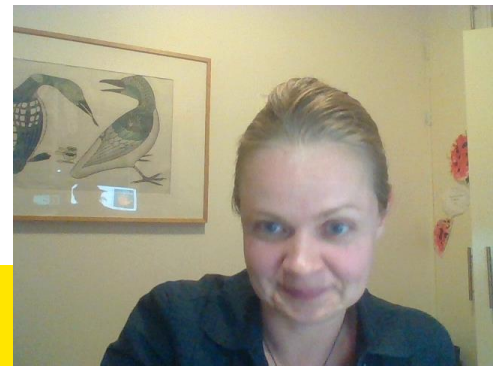
An approach ... with thanks to Noe

A) General inspection

A1) Growth

- HC
- Length/ Height
- Weight
- BMI

- Centiles
- Mid parental height



Short and tall stature

- Q? Proportionate or not proportionate. Compare to siblings. Pre or post natal onset
- Short stature: non proportionate
 - Consider skeletal dysplasia

MANY chromosomal and single gene neurodevelopmental genetic disorders affect growth



Silver Russell syndrome

IUGR ($<-2SD$)_ poor growth after birth, a relatively large head size, a triangular facial appearance, a prominent forehead (looking from the side of the face), body asymmetry and significant feeding difficulties. Majority have normal intelligence.

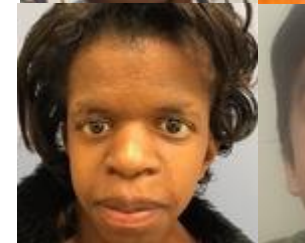
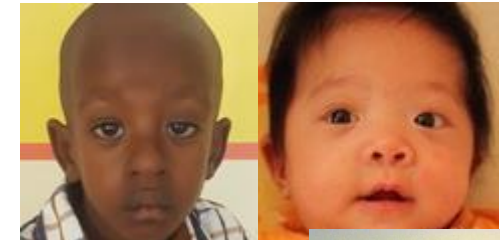
60% : detectable abnormality in imprinting regions chr 7 and 11



Turner syndrome



1:2000 female births
Complete or partial deletion of X chromosome.
Fertility impact



Noonan syndrome



Tall: Marfan, Homocystinuria, Klinefelters, Sotos

MARFAN & RELATED CONDITIONS | WHAT TO EXPECT | RESOURCES & ANSWERS | WALK FOR VICTORY | GET INVOLVED | ABOUT US | [DONATE](#)

E3 SUMMIT

DX HOME **CALCULATION OF SYSTEMIC SCORE**

CRITERIA Clinical manifestations of MFS in other organ systems were critically evaluated for their specificity and diagnostic utility based on expert opinion and the available literature. Several of the "minor" criteria from the old Ghent nosology were eliminated, but the most selective systemic features were included in the "systemic score".

SYSTEMIC CALCULATOR

Z-SCORE

TESTING INFO

DIFFERENTIAL DIAGNOSIS

RELATED DISORDERS

RESOURCES

Feature

Value

Click to include

Wrist AND thumb sign

+

3

☐

Wrist OR thumb sign

+

1

☐

Pectus Carinatum Deformity

+

2

☐

Pectus Excavatum or Chest Asymmetry

+

1

☐

Hindfoot Deformity

+

2

☐

Plain Flat Foot

+

1

☐

Spontaneous Pneumothorax

+

2

☐

Dural Ectasia

+

2

☐

Protucio Acetabulae

+

2

☐

Scoliosis or Thoracolumbar Kyphosis

+

1

☐

Reduced Elbow Extension

+

1

☐

3 of 5 Facial Features

+

1

☐

Skin Striae

+

1

☐

Severe Myopia

+

1

☐

Mitral Valve Prolapse

+

1

☐

Reduced Upper Segment / Lower Segment & Increased Arm span / Height

+

0

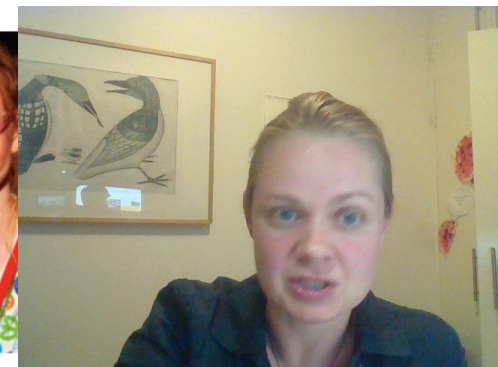
Open to calculate

*A score of ≥ 7 is considered a positive systemic score.

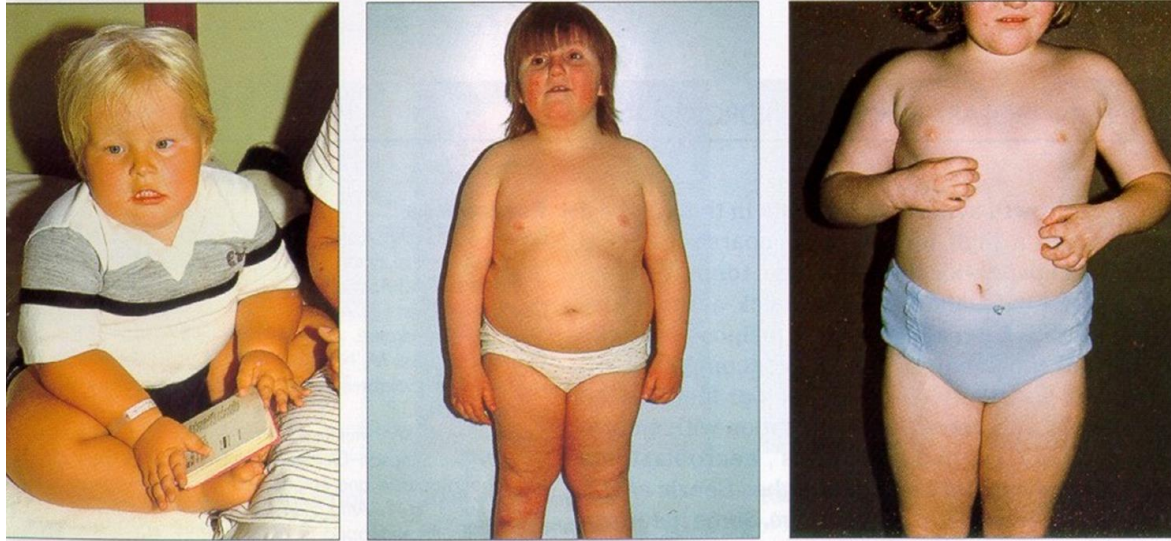
- <https://info.marfan.org/>
- Diagnostic criteria
- An *FBN1* pathogenic variant known to be associated with Marfan syndrome AND one of the following:
 - Aortic root enlargement (Z-score ≥ 2.0)
 - Ectopia lentis
- Demonstration of aortic root enlargement (Z-score ≥ 2.0) and ectopia lentis OR a defined combination of features throughout the body yielding a systemic score ≥ 7

Marfan syndrome is a serious condition, and some complications are potentially life-threatening. Advances in medical care have made it possible for people with Marfan syndrome to live a normal lifespan if they are diagnosed and treated properly.

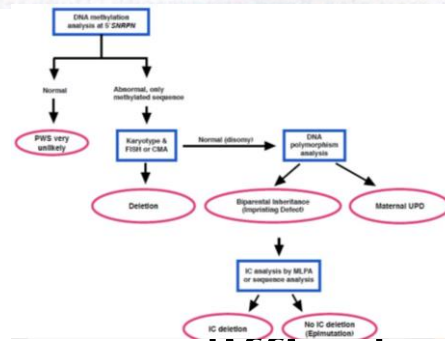
Marfan syndrome most often affects the heart, blood vessels, bones, joints, and eyes.



Obesity: Prader-Willi, Bardet-Biedl



- Hypotonia
- Hypogonadism
- Hyperphagia
- Cognitive impairment; difficult behaviours



Typical facial features; these are often subtle and are not always present. Features include deeply set eyes, widely spaced eyes, downslanted palpebral fissures, a depressed nasal bridge, small mouth, malar flattening, e. Brachydactyly and scars from excisions, f. Dental crowding, g. High palate, h. Fundoscopy demonstrating rod-cone dystrophy.



Development, characteristic behaviours/autistic features



- Rett syndrome – Clinical findings

- Most distinguishing finding: A period of regression (range: ages 1-4 years) followed by recovery or stabilization (range: ages 2-10 years; mean: age 5 years)
- Main findings
 - **Partial or complete loss of acquired purposeful hand skills**
 - **Partial or complete loss of acquired spoken language or language skill (e.g., babble)**
 - Gait abnormalities: impaired (dyspraxic) or absence of ability
 - **Stereotypic hand movements including hand wringing/squeezing, clapping/tapping, mouthing, and washing/rubbing automatisms**
- Supportive findings
 - Breathing disturbances when awake
 - **Bruxism when awake**
 - Impaired sleep pattern
 - Abnormal muscle tone
 - Peripheral vasomotor disturbances
 - Scoliosis/kyphosis
 - Growth retardation
 - Small, cold hands and feet
 - **Inappropriate laughing/screaming spells**
 - **Diminished response to pain**
 - **Intense eye communication - "eye pointing"**



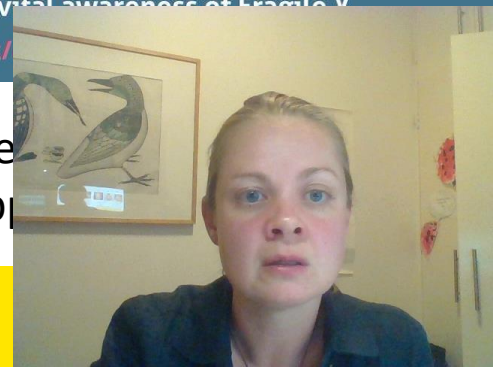
People with Fragile X may find making eye contact stressful, particularly with unfamiliar people.

Gaze avoidance may be a way with coping with anxiety.

#fragile X pedition: help us to raise vital awareness of Fragile X

Find out more: everydayhero.co.uk/

Fragile X syndrome: autistic features very common, flapping, hyperactivity,



Head



- Head circumference
- Shape
- Craniosynostosis - 0.5-3.4%
 - Sagittal 50% (dolicocephaly)
 - Coronal 22% (brachycephaly)
 - Metopic 6% (trigonocephaly)
 - Look at hands
- Fontanelles –
 - Size and time of closure
- Radiology-
 - sutures
 - Thick/thin/hyperostosis

Head: size, shape, fontanelles, sutures, hair
(quality, quantity), position of hairline

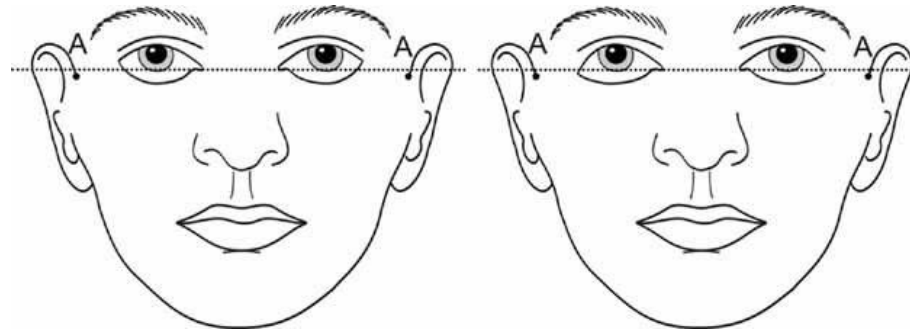
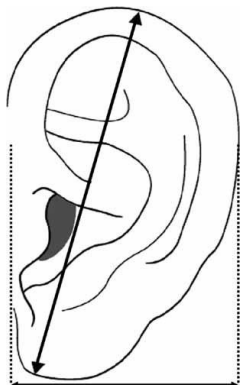
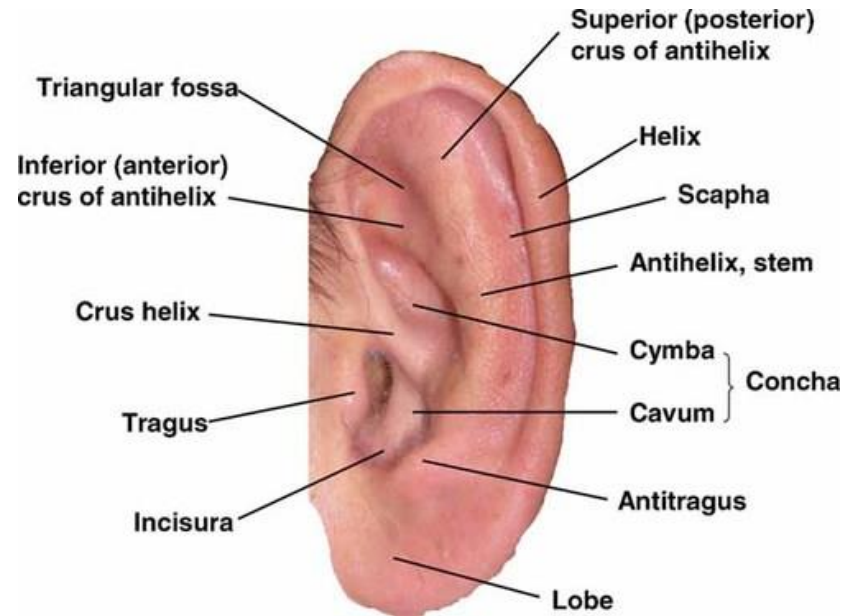
Face: shape, symmetry, forehead

Craniosynostosis syndromes

Alagille's



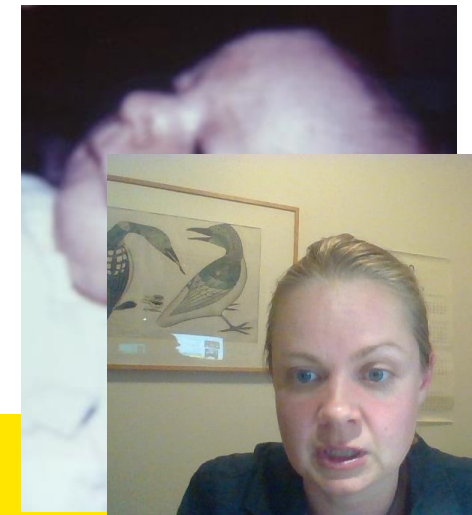
Ears



Low set ears

Definition : Upper insertion of the ear to the scalp below an imaginary horizontal passing through the inner canthi and extend that line posteriorly to the ear

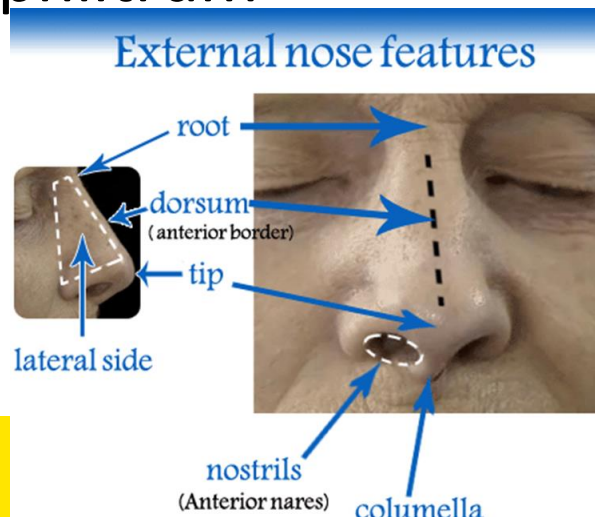
- Microtia/Anotia Macrotia
- Shape
- Position
- Configuration
- Auricular tag
- Pits
- Creases
- Hearing!



Deafness: Goldenhar, CHARGE, Waardenburg, Treacher Collins, Alport, NF-2, BOR, GJB2 (connexin 26), Jervell and Lange Nielsen, Alport

Nose

- size,
- shape,
- nasal bridge,
- tip,
- nostrils,
- philtrum



Fetal exposure to alcohol during the first trimester affects development of facial features.

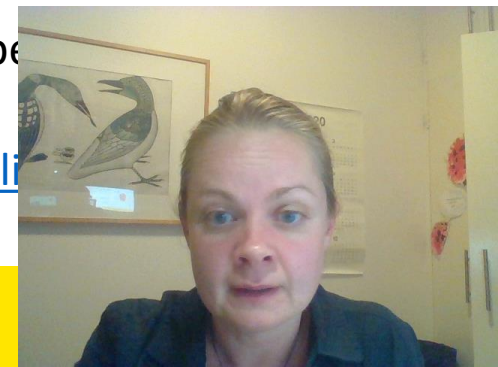
A range of facial anomalies can occur as result of prenatal alcohol exposure. There are three features which commonly occur across age, gender and ethnic groups:



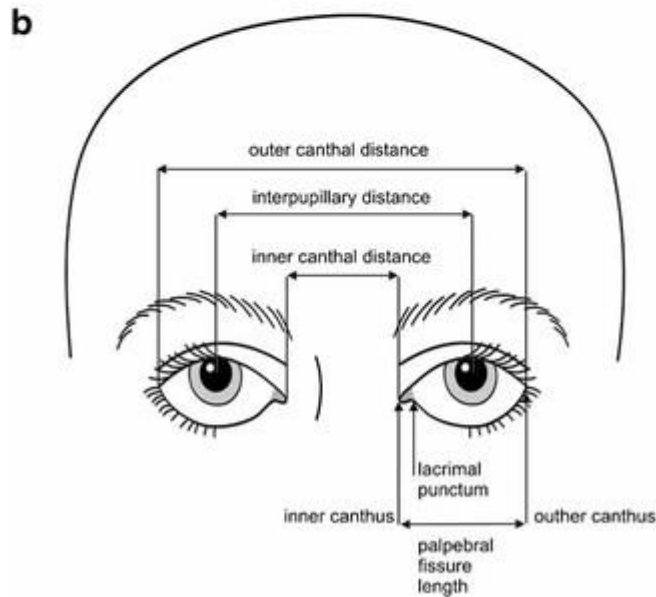
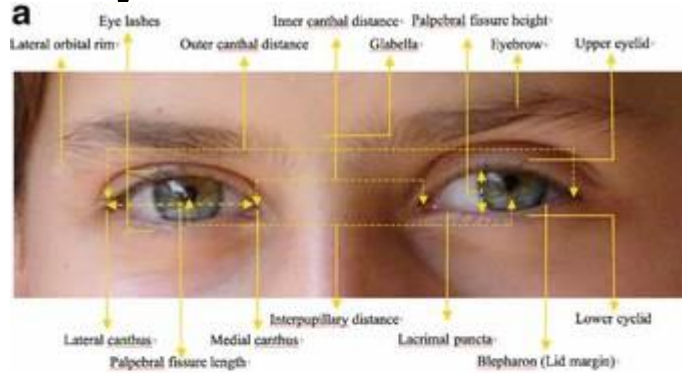
(Photo reproduced with permission from Susan Astley, University of Washington)

https://www.fasdhub.org.au/siteassets/pdfs/australian-diagnosis-of-fasd_all-appendices.pdf

- Small palpebral fissures: short horizontal length of the eye opening, defined as the distance from the endocanthion to the exocanthion (points A and B on photo below)
- Smooth philtrum: diminished or absent ridges between the upper lip and nose
- Thin upper lip volume



Eyes



Telecanthus – increased distance between inner canthus- varies with ethnicity

Critically – is the intra-pupillary distance increased or not

Hypertelorism- widely spaced eyes- increased intra-pupillary distance



cyclopia

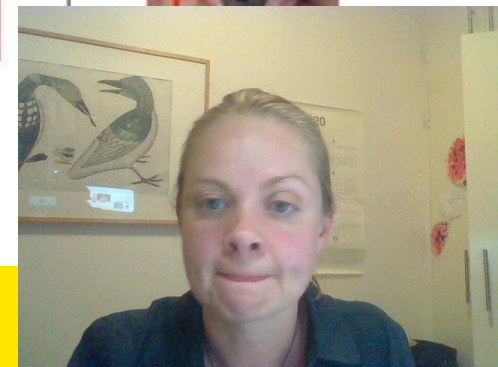
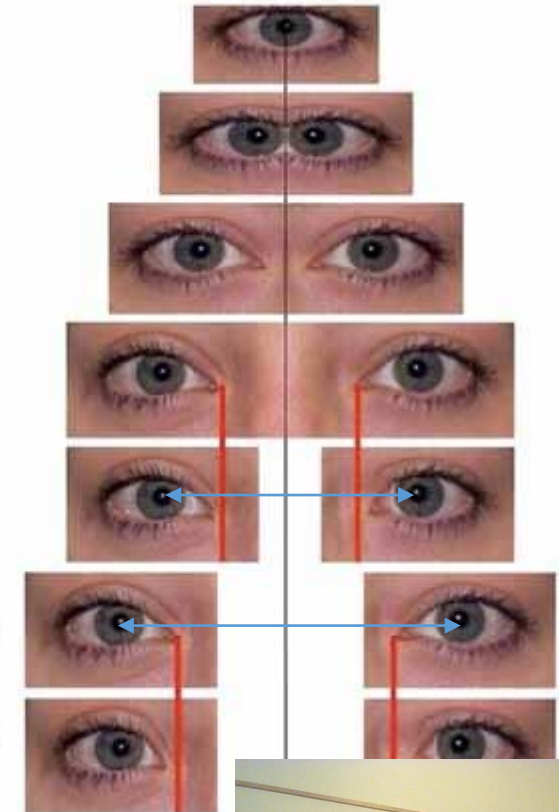
hypotelorism

normal

telecanthi

hypertelorism

hypertelorism + telecanthi



Mouth

- mouth,
- jaw,
- lips,
- teeth,
- palate,
- tongue,
- uvula,
- midline defects

Cleft lip/palate: 22q11 deletion, Stickler

- Approx 50% of cleft lip/palate will have other anomalies
 - isolated CP (30%)
 - isolated CL (11%)
 - CLP (9%)

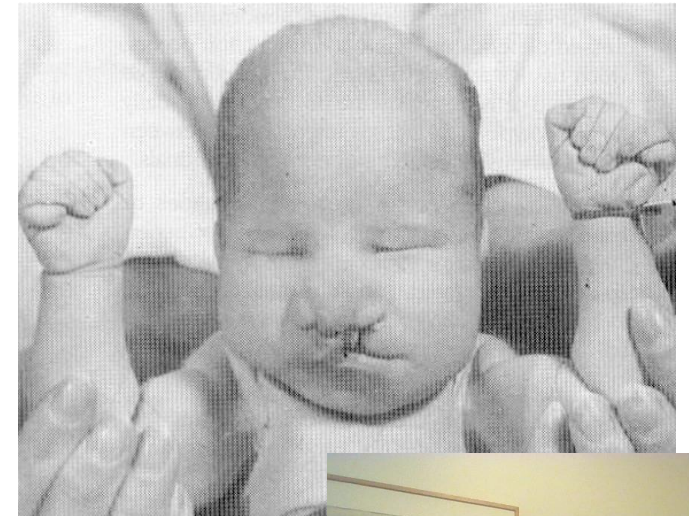
Recurrence risk depends on family history and type:

Non syndromal cleft palate (CP)

- One affected child RR 2%
- One affected parent RR 6%
- One affected parent and one affected child RR 15%

Non syndromal Cleft lip and palate

- One affected child RR 4%
- One affected parent RR 4%
- One affected parent and one affected child RR 10%



Mandible

- Agnathia
- +/- holoprosencephaly
- Micrognathia –
- associated with > 130 syndromes
- >47 chromosomal abnormalities
- Contribution to sequence .eg. Pierre Robin
- Retrognathia
- Normal size and shape -posteriorly positioned jaw



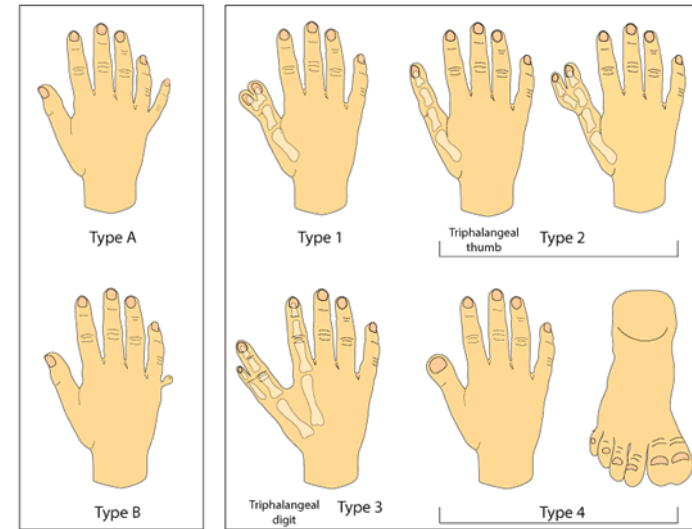
Limbs

Hands: shape, size, symmetry, nails, finger length and shape, palmar creases

Length –brachydactyly/arachnodactyly
digits-

- oligodactyly
- polydactyly
- clinodactyly
- syndactyly

Arms: segment proportions, asymmetry, joint hypermobility



Marfan, Ehler Danlos, Beckwith-Wiedemann

Hands: shape, size, symmetry, nails, finger length and shape, palmar creases	Radial ray anomalies: Fanconi anaemia, VACTERL, TAR, Blackfan diamond
Arms: segment proportions, asymmetry, joint hypermobility	Marfan, Ehler Danlos, Beckwith-Wiedemann



Joint hypermobility scale (Beighton)

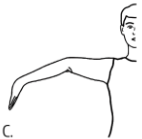
<https://www.ehlers-danlos.com/assessing-joint-hypermobility/>



- (A) With the palm of the hand and forearm resting on a flat surface with the elbow flexed at 90°, if the metacarpal-phalangeal joint of the fifth finger can be hyperextended more than 90° with respect to the dorsum of the hand, it is considered positive, scoring 1 point.



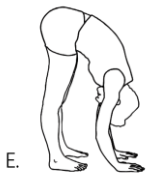
- (B) With arms outstretched forward but hand pronated, if the thumb can be passively moved to touch the ipsilateral forearm it is considered positive scoring 1 point.



- (C) With the arms outstretched to the side and hand supine, if the elbow extends more than 10°, it is considered positive scoring 1 point.



- (D) While standing, with knees locked in genu recurvatum, if the knee extends more than 10°, it is considered positive scoring 1 point.



- (E) With knees locked straight and feet together, if the patient can bend forward to place the total palm of both hands flat on the floor just in front of the feet, it is considered positive scoring 1 point.

≥6 for prepubertal children
≥5 for pubertal children and adults up to age 50
≥4 for those age >50 years

ASSESSING JOINT HYPERMOBILITY

THE BEIGHTON SCORING SYSTEM

The Beighton Scoring System measures joint hypermobility on a 9-point scale. The joints assessed are:

- Knuckle of both little/fifth/pinky fingers
- Base of both thumbs
- Elbows
- Knees
- Spine



Hypermobile EDS requires three criteria to be met

- Generalized joint hypermobility (Criterion 1)
- Evidence of syndromic features, musculoskeletal complications, and/or family history (Criterion 2)*
- Exclusion of alternative diagnoses (Criterion 3)#

Must do an echo to look at aortic root size

Repeat 3-5 years if N to late teens

- Management: low impact exercise, physical therapy, splints/ supports/ padding/ accommodations (OT)/ GI/ yo family therapy/ pain therapy

*musculoskeletal pain, joint dislocations

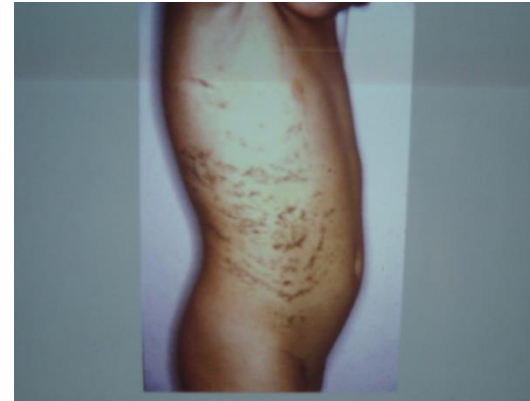
e.g. skin fragility, atrophic scarring, vasculopathy, Ehlers-Danlos syndrome, Williams, aortic enlargement



Skin

**Skin: scars,
neurocutaneous
stigmata,
pigmentation**

**Café-au-lait
macules: NF-1,
Fanconi
Anemia,
McCune-
Albright
Hypo-
pigmentation:
Tuberous
sclerosis**



Neurofibromatosis 1 (NF1) should be suspected in individuals who have any of the following findings:

- Six or more café au lait macules (Figure 1) >5 mm in greatest diameter in prepubertal individuals and >15 mm in greatest diameter in postpubertal individuals
- Two or more neurofibromas (Figure 2) of any type or one plexiform neurofibroma (Figure 3)
- Freckling in the axillary or inguinal regions
- Optic glioma
- Two or more Lisch nodules (iris hamartomas)
- A distinctive osseous lesion such as sphenoid dysplasia or tibial pseudarthrosis
- A first-degree relative (parent, sib, or offspring) with NF1 as defined by the above criteria

Tuberous sclerosis diagnostic criteria

Major features

- **Angiofibromas (≥3) or fibrous cephalic plaque**
- Cardiac rhabdomyoma
- Cortical dysplasias, including tubers and cerebral white matter migration lines
- **Hypomelanotic macules (3 to >5 mm in diameter)**
- Lymphangioleiomyomatosis (LAM) Multiple retinal nodular hamartomas
- Renal angiomyolipoma (Shagreen patch)
- Subependymal giant cell astrocytoma (SEGA)
- Subependymal nodules (SENS)
- **Ungual fibromas (≥2)**

Minor features

- **"Confetti" skin lesions (numerous 1- to 3-mm hypopigmented macules scattered over regions of the body such as the arms and legs)**
- Dental enamel pits (>3)
- Intraoral fibromas (≥2)
- Multiple renal cysts
- Nonrenal hamartomas
- Retinal achromic patch

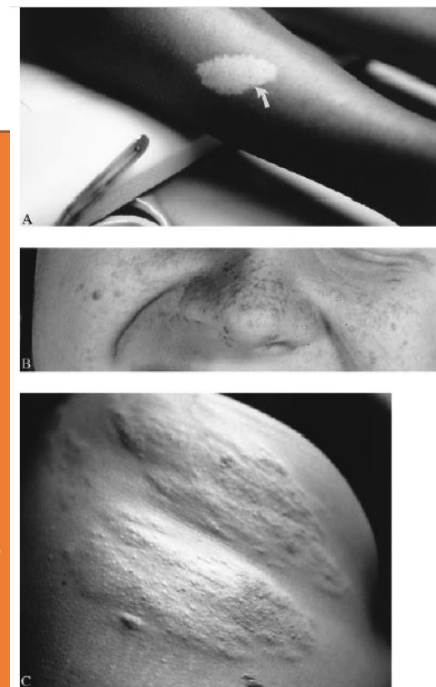
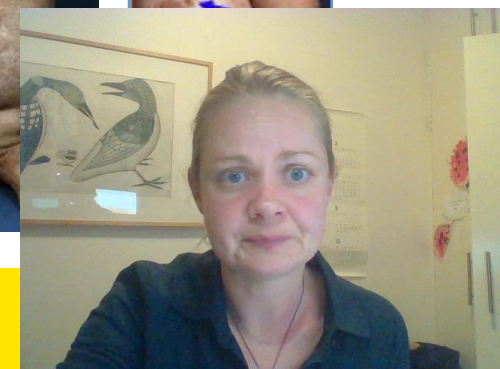


Figure 1. Classic cutaneous manifestations of tuberous sclerosis include (A) hypomelanotic macule (ash-leaf spot) (arrows), (B) facial angiofibromas. (C) Shagreen patch. Figures 1A and 1C reprinted from Roach ES, Semin Neurol 1988; 8:83–96, with permission. Figure 1B reprinted from Roach ES, Delgado MR, Derm Clin 1995;13:151, 161, with permission.



Fig 3

Fig 1



Rest of the body1!

Torso	
Neck: webbing, skin folds	Noonan
Back/chest: spine (scoliosis, surgery, stature), sternum, chest, nipples, heart sounds	Klippel Feil Congenital cardiac malformations in various syndromes (partly also covered in cardiology)
Abdomen: organomegaly, scars, hernia	
Lower limbs and feet	
Legs: segment proportions, asymmetry, hypermobility	Beckwith-Wiedemann
Feet: nails, toes, webbing, foot size and shape (flat, curved, symmetry)	Syndactyly
Genitalia	
Phallus, scrotum, testes (size and development), labia, puberty	Pubertal delay: Turner, Klinefelter
Anus: position/perforate	VACTERL



SELECTED GENETIC DISEASES WITH DYSMORPHIC FEATURES

- For the conditions listed below: features on examination/dysmorphic features; where applicable - diagnosis, treatment, prognosis for the condition.
- Alagille syndrome
- Disorders of chromosomal duplication or deletion, such as cri-du-chat syndrome
- Duchenne and Becker muscular dystrophy (DMD) – also covered in neurology
- Fragile X syndrome (FXS)
- Genetic imprinting disorders:
 - Angelman syndrome
 - Beckwith–Wiedemann syndrome
 - Prader–Willi syndrome
- Genetic disorders with neurological features (also covered in neurology)
 - Ataxia telangiectasia
 - Charcot–Marie–Tooth disease
 - Huntington disease
 - Rett syndrome
 - tuberous sclerosis
- Genetic disorders of growth and musculoskeletal development
 - achondroplasia
 - Treacher Collins syndrome
- Klinefelter syndrome
- Marfan syndrome
- Microarray abnormalities:
 - 15q11.2 deletion
 - 16p11.2 deletion or duplication
 - 22q11.2 deletion or duplication
- Myotonic dystrophy (also covered in neurology)
- Neurofibromatosis type 1 (NF1) and type 2 (NF2)
- Noonan syndrome (NS)
- Osteogenesis imperfecta (OI)
- Trisomy 13, 18, 21
- Turner syndrome
- Williams syndrome



- Moving into the frontier technology age
.... Facial recognition software

