AGING

COMMENTS: They found a correlation between onset of menopause (age 44.7) and onset of dementia.


COMMENTS: From a residential center for 38 adults with DS. Some problems listed include cataracts (50%), recurrent keratitis (21%), keratoconjunctivitis (15.8%), significant hearing loss (25%), untreated congenital heart anomalies (15.8%), acquired cardiac disease (15.8%), pulmonary hypertension (7.8%), recurrent respiratory infections/ aspiration leading to chronic pulmonary interstitial changes (30%), complications from senile dementia/Alzheimer-type disease (42%), adult-onset epilepsy (36.8%), osteoarthritic degeneration of the spine (31.6%), osteoporosis with resultant fractures of the long bones (55%) or vertebral bodies (30%), and untreated atlantoaxial instability (7.9%).

BIOCHEMISTRY

CARDIOLOGY

COMMENTS: From the Atlanta Down Syndrome Project over a period of 6.5 years there were 243 infants born with DS (prevalence of 9.6/10,000). A cardiac diagnosis was available for 93% of the infants. 44% had congenital heart disease (45% atrioventricular septal defect, 35% ventricular septal defect, 8% isolated secundum atrial septal defect, 7%, isolated persistent patent ductus arteriosus, 4% isolated tetralogy of Fallot, and 1% other).


COMMENTS: Despite more obesity and elevated lipid levels atherosclerotic heart disease is probably nonexistent.


COMMENTS: It doesn’t work.


DENTAL

EDUCATION & THERAPY


News from the Down Syndrome Medical Interest Group (DSMIG)

William I. Cohen, M.D.  Down Syndrome Center, Children’s Hospital of Pittsburgh
Bonnie Patterson, M.D.  Cincinnati Center for Developmental Disorders
Co-Chairs

Mission: The Down Syndrome Medical Interest Group (DSMIG) was founded in early 1994 with the express purpose of serving as a forum for professionals addressing aspects of medical care of persons with Down syndrome. DSMIG wishes to promote the highest quality care for children and adults with DS: 1) by fostering and providing professional and community education; 2) by disseminating tools for clinical care and professional support; such as the Health Guidelines for Individuals with Down Syndrome; 3) and by engaging in collaborative clinical research regarding issues related to the care of individuals with Down syndrome.

For further information, contact either co-chair: Bonnie Patterson at 513-559-4691 or Bill Cohen at 412-692-6546.
If you are interested in being added to our mailing list, please send your name, professional title, agency, address, telephone number, fax number, and email address (if any) to William I Cohen MD, Down Syndrome Center, Children’s Hospital of Pittsburgh, 3705 Fifth Avenue, Pittsburgh, PA 15213. 412-692-6546; fax 412-692-5679; email: cohenb@chplink.chp.edu.

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News From DSMIG

Research Conference and DSMIG Meeting in Toronto

Faithful readers of these notes are most certainly aware of the research conference to be held in Toronto, Ontario, Canada on Thursday and Friday, October 25th and 27th, 2000. New Directions in Down Syndrome Research is a second biennial scientific conference sponsored by the Down Syndrome Research Foundation and Resource Center (DSRF), Vancouver, British Columbia, Canada. The first conference was held in April, 1998 in Vancouver. This meeting is cosponsored by the National Down Syndrome Society (NDSS) and includes such speakers as Brian Chicoine, MD, Charles Epstein, MD, Bob Haslam, MD, Julie Korenberg, PhD, Digby Elliot, PhD, David Patterson, PhD, among many others. Individuals on the DSMIG mailing list have been sent a copy of the program and registration information.

DSMIG will hold its annual meeting on Wednesday, October 25, 2000, the day preceding the Scientific Conference.

If you need conference registration information, contact Jo Mills, Executive Director of the DSRF via phone 604-431-9694 or e-mail: josephin@sfu.ca

Please contact me directly at 412-692-7963 or via e-mail: cohenb@chplink.chp.edu. Please include your fax number and I will fax you a registration form for the DSMIG annual meeting.

I am pleased that our Canadian colleagues will join us for the morning; they will then meet separately in the afternoon to form a Canadian Interest Group.

The main focus of our work will be further development of guidelines specifically motor development, communication, behavior, and education. These will parallel the Health Care Guidelines that were last revised in 1999.
ENDOCRINOLOGY
COMMENTS: The prevalence of hypothyroidism in this group of 214 (5 were not screened) school age children in Scotland was 8.9%.

EPIDEMILOGY
COMMENTS: Gastrointestinal problems (77%), cardiac anomalies (38%), and hematologic problems (11%) were the most common complications for 216 infants.

GASTROENTEROLOGY

GENETICS
COMMENTS: Russian. N=1778.

HEMATOLOGY/ONCOLOGY
COMMENTS: Although the risk of cancer was slightly higher in this Danish population, it was due to a higher risk for leukemia. The risk for solid tumors was about half. There were no cases of breast cancer. There was a nonsignificant increase in the number of cases of testicular cancers, ovarian cancers, and retinoblastomas. N=2814. The vitamin therapy advocates say that cancer is increased because of oxidative stress. This study shows a decrease in solid tumors and no leukemia after age 29.

MISCELLANEOUS


**NEUROLOGY**


**NUTRITION**


**OPHTHALMOLOGY**


COMMENTS: Amblyopia occurred in 22%. Bilateral vision less than 20/50 occurred in 24%. N=68 (5-19 years).

**ORTHOPEDICS**


**OTOLARINGOLOGY**


**PRENATAL DIAGNOSIS**


COMMENTS: Danish.


COMMENTS: An editorial.


**PSYCHIATRY**


**PULMONARY**


New Directions in Down Syndrome Research
Conference 2000

October 26th – 27th, 2000
Toronto, Canada

Down Syndrome Research Foundation &
National Down Syndrome Society

Platform Presentations

Role of Clinical Research in Ensuring Quality Care
H.A. Haslam
Hospital for Sick Children, Toronto, Ontario

I have chosen to present two clinical research projects utilizing randomized controlled trials (RTC) to illustrate the importance of clinical research in ensuring quality care.

The RTC is defined as a carefully and ethically designed experiment which includes the provision of adequate and appropriate controls by a process of randomization so that precisely framed questions can be answered. RTC’s provide the framework for evidence based health care which is a term used to describe the “conscientious and judicious use of currently best available evidence from research to guide health care decisions”.

Megavitamins are frequently administered to children with attention deficit hyperactivity disorder (ADHD). We studied the effectiveness of a popular megavitamin regime utilizing a two-stage trial in 41 children with ADHD. Stage 1 was a 3-month clinical trial of megavitamins and stage 2 consisted of four, 6-week, double-blind repeated crossover periods. Twelve children (29%) showed significant behavior improvement during stage 1. These children were then enrolled in a double-blind crossover phase (stage 2) to evaluate megavitamin therapy. Using analysis of variance methods for crossover studies, there was no significant difference (p>0.05) in most behavior scores between those children receiving vitamin and placebo during stage 2. Children exhibited 25% more disruptive classroom behavior when treated with vitamins v. placebo (p<0.01). Forty-two percent of the children exceeded the upper limits of serum transaminase levels (liver function test) while receiving vitamins. It is concluded that megavitamins are ineffective in the management of ADHD and should not be used because of the potential hepatotoxicity.

Piracetam has been touted, without controlled blinded studies, as an important drug to enhance cognitive function in children with Down syndrome (DS). We conducted a double-blind, placebo-controlled crossover study assessing the cognitive and behavioral effects of piracetam in DS children. Twenty-five DS children were randomly assigned to one of two treatment orders (following baseline cognitive studies); piracetam-placebo or placebo-piracetam. Each treatment period was four months in duration. The primary outcome measure was a cognitive test battery that included 14 tasks assessing a wide range of cognitive functions (e.g. attention, learning and memory). Secondary outcome measures were determined from parent and teacher questionnaires. Eighteen children completed both phases of the study. Based on an analysis of difference scores from the baseline tests, piracetam did not significantly improve cognitive performance as compared to placebo. We found that piracetam was associated with central nervous system stimulatory side effects in seven children, including aggressiveness, agitation or irritability, sexual arousal, disturbed sleep and decreased appetite. We conclude that piracetam does not improve cognitive function or behavior in children with DS, even when does associated with adverse effects were utilized.

Anecdotal reports of the efficacy of certain treatment regimens for children should be viewed with caution. These studies highlight the importance of clinical research in ensuring quality care.
Plasma Amyloid Beta Protein 1-42 (Ab42) Levels are Increased in Old Down Syndrome (DS) But Not in Young DS
NY State Institute for Basic Research in Developmental Disabilities, Staten Island, NY.

All adults with DS have neuropathological changes characteristic of Alzheimer disease (AD) by 40 years of age. Soluble forms of Ab generated from amyloid precursor protein commonly end at C-terminal residue 40 or 42. The possession of two variants of ApoE e4 allele is a significant risk factor for the development of AD. Our objective was to quantitate the levels of Ab40 and Ab42 in plasma from young DS (<40 years of age), old DS (>40 years) and age-matched normal controls, and analyze the relationships with apolipoprotein E (ApoE) phenotype. Blood was collected from 28 young DS (mean age 30 ± 6.7 years), 30 old DS (51 ± 7 years), 23 controls (7 with ApoE e4 allele and 21 without), 32 age-matched controls (7 with ApoE e4 allele and 21 without), 32 old DS (61 ± 7 years), and 32 age-matched controls (10 with ApoE e4 allele and 22 without). Ab40 levels were higher in young DS than controls (p<0.001). Ab42 levels in young DS and controls were similar. Ab40 and Ab42 levels were higher in old DS than controls (p<0.001). There was no relationship between Ab levels with ApoE e4 allele in DS and controls. Plasma Ab42 is increased in old DS concurrently with the development of AD neuropathology.

Aspects of Neoplasms in Down Syndrome
D. Satgé,1 A.J. Sasco,2 M Vekemans3
1 Lab Pathology, Centre Hospitalier (CH), Tulle, France, 2 Lab Epidemiology for Cancer Prevention, International Agency for Research on Cancer (IARC), Lyon, France, 3 Lab Cytogenetics, Hopital Necker, Paris, France

After a successful treatment of cardiac and infectious diseases, neoplasms become an important problem in patients with Down syndrome (DS). A review of the literature shows that they are different from those in the general population (GP). Firstly, neoplasms occur mainly in young children, becoming rare in adulthood. Secondly, leukemias are particularly over-represented. Thirdly, solid tumors are rare. Embryonal tumors such as neuroblastoma, nephroblastoma, and medulloloblastoma are exceptional in children. In adults, common epithelial neoplasms, mainly gynecological, mammary, bronchial, digestive and ENT tumors are rare. However lymphoma, germ cell tumors, sarcomas, Ewing tumors and retinoblastoma are more frequent. In addition, over-represented neoplasms occur earlier and more frequently in males than in females. Finally, a particular response to antineoplastic drugs is observed: enhanced methotrexate toxicity occur while chemotherapy against AML is much more effective in DS than in the GP. The mechanisms explaining this particular tumor profile are not clarified yet. Hormonal, immunological, and environmental factors certainly play a role. On the other hand oncogenes mapping to chromosome 21 such as AML1, ETS2, ERG could favor hematological and germ cell neoplasms by gene dosage effect. Conversely genes coding for enzymes such as SOD2 and for factors involved in cell proliferation and differentiation such as S100 beta and ANA could be tumor protecting genes.

Conclusion: Knowing the organs more prone to neoplasms in DS is important for an early diagnosis. Additionally, now that a complete sequence of chromosome 21 is available it is capital that a good knowledge of the tumor profile observed in DS patients contribute to our understanding of genetic predisposition to cancer.

A grant from Fondation Jerome Lejeune supported this study.

Six Weeks – Thirty Five Years Old: Longitudinal Study of People with Down Syndrome
J. Carr
St. George’s Hospital, England

A cohort of infants with Down syndrome, born in 1964, has been followed up at intervals, most recently age 35 years. They were tested on intelligence, language, reading and arithmetic, and their daily living skills were assessed. Comparison with the same tests given at ages 21 and 30 showed small decrements in scores in most cases, these being probably no more than would be expected from normal aging. Exceptions were reading comprehension and language scores, which showed small increases over time. As before, higher scores were found for the women, those bought up at home, and for language and reading, for those from social class NM (non-manual) families but fewer of the differences were now significant. These results, demonstrating considerable stability over the period from age 21 to 35, are discussed with reference to other relevant research.

Perception of Emotional Information in Children with Down Syndrome
S. Pollack
Department of Psychology, Psychiatry and Pediatrics and Waisman Research Center, University of Wisconsin at Madison, Madison, Wisconsin.

We examined how accurately and quickly children with DS were able to recognize facial displays of emotion and sought to relate this ability to children’s socio-emotional development. Children viewed color images of faces displaying expressions of happiness, anger, sadness, fear, and disgust. The faces were initially presented in a highly degraded format. However, every half-second, the images became more organized and focused. At regular intervals, children were prompted to identify the emotion depicted on the screen. In addition, children completed structured interviews relating to development of depression and anxiety. Children with DS reported significantly more feelings of depression and anxiety than controls. Moreover, children with DS required more visual information about each facial expression to determine the emotion being portrayed, suggesting they may miss early social cues. Unusually slow or inaccurate recognition of the feelings being conveyed by others may contribute to feelings of frustration and experiences of social rejection. In fact, children with Down syndrome in our study reported high levels of sadness and anxiety that were specifically focused around interpersonal issues. These findings will be discussed in terms of how emotion recognition may be related to the development of social difficulties in later childhood and adolescence.
**Socio-Emotional Understanding in Children with Down’s Syndrome**
T.K. Pitea and J.G. Wishart
University of Edinburgh, Scotland

Children with Down’s syndrome (DS) are often viewed by the public and by many professionals as being none-too-bright but nevertheless happy, affectionate, and sociable children. To understand the social world fully, however, an ability to process information in the facial expressions of others is crucial.

Three tasks - matching unfamiliar faces to a target face by expression or identity and choosing an expression to fit the outcome of a story - were presented to 16 children with DS aged 8-14 years, 16 age-matched children with non-specific developmental delay, and 16 typically-developing children matched for basic face recognition ability. The children with DS made more errors on all 3 tasks although this difference was significant only on the expression matching task. The pattern of results rules out a general visual-spatial processing explanation of group differences and is consistent with a more specific inability to recognize emotions, in particular surprise and fear. Results show parallels with findings from clinical studies of patients with amygdala damage and fit with the emerging picture of hippocampal/amygdala damage in DS. The poor task engagement seen in the children with DS also suggests amygdala dysfunction and adds further to evidence that motivational deficits add to the cognitive difficulties associated with the syndrome.

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**Cerebral Specialization in Persons with Down Syndrome**
D. Elliott
Department of Kinesiology, McMaster University, Hamilton, Ontario

Over the last 15 years, we have developed a model of brain organization in persons with Down syndrome. The main feature of the model is the biological dissociation of cerebral areas responsible for speech perception and the brain areas associated with movement organization. In this presentation, we review the neurobehavioral evidence for atypical cerebral organization in persons with Down syndrome. We also outline the development of our model of brain organization, and describe several recent attempts to test the predictions of the model.

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**Cerebral Specialization in Persons with Down Syndrome II**
D. Weeks
Simon Fraser University, Burnaby, BC

As discussed in the previous talk, an anomalous right hemisphere specialization for speech perception led us to propose a neurobehavioural model of brain organization in persons with Down syndrome to help us explain some of the specific information processing difficulties experienced by these people, as well as to guide our research.

In this talk we present our recent efforts at examining the neural underpinning of our behaviour model. Indeed both MEG and EEG reveal patterns of activity that are consistent with our behavioural work and provide new insights into the “perceptual motor” behaviour of people with Down syndrome.

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**Prolonged EEG’s in Children with the Dual Diagnosis of Down Syndrome and Autism Spectrum Disorder**
B. Patterson, R. Strawburg., D. Smith, and F. Hickey.
Cincinnati Center for Developmental Disorders, University of Cincinnati Medical School,
Children’s Hospital of Cincinnati, Cincinnati, OH.

Purpose: The purpose of this study was to determine if children with the dual diagnosis of Down syndrome and autism had abnormal prolonged EEG’s without evidence of clinical seizures.

Methods: Thirteen children followed in the Down Syndrome Clinic at the Cincinnati Center for Developmental Disorders and diagnosed with autism spectrum disorder (based on history, observation, and standard questionnaires) had 23 hour EEG studies.

Results: Seven of the 13 children had normal EEG findings. Of the 6 children with abnormal findings, 3 had slowing (1 background, 1 right centro-temporal and background, 1 left temporal) and 3 had epileptiform spikes (1 left central, 1 left temporal-frontal, 1 bifrontal). Non-specific background slowing has been reported in children with Down syndrome and the incidence of seizures is reported at 5-10%. In this study 20% of the children had epileptiform abnormalities on EEG, this is the same percentage that has been reported in children with autism spectrum disorder without a history of clinical seizures. These abnormalities are most often associated with a history of regression of language. Seven of the children in this study had a history of regression of skills prior to 5 years of age and 6 were the children with EEG abnormalities.

Conclusions: Children with Down syndrome and autism have evidence of EEG abnormalities on prolonged EEG studies at the same incidence as reported in autism spectrum in the general population. Prolonged EEG’s should be considered part of the medical work-up of children with Down syndrome and autism particularly if there is a history of regression.
Quality Of Life Changes for Adults With Developmental Disabilities In Ontario: Final Results From the Ontario Quality of Life Project
I. Brown
Centre for Health Promotion, University of Toronto, Toronto, Canada

Quality of life is a concept that has recently taken a central role in policy development and service delivery within the field of developmental disabilities in many countries. The use of quality of life as a concept reflects a growing philosophy in developed countries of the importance of providing services that contribute to enhancing the quality of people's lives, and in developing countries of the importance of providing services that address at least the basic human needs of people with disabilities.

The Ontario Quality of Life Project, funded by the Ontario Ministry of Community and Social Services and carried out by the Centre for Health Promotion at the University of Toronto, was initiated in 1991 and was completed in 1999. It assessed the quality of life of 504 adults with developmental disabilities, randomly selected from across Ontario, and followed, over a three-year period, 212 of these adults. The study’s final report has recently been released, although the findings have not been presented or published to date. The results provide information on a wide variety of life experience variables, as well as quality of life data from three perspectives: the person with developmental disabilities, another close person, and the trained assessor. This presentation will highlight the main findings, and those that are of particular interest to individuals with Down syndrome and their families. Study participants were not selected by etiology, and thus quality of life information specifically about those participants with Down syndrome are not available. However, adults with Down syndrome were included in the random selection, and thus the overall results are generalizable to them as part of the wider developmental disability population.

This project has been extremely influential in Ontario, throughout Canada, and internationally. This presentation will address its implications for the development of disability policy, and for the way support is conceived and carried out.

L. Rastelli and M. Pothos
Department of Pediatrics, Children's Hospital of Eastern Ontario, Ottawa, Ontario.

Objective: Guidelines for professional behaviour in breaking bad news to parents is widely available. Our aim was to determine the level of parental satisfaction with the interview informing them that their newborn has Down syndrome.

Method: A parent questionnaire was formulated asking questions related to timing, person disclosing, manner of disclosure, setting, reasons provided, terminology used in disclosure and overall level of satisfaction. 40 parents of children followed at the Children's Hospital of Eastern Ontario's Down Syndrome Clinic were approached. One hundred percent of them agreed to participate and described their recollection and satisfaction with the manner in which the news of their child's diagnosis was conveyed in the newborn period.

Results: 38/40 (95%) of parents remembered the disclosure well to vividly well. 40/40 (100%) of parents preferred the disclosure to come from the physician most familiar to them (i.e. obstetrician). 20/29 (69%) of parents who were told within 24 hours of delivery were satisfied with the timing. 9/10 (90%) of parents who were told days/weeks later were dissatisfied and retained bitter feelings years later. 18/40 (45%) were alone (without significant other) at time of disclosure and 100% of them were dissatisfied with this. 22/40 (55%) of parents felt the information given about the diagnosis was unbalanced (i.e. just a listing of problems, with no positives). For infants born 1994-1999, the term “mongolism” was used in 9/28 (32%) of disclosures and institutionalization was offered as an option in 3/28 (11%) of disclosures. 26/40 (65%) of parents were given appropriate resources at time of disclosure. 14/40 (35%) of parents were not given any resources. Overall, 30/40 (75%) were dissatisfied with the manner in which they were informed of their child's diagnosis.

Conclusion: Even in the late 1990's, there is a high level of dissatisfaction around the disclosure of Down syndrome. Practice guidelines to disclosure of the diagnosis of Down syndrome are available. Previous studies demonstrate that by following these guidelines, there is a high level of parental satisfaction with the process. More training needs to be given to physicians assuming the responsibility of informing parents about their child's disability.

Down Syndrome and Alzheimer's Disease: A Link Between Development and Aging
I. T. Lott
Institute of Aging and Dementia, Departments of Psychobiology, Neurology, and Pediatrics, University of California, Irvine

It is well known that the pathological findings (plaques and tangles) of Alzheimer's disease (AD) are invariably present in the brains of individuals with Down Syndrome (DS) over age 35 years. Recently, primitive amyloid deposits have been observed in brains from children with DS, affording an opportunity to examine the link between AD and DS over the lifespan. We have shown that it is possible to date the age of amyloid through a physical-chemical process called racemization. In DS, the "oldest" amyloid is deposited in the superficial layers of the frontal cortex. With age, more mature amyloid deposits are seen in deeper layers of the frontal cortex and in the hippocampus. This observation is of particular interest in light of our findings of indiffemence and pragnosis as early symptoms of dementia in DS. Both of these symptoms relate to frontal lobe dysfunction and show a high degree of correlation with atrophy on MRI scans and the presence of "frontal lobe" release reflexes on neurological testing. Since acetylcholinergic neurons are vulnerable in the AD process, we carried out a recent pilot study of 9 individuals with DS in which we were able to show a temporary reversal of dementia symptoms when they were treated with the acetylcholinesterase inhibitor, donepezil (P<0.03). The findings to be presented link some aspects of development, aging, and dementia and provide a theoretical basis for considering protective strategies at earlier epochs in the lifespan of people with DS. (Supported in part by NIH, AG 05142 and HD 28202.)
Health Issues in Adults with Down Syndrome.
B. Chicoine
Adult Down syndrome Center, Lutheran General Hospital

The health problems that have been found in nearly 1,000 adults with Down syndrome seen at the Adult Down Syndrome Center will be discussed. Particular emphasis will be given to orthopedic problems of older adults with Down syndrome.

Psychosocial Issues in Adults with Down Syndrome.
D. McQuire
Adult Down syndrome Center, Lutheran General Hospital

The findings on diagnosis and treatment of mental health conditions from a multidisciplinary clinic serving the health and psychological needs of over 1,000 adults. Participants will learn the differential diagnosis of mental health conditions from health, aging, and non-reversible dementia and treatment strategies for a wide variety of mental health conditions.

Factors Affecting Neurocognitive and Neuropsychological Function in Older Persons with Down Syndrome.
M. Percy 1 T. Mazzulli. 2 A. J. Dalton. 3 P. Mehta. 3 B. Fedor. 3 and A. Warren 4
University of Toronto Dept. of Physiology and Surrey Place Centre 1, Toronto, Canada
Mt. Sinai Hospital Dept. of Microbiology, Toronto, Canada 2;
New York State Institute for Basic Research, Staten Island, New York 3;
Johns Hopkins Medical School, Baltimore, MD 4.

Adults with Down syndrome (DS) develop dementia of the Alzheimer type (DAT) 30-40 years earlier than in the general population. To identify factors that might contribute to DAT, we assessed neurocognitive and neuropsychological function in 35 adults with DS, aged 45.0 - 103 years, with a Dementia Test Battery (DTB), and examined the effects of age and some other explanatory variables on the DTB scores. DTB scores decreased markedly with increasing subject age (p<0.0001). In those over 48 years of age, the following trends were observed. Factors that appeared to be somewhat protective against low DTB scores were: being female; not having an apolipoprotein E (ApoE) E4 allele (the ApoE E4 allele is a risk factor for Alzheimer’s disease in the general population); having normal thyroid function; and, not having had a past hepatitis B virus (HBV) infection. Furthermore, in females there was a positive association between having had a past HBV infection and being hypothyroid. These interesting findings warrant further investigation. Aside from their possible relevance to DAT, immediate clinical implications are that persons with DS should be immunized as early as possible against HBV, they should be monitored closely for development of thyroid malfunction, particularly if they have or have had HBV infection, and their thyroid malfunction should be treated.

The Link Between Down Syndrome (DS) and Alzheimer’s Disease (AD)
O. Friedman
University of Toronto, Toronto, Ontario

Unequivocally, patients with DS develop AD-like pathognomonic neuropathological changes (i.e. senile plaques, neurofibrillary tangles, and lower cerebral cortical levels of acetylcholine) by the 4th decade of life. Conversely, the incidence of Alzheimer-type neuropathology in individuals with mental retardation due to other causes has been reported to be consistent with that of the general population. In spite of the AD-type neuropathological changes, the major clinical sign of dementia of AD, progressive dementia, is not commonly observed in most mature and elderly people with DS. Thus, a significant discrepancy between age-specific rates of AD neuropathology and clinical dementia exists, and as such, pathological changes cannot serve as accurate predictors of dementia. From a practical perspective then, such as in program planning and clinical care, it is important to recognize what the age-specific prevalence rates of AD in DS patients are, seeing that as the disease progresses, treatment practices may have to be adapted to the changing needs of the individual.

This study attempted to weigh the significance of AD in clients with DS using an informant questionnaire which assessed changes in memory, personality, general mental functioning, and daily living skills and which was modified from information presented in a report of the American Association on Mental Retardation (AAMR), and the International Association for the Scientific Study of Intellectual Disability (IASSID) working groups for the establishment of criteria for the diagnosis of dementia in individuals with intellectual disability. Fifty participants were selected from an unbiased, population-based sample of older people with DS from a social service agency located in Toronto. The aims of the study were to both identify the age-specific prevalence rates of AD using DSM-IV criteria for the diagnosis of AD-type dementia, and to consider the roles of age and gender on cognitive decline. Suggestions regarding proper assessment and care management of AD among adults with DS were also outlined.
Alzheimer’s Disease, Survival, and Genetics in the “Oldest-Old” with Down Syndrome
W. Zigan...1  E. Jenkins...1  I. Mehta...1  N. Schupf...1  T. Urv...1  W. Silverman...1  B. Tycho...2  R. Mayeux...2  Dorthy Warburton...2
New York State Institute for Basic Research in Developmental Disabilities, Staten Island...1  New York and Columbia University, New York...2
Advances in public health practices have resulted in a dramatic extension in the average life span of people with Down syndrome (DS), but it is still unusual for these individuals to survive to age 65. However, the very fact that some adults with DS reach 65 or even 75 means that a longer life might be possible if only we can determine what makes the “oldest-old” individuals different from everybody else. To accomplish this aim we are determining, through the use of cyto- and molecular genetic techniques, whether survival of approximately 100 adults with DS in their 60s and 70s is associated with genetic factors that distinguish them from their younger peers. To begin with, we are concentrating on genes located on chromosome 21 that are involved in the aging process (e.g., APP, SOD1, and S100). Additionally, apolipoprotein E genotype and levels of serum beta-amyloid proteins Ab-40 and Ab-42 are being related to individual differences in health, neurological status, cognitive decline, and Alzheimer’s disease. Preliminary results for approximately 50 people will be presented. This work is supported by funds provided by NYS through its Office of Mental Retardation and Developmental Disabilities as well as by NIH grants HD35897 and HD37425.

Language, Cognition and Short Term Memory in Children and Adolescents with Down Syndrome
R. Chapman
Wisconsin Research Center, University of Wisconsin at Madison, Madison, Wisconsin.
The developmentally emerging behavioral phenotype of language and cognition in individuals with Down syndrome will be reviewed, with evidence presented for the emerging divergence of expressive and receptive language, the emerging divergence of lexical and syntactic knowledge in each skill area, and the emerging divergence within visuospatial and cognitive skills. The prediction of individual differences in language comprehension and language production will be examined in a six-year longitudinal study of children and adolescents with Down syndrome. Hierarchical Linear Modeling identifies chronological age, visuospatial short-term memory, and auditory-short term memory as key predictors of performance at study entry, but not individual rate of change over time, for expressive syntax. The same model accounts for comprehension skill, except that individual rate of change over the six years is predicted by chronological age and the change in visuospatial short-term memory skill. Implications of these findings for theories of specific language deficit, and for language intervention, in individuals with Down syndrome are discussed.

Speech-Intelligibility in Children and Adolescents with Down Syndrome: Research Update and Future Directions for Research
L. Kumin
Department of Speech-Language Pathology & Down Syndrome Center for Excellence, Loyola College in Maryland
Speech intelligibility, the ability to produce understandable speech, is an area of difficulty for children and adolescents with Down syndrome which impacts on school, activities of daily living, and later employment. There are general medical, dental, and neurological factors that underlie difficulties in speech intelligibility for most children with Down syndrome. There are also specific factors that contribute to whether an individual child’s speech is understandable, including rate, fluency, prosody, resonance, voice, loudness, oral motor strength and coordination, articulation and phonological processes, and dyspraxia. This presentation will review the general and specific factors that affect intelligibility in children with Down syndrome and the research literature related to each factor. Testing data and case studies will be presented documenting different patterns of intelligibility in children and adolescents with Down syndrome. A clinical framework for assessing intelligibility and the need to identify the specific factors impacting on an individual’s intelligibility will be discussed. The speaker will also discuss future research directions, highlighting the need for collaborative research to address the unanswered questions regarding speech intelligibility.

Speech-Language Intervention Groups for Preschoolers with Down Syndrome
S. Hartnell, M. Irello, S. Bingham and A. Zimmerman
Surrey Place Centre, Toronto, ON.
Children with Down syndrome have specific communication needs that usually cannot be met by a consultative or mediator-model therapy approach. As these children develop language there is often an expressive-receptive language gap as well as a gap between their expressive language ability and their articulation or phonology skills. The delay in expressive and articulation skills is due to poor oral-motor control and sequencing skills, lack of phonological awareness and difficulty initiating verbal responses and utterances. These skills can be improved when directly targeted through intensive therapy programs. Thirty children aged three to five participated in intervention groups of three to four participants. The groups were led by a speech language pathologist and a communication assistant. Intervention consisted of ten weekly sessions of 60 to 90 minutes. Each session was theme based and a total communication approach was used. Parents/caregivers observed and/or participated in the sessions. At the end of each session written and verbal suggestions were provided to caregivers including descriptions of the signs used during the session. Parents provided information by a telephone interview about their satisfaction with the intervention groups, and their perceptions about the gains. Caregivers as well as staff underscore the importance of providing young children with Down syndrome this effective intervention. In addition, data will be presented on 20 of the children who were screened using the American Speech-Language-Hearing Association (ASHA, 1999) National Outcome Measurement System (NOMS) as a guide to note change over the intervention period.
Growth Retardation in Down Syndrome
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Growth of children with Down syndrome (DS) differs markedly from that of normal children and short stature is a cardinal feature in DS. We present data on new DS specific growth charts, thyroid function in children with DS followed annually for 15 years and a trial with growth hormone treatment of 15 young children with DS. The DS growth charts are based on a combination of longitudinal and cross-sectional data from 4 832 examinations of 354 individuals with DS (203 M, 151 F), born between 1970 and 1997. Mean height lengths were 48 cm in both sexes. Final heights, 161.5 cm for males and 147.5 cm for females, were reached at relatively young ages, 16 and 15 years, respectively. The difference in height between the sexes was thus the same as that of healthy individuals. We have earlier shown that final height in DS-individuals was about 18 cm below target height. Mean birth weights were 3.0 kg for boys and 2.9 kg for girls. A body mass index (BMI) >25 kg/m² at 18 years of age was observed in 31% of the males and 36% of the females. Head growth was impaired resulting in a SDS for head circumference of -0.5 (Swedish standard) at birth decreasing to -2.0 at four years of age. Puberty was somewhat early and pubertal growth rate was decreased. Our growth charts show that European DS boys are taller than American boys with DS whereas European DS girls, although being lighter, have a similar final height as the American girls with DS. If standard growth charts are used for DS children the development of associated diseases influencing linear growth may be overlooked. Hypothyroidism commonly occurs in DS. In 93 children with DS who were followed with annual thyroid screening for 15 years about 30% developed thyroid dysfunction. Growth velocity was improved significantly in most children upon treatment with thyroxin. In the same group of children celiac disease was found in 5%. Fifteen young children with DS were treated with growth hormone (GH) for three years. The mean height of the children increased from -1.8 SD (Swedish standard) to -0.8 SD whereas that of a control group fell from -1.7 to -2.2 SD during the same age period. After cessation of GH treatment the growth velocity declined. The growth of the head did not increase during the treatment and there was no effect on mental or gross motor function.

IgA, IgG2 and IgG4 Deficiency is Common in Children with Down Syndrome
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Objective: To determine the rate of immune deficiency among children with Down syndrome in a community-based sample in Eastern Ontario. Background: Down syndrome is the most common chromosomal disorder worldwide and is the leading identifiable cause of developmental disability. The incidence in the general population is 1 in 600-800 live births. It is widely accepted that infections are a significant cause of morbidity in this population. While several small studies have documented abnormalities in T cell and immunoglobulin numbers in children with Down syndrome, the incidence of these abnormalities has not yet been determined.

Design/Methods: Retrospective chart review of all children followed in the Down Syndrome Clinic of the Children’s Hospital of Eastern Ontario since its opening in 1992. Greater than 97% of children with Down syndrome from the Ottawa-Carleton catchment area are followed here routinely for developmental and medical services. 181 children under 18 years of age had measurements of serum immunoglobulins, IgG subclasses, T cells and/or complement levels. These levels were compared to age matched controls.

Results: 178 patients had measurements of serum total IgG and 4(2.25%) had subnormal total IgG. 177 patients had serum IgA and IgM levels measured; 10(5.65%) had IgA deficiency and 30(16.9%) had IgM deficiency. 171 patients had serum IgG subclasses measured; 7(4.0%) had IgG1 deficiency, 29(17.0%) had IgG2 deficiency, and 78(45.6%) had IgG4 deficiency. Of those patients with IgG2 deficiency (n=30), 11(36.7%) had isolated IgG2 deficiency and 19(63.3%) had combined IgG2 IgG4 deficiency. Of the 181 patients reviewed; 56 patients had significant difficulties with viral infections. Their serum CD3, CD4, CD8 and CD19 levels were measured. 50(89.3%) had low CD19/pre-B cells). Of 54 patients who had serum natural killer cells measured, 35(64.8%) had low natural killer cells.

Conclusions: IgA, IgM, IgG2 and IgG4 are common deficiencies of the humoral system in children with Down syndrome. Low pre-B cells and NK cells were found in a subset of children with recurrent viral infections. Children with Down syndrome should have their immune parameters measured to provide optimal treatment and counseling of families. To our knowledge, this is the largest series of immune measurements in a community-based sample of children with Down syndrome. Prospective trials evaluating the rate of immune deficiency and the correlation to infections within this population are necessary.

Bridging the Gap between pure and Applied Research
D. Patterson
Eleanor Roosevelt Center, Denver

Recent advances in research on chromosome 21 include the complete decoding of the genetic information on the chromosome and the production of a gene catalogue for chromosome 21. In addition, animal models, particularly mouse models, in which the particular features of Down syndrome may be studied have been produced. These developments offer hope that true understanding of the biological basis for Down syndrome can be obtained in the near future. Progress towards this goal will be described.
Poster Presentations

Are Individuals with Down Syndrome at Risk for Hereditary Hemochromatosis?
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Hereditary Hemochromatosis (HHC) is a genetic disorder which results in a higher than normal iron uptake from the diet. Complications of high levels of iron can result in oxidative damage in vital organs and increased rates of hepatic carcinoma and heart disease. Treatment of HHC involves removal of excess iron through regular phlebotomies and an iron reduced diet. Recently, two point mutations (C282Y and H63D) that are thought to be involved in HHC have been described. To assess the prevalence of these mutations, we screened a group of individuals with Down syndrome (n=50) and an age matched control group (n=52). In the control group we found two individuals who were homozygous for H63D and in the Down's group we found one individual homozygous for H63D and another who was a compound heterozygote. These results do not differ significantly but they do raise the possibility that individuals with HHIC might be left undiagnosed and therefore untreated. Since it is estimated that 1 out of 9 Canadians have at least one gene involved with HHIC, and complications worsen with time, it is essential that we begin to screen and treat all suspected individuals, including those with Down syndrome, for this disorder.

Neuropsychological Test Battery to Detect Early Stage Dementia of the Alzheimer Type in Individuals with Down Syndrome
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Three groups of ability-matched adults with Down syndrome were administered a battery of neuropsychological tests to identify cognitive decline characteristics of early stage dementia of the Alzheimer type, and to compare the performance of demented elderly normal control (Group DAT, n=12) with normal elderly control (Group ENC, n=14) and middle-aged normal control (Group MNC, n=9) individuals. DAT subjects were selected on the NINCDS-ADRA as well as the criterion cutoff scores on the Dementia Scale for Down Syndrome. The battery included tests of information and orientation (IO), immediate (IM) and delayed memory (DM) (Fuld Object Memory Evaluation), verbal learning ability (VL) (Fuld trial 5), expressive language (Boston Naming Test (BNT)), category fluency (Grocery List (GL)), construction (WISC-III Block Design (BD)) and praxis (PX). Multivariate test derived from Wilks Lambda yielded F(16, 50)=5.44 p<0.001. Significant between-subject effects were found on the IO, IM, DM, VL variables p<0.01. Multiple comparison with Bonferroni (cutoff p=0.01) revealed that on the IO, IM, DM, and VL tests both MNC and ENC subjects performed better than the DAT participants. The performance of ENC and MNC subjects did not differ significantly on these measures. Implications for the diagnostic assessment of people with DS are discussed.

Family-Provider Relationships
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The purpose of this study was to explore the nature and quality of family-provider relationships when a child has Down syndrome. Mailed questionnaires were used to collect data from 94 families that include a child with Down syndrome. The results indicate that, in general, these families wanted, and were able to develop, positive family-centered relationships with their child’s primary health care provider. A significant association was found between the nature of the family-provider relationship and well being in these families. An interesting finding was that a number of families indicated that family members had “worked hard” to achieve the kind of relationship they had with health care providers. One family changed providers ten times. Findings from this study contribute to a better understanding of the role that health care providers play in individual and family adaptation to chronic conditions.

The Term of Psychosocial Deprivation and Its Meaning for the Development of Children with Down Syndrome
W. Storm
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During the last 15-20 years there has been observed a distinct progress in the developmental capabilities of children with Down syndrome. Several milestones are reached temporally earlier, further capabilities have been added. Measures of early intervention and a better medical management are especially considered responsible as a cause for this improved quality of life.

Based on a discussion of the term “psychosocial deprivation” it becomes evident how important the social environment is not only for the physical but also for the cognitive development of children with Down syndrome. In this regard the quantity of social support is less decisive for the adaptation than its quality. Hints for the past and still present psychosocial deprivation of people with Down syndrome and its sequelae for a reduced quality of life demonstrate the protective and healing value of social acceptance and communication especially in these persons.
Middle Ear Effusion in Newborns with Down Syndrome
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Hearing loss can be found in more than fifty percent of children with Down syndrome. Chronic or recurrent middle ear effusions are considered the most frequent etiology with an incidence of 60%. To answer the question of how early these problems may arise and be detected nineteen newborns were examined by the methods of otoscopy and acoustic impedance. 36.8% of the ears demonstrated evidence of middle ear effusion recommending the necessity of identifying and monitoring hearing loss from the newborn age in children with Down syndrome.

Aspiration: A Common Cause of Respiratory Problems in Children with Down Syndrome
M. Pothis, E. Churcher, D. Delaat, M. Bouthillier, N. Côte, and M. Touchette-Garon
Children’s Hospital of Eastern Ontario, Ottawa, Ontario.

Background: In the Down syndrome population, pulmonary disease, particularly respiratory infections, is associated with significant morbidity; yet, there is no published literature on the role of aspiration and respiratory symptoms.

Objective: To determine the extent to which aspiration from either oropharyngeal incoordination and/or gastroesophageal reflux is a cause of recurrent respiratory difficulties in young, well-developing children with Down syndrome.

Design: Retrospective chart review of all 255 children followed in the Down Syndrome Clinic at the Children’s Hospital of Eastern Ontario since 1992.

Methods: The charts of children 0 to 5 years of age with complaints of recurrent respiratory problems at any of the clinic visits were analyzed for symptoms, signs, investigations, interventions, and outcome.

Results: Of the 148 patients seen between ages 0 to 3; 52% (35%) had complaints of recurrent respiratory problems. Of these 52 children, 15% (28%) had evidence of aspiration secondary to poor oropharyngeal function from feeding studies. Remarkable improvement post treatment was seen. 10% (20%) had significant gastroesophageal reflux with improvement on prokinetic medication. 5% (10%) had a diagnosed immune deficiency. 4% (8%) had congestive heart failure. 18% (33%) were felt to have post infectious respiratory symptoms or asthma.

Conclusion: Aspiration from poor oropharyngeal coordination or gastroesophageal reflux is a significant cause of respiratory difficulties in the Down syndrome population (48% in this series). Assessment of feeding skills and gastroesophageal reflux is crucial in the evaluation of respiratory problems in this population.

Identification of Hearing Loss and Otitis Media in Children with Down Syndrome
J.P. Pillion, M.A. Saylor, D.E. Shiffler, and G.T. Capone
Kennedy Krieger Institute

Records of 100 children seen in conjunction with the Kennedy Krieger Institute Down Syndrome Clinic were retrospectively examined. The purpose of the study was to determine the validity of parental reporting on the hearing and middle ear status of children with DS. Data will be presented pertaining to the correspondence between parental reports of audiologic and tympanometric findings. Rates of sensitivity, specificity and negative and positive predictive values of parental reporting will be presented. The standard with which parental reports were compared were a variety of audiological techniques including developmentally appropriate behavioral test techniques, acoustic admittance measures and electrophysiologic test procedures. Findings indicate a low degree of sensitivity for parental reporting of hearing loss and middle ear status in DS. Implications for early identification of hearing loss and management of hearing loss in children with DS will be presented.

Qualitative Aspects of Motor Control in Children With Down Syndrome
M. Brunt
Silver Creek Nursery School
Toronto, Ontario

A review of the literature identifies references to qualitative differences in the motor performance of children with Down syndrome, in addition to delays in gross and fine motor development. Deficiencies in the development of postural control, deficiencies in sensory processing and compensatory movement patterns are some of the factors identified in the literature. The nature of these differences as outlined in the literature will be examined. Implications for physiotherapy and occupational therapy intervention with children with Down syndrome, and directions for further research will be discussed. Issues that may face the child at home and school related to the quality of movement will be outlined in this poster presentation.
Camp Talkalot: A Speech and Language Initiative
J. A. Jaques., R. Vis Dubé., T. Gasee.
Down Syndrome Association of Toronto

The purpose of this presentation is to describe a speech and language therapy program offered under the auspice of the Down Syndrome Association of Toronto (DSAT). The Board of Directors of DSAT initiated this program in response to the lack of speech and language services available to school-aged children with Down syndrome. A start-up grant was received from the Down Syndrome Research Foundation to help offset the initial costs of the program.

Camp Talkalot is a speech and language program designed to provide direct speech and language therapy to school-aged children with Down syndrome. Camp Talkalot is offered as a summer camp program, running in two-week, half-day sessions. The program is also offered one half-day per week for blocks of 8 to 10 weeks during the school year. The Talkalot Team consists of a speech and language pathologist, a graduate student in speech-language pathology, and three educational assistants. Each session provides students with a combination of language stimulation activities and direct speech and language therapy. Survey data from parents of children involved in the program indicates a very high level of satisfaction with the program.

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Canadian Population Registry of Individuals With Down Syndrome: Development and Preliminary Results
N. Virji-Babul1,2 and D. Kisly1
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This presentation describes the theoretical, research-oriented and technical dimensions of a population registry developed by the Down Syndrome Research Foundation. This project, which began in 1999, has two general goals: i) to collect general information (i.e. age, sex, handedness, medical problems, level of education, marital status, etc.) on individuals with Down syndrome; and ii) to establish a voluntary registry of individuals (or guardians) interested in participating in DSRF-approved projects or research pertaining to all aspects of Down syndrome.

The project supports both web-based, printed and telephone survey methods to collect data, and encourages participants to update their submitted profiles on a yearly basis. In so doing, the project should facilitate widespread participation in the project, help us maintain a more current database and support the identification of key population and health trends.

The initial level of participation looks promising: during the preliminary, pilot stage alone, the DSRF received more than 70 profiles from 4 different provinces (BC, Ontario, Alberta and Quebec). The average age of the participants is 10 years (range of 1 year to 35 years) with 31 females and 35 males. The majority are right-handed (58%). The most common medical problems are related to hearing (49%), cardiac (47%), visual (39%), GI (25%) and thyroid (13%) conditions. With the exception of one, all other participants are currently living at home with one or both parents.

Based on the data from the initial pilot survey, further modifications have been made to the registry and efforts are now underway to increase the level of participation on a national level.

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A Pilot Study to Determine the Percentage of Circulating Peripheral Blood Megakaryoblasts in Normosomic Infants: For Future Comparison to Infants with Down Syndrome in a Large Multi-center Protocol to Determine Incidence of Transient Myeloproliferative Disorder (TMD) and Related Risk of Acute Leukemia.
S. L. Bayliff, ( Dumc, Pediatric Hematology-Oncology, J. Gong, Dumc, Hematology, and P. M. Rosoff, (Dumc, Pediatric Hematology-Oncology)

Background: Down syndrome (DS) is the most common congenital chromosomal disorder in humans. In addition to numerous developmental abnormalities and congenital defects, patients with DS have a 15-20 fold increased risk to develop childhood leukemia. They are also uniquely susceptible to a "pre-malignant" syndrome known as Transient Myeloproliferative Disorder (TMD), most often diagnosed by the presence of circulating megakaryoblasts. It is currently thought that about 1% of children with DS will develop TMD; however, this estimate is based upon very little reliable epidemiological data. Most cases of TMD resolve by 1 year of age, however, data suggests that 10-20% of DS patients with TMD develop AML, most commonly megakaryoblastic leukemia ("M7").

Purpose: In an effort to establish the true incidence of TMD and the associated risk of leukemia in children with DS, we plan to initiate a multi-center prospective cohort study of newborn DS patients. One long-term goal of this project is to determine which population of patients with TMD is at higher risk of developing true AML and may benefit from an early intervention, chemoprevention strategy. Peripheral blood will be closely monitored by flow cytometry for development of TMD and then for possible progression to leukemia. The most appropriate control population for comparison is normosomic infants; however, there are no data describing the "normal" percentage of megakaryoblasts present in a newborn's circulation. Furthermore, the methods of detecting a megakaryoblastic cell line in the peripheral blood can be expensive and labor intensive. Thus, to better establish the efficacy of using flow cytometry to detect extremely small percentages of megakaryoblasts in the peripheral blood, we intend to quantify normal percentages of circulating megakaryoblasts in the cord blood of 100 normosomic infants.

Methods: Discarded cord blood samples from 100 live births (without associated perinatal complications evident by lack of pathology) will be collected from the Dumc Blood Bank for study. A total of 3 ml of cord blood will be collected upon enrollment. Three-antigen flow cytometry will be used to establish the percentage of megakaryoblasts present. The specific monoclonal antibodies to be tested are CD41, CD61 and the plasma factor VIII antigen (factor VIII:AGN) all of which are expressed on the surface of megakaryoblasts. A positive control for this study will be the GRW megakaryoblast cell.

Results: Once 100 samples are collected and flow cytometry completed, we will be able to report the percent of megakaryoblasts identified by CD41, CD61 and factor VIII:AGN expression. With this data available to us, we will then be able to apply our methods to our target population of children with Down syndrome.
The Reading Abilities of Preschool Children with Down Syndrome – An Obvious Strength
M. Appleton, S. J. Buckley, & J. MacDonald
Department of Psychology, University of Portsmouth, Southsea, UK and The Down Syndrome Educational Trust
The study recruited 18 preschool children with Down syndrome and 18 typically developing preschoolers, aged 3 to 4 years, into an early reading programme to be taught by their parents. The two groups made very similar progress in the first year. In both groups, some children learned many sight words and some learned only a small number. After 3 years, 11 of the children with Down syndrome and 16 of the non-disabled group could score on standard reading measures and there is no difference in their reading abilities. The early readers with Down syndrome are reading as well as their peers. It is not clear what distinguished the early readers from those who did not make progress.
Clearly reading ability is a strength for many children with Down syndrome and a very powerful tool for learning for them, as reading activities can teach new vocabulary, new grammar and improve discrimination and production of sounds. The teaching methods used to teach the children and develop their spoken language will be explained.

The Benefits of Full Inclusion in the Mainstream Classroom
S. J. Buckley, G. Bird, B. I. Sacks, T. Archer
Department of Psychology, University of Portsmouth, Southsea, UK and The Down Syndrome Educational Trust
A recently completed study of 46 teenagers with Down syndrome who have been mainstreamed all the way through school provides evidence of a very significant gain in expressive language skills (a mean gain of two years and six months ahead of a comparable group of teenagers with Down syndrome in special schools). While some of this gain may be due to being immersed in a normal language environment, much of it may be due to daily supported reading and writing activities. The children record their work daily in written form, irrespective of independent reading ability, as they have the support of a Learning Support Assistant to help them. This means daily exposure to reading and speaking correct grammatical sentences. Working on phonics and on spellings improves the children’s sound discrimination and production skills, with consequent benefits for their speech intelligibility in everyday conversation. On the literacy measure – reading and writing skills – the mainstreamed teenagers with Down syndrome are three years and four months ahead of their comparison group in special school. The data is very informative as the two groups do not differ on measures of the skills or abilities which are most influenced by parents such as independence in daily living skills, social skills and activities and behaviour.

The Link Between Vocabulary Size and Grammar – Important Implications For Therapy
S. J. Buckley & T. Pennanen
Department of Psychology, University of Portsmouth, Southsea, UK and The Down Syndrome Educational Trust
A current study, still to be published, has looked at the early vocabulary development of over 200 children and illustrates the typical relationship between vocabulary size and the development of early sentences and grammar for children with Down syndrome. In typically developing children once they have a vocabulary of over 250 words, they begin to develop grammar. It has been recently suggested in the literature that this was not the case for children with Down syndrome, i.e. even when their vocabulary exceeded 250 words, they did not begin to develop grammar, but these earlier studies have been based on very small samples. The finding of the usual link has important implications for early language therapy, as a minimum vocabulary size of 250 words is necessary for sentences and grammar to start to develop. At present some children with Down syndrome have not reached this point at six years or older. Very few parents will have been given a vocabulary list to work with to ensure that their child is learning the range of words that they need as fast as they could be. A productive vocabulary of about 250 words is necessary in order to start developing grammar and sentences, but it still may not automatically lead to grammar in all children with Down syndrome. The short-term memory and phonological difficulties may hold some children back even when they have a vocabulary of more than 250 words, with implications for therapy.
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