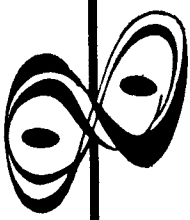
FIFTH INTERNATIONAL CONGRESS ON TWIN STUDIES



Amsterdam: 15-19 September 1986

Site

Grand Hotel
Krasnapolsky

Secretariate

Professor Aldur W. Eriksson, Institute of Human Genetics,
Medical Faculty, Free University, PB 7161
1007 MC Amsterdam, The Netherlands - Tel. (020) 5482764

Sponsored by

The International Society for
Twin Studies and
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Program and Abstracts

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FIFTH INTERNATIONAL CONGRESS ON TWIN STUDIES: Amsterdam: 15–19 September 1986

MONDAY 15	TUESDAY 16	WEDNESDAY 17	THURSDAY 18	FRIDAY 19
	08:40–13:00 Plenary Sessions *St Jans Room* 08:40 Opening Session 09:20 Presidential address 10:00 Symposium 1A Twin research in intelligence	*08:40–13:00 Plenary Sessions* *St Jans Room* 08:40 Lecture In vitro fertilization and twinning 09:20 Symposium 2A Incidence of twinning	*08:40–13:00 Plenary Sessions* *St Jans Room* 08:40 Lecture Twin research in coronary heart disease 09:20 Symposium 3A Twin research on blood pressure	*08:40–13:00 Plenary Sessions* *St Jans Room* 08:40 Lecture The future of twin research 09:20 Symposium 4A Twin research in psychiatry
	11:00 Coffee Break	11:00 Coffee Break	11:00 Coffee Break	11:00 Coffee Break
	11:30 Symposium 1B Twin research in temperament and personality	11:30 Symposium 2B Obstetrical aspects of multiple gestation	11:30 Symposium 3B Twin research in cancer	11:30 Symposium 4B Twin research in pharmacogenetics 12:30 Closing Session
	13:00 Lunch Break	13:00 Lunch Break	13:00 Lunch Break	
	14:00–18:00 Concurrent Sess. 14:00 *St Jans Room* Workshop 1C Twin research methodology 14:00 *4 Seasons Room, I* Workshop 1D Twins, parents of twins, and research 14.00 *Van Gogh Room* Paper Session 1E Twin registers and clinical studies 14:00 *4 Seasons Room, II* Paper Session 1F Twin biology, I	*14:00–18:00 Concurrent Sess.* 14:00 *St Jans Room* Workshop 2C Twin research in developmental studies 14:00 *4 Seasons Room, I* Paper Session 2D Multiple pregnancy and twin growth 14:00 *Van Gogh Room* Paper Session 2E Twinning and congenital malformations 14:00 *4 Seasons Room, II* Paper Session 2F Twin biology, II	*14:00–18:00 Concurrent Sess.* 14:00 *St Jans Room* Paper Session 3C Twin research in psychology and behavior genetics 14:00 *4 Seasons Room, I* Paper Session 3D-1 Management of multiple gestation 14:00 *La Volière Room* Paper Session 3E Twin research in biochemistry, physiology and anthropology 14:00 *4 Seasons Room, II* Paper Session 3F Twin research in substance exposure	
	16:00 Coffee Break	16:00 Coffee Break	16:00 Coffee Break	
16:30 *Grand Hotel Krasnapolsky, Reception area* Registration	16:30 Workshop 1C -- Contd 16:30 Workshop 1D -- Contd 16:30 Paper Session 1E -- Contd 16:30 Paper Session 1F -- Contd	16:30 Workshop 2C -- Contd 16:30 Paper Session 2D -- Contd 16:30 Paper Session 2E -- Contd 16:30 Paper Session 2F -- Contd	16:30 Paper Session 3C -- Contd 16:30 *4 Seasons Room, I* Workshop 3D-2 Unique aspects of higher order multiple births 16:30 Paper Session 3E -- Contd	
19:00 Welcome reception and Address by Prof. Eriksson	19:15 SOCIAL PROGRAM Canal cruise and reception	18:30 Business Meeting of ISTS Evening free	20:00 SOCIAL PROGRAM Banquet	

TUESDAY 16

St Jans Room

08:40 OPENING SESSION

09:20 PRESIDENTIAL ADDRESS
Walter E. Nance

10:00 Symposium 1A
TWIN RESEARCH IN INTELLIGENCE
Chairman: Jacobus F. Orlebeke

Introductory remarks
J.F. Orlebeke

A new method for representing mental growth
R.S. Wilson

IQ resemblance in reared apart twins: Within pairs, among pairs, among studies
T.J. Bouchard, D.T. Lykken, E.D. Eckert, L.L. Heston, A. Tellegen, N.L. Segal, K.J. Wilcox

Twin study of two cultural-free intelligence scales on Chinese adolescents
C. Chang

11:00 COFFEE BREAK

11:30 Symposium 1B
TWIN RESEARCH IN TEMPERAMENT AND PERSONALITY
Chairman: Anne-Mari Torgersen

Behavioral genetic analysis of temperament and personality: Data from twins reared apart and twins reared together in the Swedish Adoption/Twin Study of Aging
N.L. Pedersen, R. Plomin, G.E. McClearn

Model fitting approaches to the analysis of EASI temperament ratings collected from the parents of twins
M.C. Neale, J. Stevenson

Longitudinal research on temperament in twins
A.-M. Torgersen

Developmental perspectives on twin temperament
A.P. Matheny

13:00 LUNCH BREAK

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St Jans Room

14:00 Workshop 1C

TWIN RESEARCH METHODOLOGY

Chairman: David W. Fulker

Mate similarity and its effects on twin data: The multivariate case
G. Carey

Path analysis of seven field factors in twins and their parents
K. Phillips, D.W. Fulker, R.J. Rose

Constrained maximum likelihood analysis of familial resemblance of twins and their parents
D.E. Boomsma, P.C.M. Molenaar

Spectral analysis of twin time series designs
P.C.M. Molenaar, D.E. Boomsma

Innovations in the statistical analysis of twin studies
J.L. Hopper, P.L. Derrick, C.A. Clifford

Bivariate life table models for analysis of gene-environment interactions in twins
D.C. Thomas, B. Langholz, B. Floderus-Myrhed, D. Deapen, T.M. Mack

Methodology in families-of-twins designs: Illustrations from a Finnish twin-family study
S. Sarna, J. Kaprio, M. Koskenvuo, H. Langinvainio, K. Heikkila, H. Rita, R.G. Rose

4 Seasons Room, I

Workshop 1D

TWINS, PARENTS OF TWINS, AND RESEARCH

Chairman: Pat Stewart

A comparative study of the physical, emotional and financial disadvantages of triplet families compared with families of three closely spaced children
P.A. Stewart, J. Hennessy

The social consequences of having higher multiple births in the family
J.B. Buckler, J.M.H. Buckler

The special situation of mothers with triplets
H. Grützner-Könnecke

The expectation and parentage of twins: A study on the language development of twin infants
B. Alin-Akerman

The effect of twins on family relationships
A.C. Sandbank

The bereaved twin
J.M. Woodward

Support for parents who lose a newborn twin
A. Bryan

Essential nonmedical perinatal services for multiple-birth families
P.E.M. Malmstrom, E.F. Davis, P. Wagner

16:00 COFFEE BREAK

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VAN GOGH ROOM

14:00 Paper Session 1E
TWIN REGISTERS AND CLINICAL STUDIES
Chairman: Kare Berg

Vietnam era veteran twins: A new register
S.A. Eisen, W. True, J. Goldberg, W.G. Henderson, D. Robinette

Ascertainment bias in the Vietnam era twin register
J. Goldberg, W. True, S.A. Eisen, W.G. Henderson, C.D. Robinette

Ascertainment bias in a nonrandom registry of twins with disease
T.M. Mack, D. Deapen, B. Langholz, D.C. Thomas

Dutch study of cancer in twins
J. Berkel, M.E. Avé

Pregnancy history characteristics of Norwegian twins
L.A. Corey, K. Berg, W.E. Nance, P. Magnus

Twin studies in the Minnesota Comprehensive Epilepsy Program
W.E. Anderson, K. Wilcox, I.E. Leppik, S.S. Rich, D.T. Lykken, W.A. Hauser

Heritability of refractive errors: A population-based twin study
J.M. Teikari, J. Kaprio, M. Koskenvuo, A. Vannas

Twin study in myopia
L.K. Lin, C.J. Chen

4 SEASONS ROOM, II

Paper Session 1F
TWIN BIOLOGY, I
Chairman: Aldur W. Eriksson

The mechanisms of MZ and of DZ twinning in the light of molecular biology
L. Gedda, G. Brenci

Sociobiology and multiple birthing: r vs K reproductive strategies
J.P. Rushton

Placental structure and zygosity in twins
G. Mortimer

Fetal membranes in MZ and DZ twinning
L. Gedda, R. Russo, G. Brenci

Seasonality of conception in monochorial and dichorial monozygotic twins
P.H. Jongbloet, R.R. Vlietinck, H. van den Broele, C. Derom, R. Derom, H. van den Berghe, M. Thiery, A.W. Eriksson

Season of conception and risk of twinning
J. Golding

Seasonality in twin births in Denmark from 1936 to 1984
B. Kappel, J. Søgaard, J. Nielsen, J. Olsen

Monthly frequency distribution of twin vs single births in Italian regions, 1981-1982
L. Gedda, G. Brenci, C. Furlan

16:00 COFFEE BREAK

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TUESDAY 16

ST JANS ROOM

16:30 Workshop 1C -- *Contd*
TWIN RESEARCH METHODOLOGY

Detecting the contributions of measured and unmeasured genotypes and environments and their interactions for liability for a disease
N.G. Martin, L.J. Eaves, A.C.Heath

The analysis of marital interaction in twin data
A.C. Heath, N.G. Martin

Zygosity testing by DNA and bloodgroup polymorphisms
R.R. Frants, J.F. Orlebeke, I. Hendrikse, A.J. Jeffreys, A.W. Eriksson

4 SEASONS ROOM, I

Workshop 1D -- *Contd*
TWINS, PARENTS OF TWINS, AND RESEARCH

Respite care: A lifeline for multiple-birth families
P.E.M. Malmstrom, M.W. Wedge, E.F. Davis, J.M. Knudsen, P. Wagner

ISTS Collective Members and research communications
J. Maxey

The Handprint/Footprint research
J. Maxey

Liaison for the International Society for Twin Studies
J. Maxey

Research at the Australian Multiple Birth Association
A. Enticott

Developing twin participation in twin studies
K. Cassill

18:00 - 18:30

Meeting of the Council of Multiple Birth Organizations (COMBO)

SOCIAL PROGRAM: Canal Cruise and Reception

19:15 Departure by boat from outside the Krasnapolsky Hotel

20:00 Reception offered by The City of Amsterdam at The Maritime Museum

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TUESDAY 16

VAN GOGH ROOM

16:30 Paper Session 1E -- *Contd*
TWIN REGISTERS AND CLINICAL STUDIES

Serum cholesterol level in MZ twins reared apart
M. Koskenvuo, Y.A. Kesaniemi, J. Kaprio, J. Juntunen, H. Langinvainio, S. Sarna, K. Kuusivaara

Apolipoproteins A1 and B in adolescent twins
J. Bodurtha, R. Schieken, K. Berg, W.E. Nance

Genetics of cardiovascular risk factors
D.E. Boomsma, J.F. Orlebeke, H.J.M. Kempen, J.A. Gevers Leuven, J.C. Pronk

Blood pressure discordance and life style: Japanese MZ twins reared apart and together
K. Hayakawa, T. Shimizu, M. Okhuni, H. Mito, A. Yura

Atrial activity and cardiovascular response to stress in a set of triplets
S. Villatico-Campbell, F. Di Maio, A. Scioli, A. Sciacca

Noninvasive recording of A-V conduction in MZ and DZ twins
S. Villatico-Campbell, F. Di Maio, A. Sciarra, A. Sciacca

4 SEASONS ROOM, II

Paper Session 1F -- *Contd*
TWIN BIOLOGY, I

Changes in birth seasonality of twins during 1971-1984 in Japan
I. Nakamura, K. Nonaka, Y. Amau, T. Miura

SOCIAL PROGRAM: Canal Cruise and Reception

19:15 Departure by boat from outside the Krasnapolsky Hotel

20:00 Reception offered by The City of Amsterdam at The Maritime Museum

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WEDNESDAY 17

St Jans Room

08:40 LECTURE
In Vitro Fertilization and Twinning
Robert G. Edwards

09:20 Symposium 2A
INCIDENCE OF TWINNING
Chairman: Paolo Parisi

Incidence of twinning: Variability and interpretations
P. Parisi

The non-decline in U.S. twin birth rates, 1964-1980
G. Allen

Twinning rates around years of privation
A.W. Eriksson, P.J. Kostense, N. Bressers, R.F.J. Tas, J.O. Fellman

Social class and twinning
J. Golding

High twinning rate in Mexican-Americans: A reproductive elite?
K. Gottlieb

11:00 COFFEE BREAK

11:30 Symposium 2B
OBSTETRICAL ASPECTS OF MULTIPLE GESTATION
Chairman: Robert Derom

Program to be made available separately

13:00 LUNCH BREAK

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St Jans Room

14:00 Workshop 2C
TWIN RESEARCH IN DEVELOPMENTAL STUDIES
Chairman: Ronald S. Wilson

Nature-nurture interaction in different types of school environments
S. Fischbein

Similarities of Kibbutz twins and singletons, in perception of their environment
R. Guttman, M. Nathan

Early influence on the school social adjustment of twins
D.A. Hay, P.J. O'Brien

Diversity, development and determinism
T.J. Bouchard

The Swedish Adoption/Twin Study of Aging (SATSA): A study of adult development
N.L. Pedersen, G.E. McClearn, R. Plomin, J.R. Nesselroade, L.T. Friberg, U. DeFaire

Research strategies for the resolution of developmental genetic models
A.C. Heath, L.J. Eaves

Modelling developmental change in quantitative phenotypes
L.J. Eaves, A.C. Heath

4 Seasons Room, I

Paper Session 2D
MULTIPLE PREGNANCY AND TWIN GROWTH
Chairman: Emile Papiernik

Fetal growth in MZ and DZ twin pregnancies
J.P. Neilson

Intrauterine growth of multiple gestations
O.P. Bleker, J. Oosting, D.J. Hemrika

Placental maturation in twin and singleton pregnancies: A comparative ultrasonographic study
M. Granat, G. Ohel, S. Mor-Yosef, D. Zeevi, A. Golan, S.H. Wexler, J.G. Schenker

Fetal lung maturation in twin gestation
K.J. Leveno, J.G. Quirk, P.J. Whalley, W.N.P. Herbert, R. Trubey

Surveillance of the twin pregnancy with Doppler velocimetry
G. Farmakides, H. Schulman, L.R. Saldana, L.A. Bracero, A. Fleischer, B. Rochelson

Prophylactic sick-leave in twin pregnancy: An improved prognosis for the twins?
H. Rydhström

Perinatal mortality associated with multiple pregnancy: A 12-year review, 1972-1984
F.P. Meehan, J. Sheil, M. O'Riordan

The outcome of multiple pregnancy in Galway, Ireland
F.P. Meehan, J. Sheil, M. O'Riordan

16:00 COFFEE BREAK

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WEDNESDAY 17

VAN GOGH ROOM

14:00 Paper Session 2E
TWINNING AND CONGENITAL MALFORMATIONS
Chairman: David B. Flannery

New hypotheses for twin studies of congenital anomalies
D.B. Flannery, M. Robinow

Twinning, nonrighthandedness and fusion malformations: Evidence for heritable causal elements held in common
C.E. Bocklage

The British Columbia experience with neural tube defects and twins
J.G. Hall, B. Keena

Maternal age and congenital malformations in single and multiple births
L. Gedda, G. Brenci, G. Senzani, R. Carrega

Early structural defects in monozygosity; cleavage disorders of the "midline field"
L. Suslak, F. Desposito

Twinning rate in sibships with the Turner syndrome and the Klinefelter syndrome
D.V.M. Crombach, L.P. Kuyt, P.J. Kostense, L.N. Went, A.W. Eriksson

Apparently balanced, de novo translocation with minor positional effects as evidence of monozygosity
N.S. Mitter

Unusual vascular malformation of the kidney in both twins of a MZ pair
G. Mastroberardino, A. Sciarra, G. Gualtieri, C. Di Fusco, P. Grammatico, G. Del Porto

4 SEASONS ROOM, II

Paper Session 2F
TWIN BIOLOGY, II
Chairman: Gordon Allen

Statistical models for the twinning rate
J.O. Fellman, A.W. Eriksson

Maternal age and parity as determinants of human twinning rate: An analysis of Dutch population data
P.J. Kostense, M. Bressers, R.F.J. Tas, A.W. Eriksson

Does the use of oral contraception depress DZ twinning?
D.M. Campbell, B. Thomson, C. Pritchard, M. Samphier

Differential intrauterine environmental correlation in MZ and DZ twins
L. Terrenato, A. Novelletto

Intricate relationships among twinning, perinatal mortality and inbreeding
H.K. Goswami

The MZ twinning rate: How nearly constant?
G. Allen, Z. Hrubec

Increasing trend in the MZ twinning rate
M. Bressers, P.J. Kostense, A.W. Eriksson

A recent trend of multiple births in Japan
Y. Imaizumi

16:00 COFFEE BREAK

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WEDNESDAY 17

St Jans Room

16:30 Workshop 2C -- *Contd*
TWIN RESEARCH IN DEVELOPMENTAL STUDIES

Development of premature twins and triplets
J.D. Cartwright, P. Rootenberg

Speech and language development in preschool twins
D.A. Hay, M. Prior, S. Collett, M. Williams

Multivariate analysis of genetic and environmental influences for longitudinal height and weight data
S. Fischbein, N.L. Pedersen

4 Seasons Room, I

Paper Session 2D -- *Contd*
MULTIPLE PREGNANCY AND TWIN GROWTH

Comparison between ultrasound findings and outcome in premature twins
M. Kessel, M. van der Voort, L.S. deVries, L.M.S. Dubowitz

The Northwestern University Multihospital Twin Study: V. Twin deliveries at Prentice Women's Hospital and Maternity Center, 1979-1984
M. Method, L. Keith, R. Depp, R. Wittman, J. Lopez-Zeno, J. Minoque, D. Min, M. Socol

The Northwestern University Multihospital Twin Study: VI. Factors relating to low Apgar scores in twin delivery
R. Wittman, L. Keith, M. Method, R. Depp

Early developmental progress of preterm twins discordant for birthweight and risk
A. Stauffer, W. Burns, K. Burns, R. Deddish, J. Melamed, C. Herman, L.G. Keith

Birthweight effects on twin temperament and maternal rewards
J.R. Spillman

Transfusion syndrome and the physical and cognitive development of MZ twins
P.J. O'Brien, D.A. Hay, L. Tan, C.J. Johnston

Growth characteristics in twins and higher order multiple births
J.M.H. Buckler, J.B. Buckler

18:30 BUSINESS MEETING OF THE INTERNATIONAL SOCIETY FOR TWIN STUDIES (18:30-19:30)

Evening Free

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WEDNESDAY 17

VAN GOGH ROOM

16:30 Paper Session 2E -- *Contd*
TWINNING AND CONGENITAL MALFORMATIONS

Follow-up in a pair of twins affected by situs viscerum specularis conducted with high-resolution electrocardiography
S. Villatico-Campbell, F.Di Maio, M.E. Silvotti, A. Sciacca

The epidemiology of conjoined twinning in Southern Africa: A review of 32 cases
D. Viljoen

Incidence, epidemiology and etiopathology of conjoined twins in Hungary
J. Métneki, A. Czeizel, A. Kis-Varga

4 SEASONS ROOM, II

Paper Session 2F -- *Contd*
TWIN BIOLOGY, II

Twinning rates in Taiwan
Y.J. Cheng, C.J. Chen, T.M. Lin, C. Chang

The incidence of twins in the Pacific region
R. Pollard

Twinning in Egypt
N. Hashem

Historical demography and genealogy of two populations with excessive twinning
J.W. Sheets

Twinning in New England in the 17th and 18th centuries
T. Miura, H. Kawana, K. Nonaka

Incidence of twinning in London, 1581-1760
K. Nonaka, T. Miura

18:30 BUSINESS MEETING OF THE INTERNATIONAL SOCIETY FOR TWIN STUDIES (18:30-19:30)

Evening Free

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THURSDAY 18

St Jans Room

08:40 LECTURE
Twin Research in Coronary Heart Disease
Kare Berg

09:20 Symposium 3A
TWIN RESEARCH ON BLOOD PRESSURE
Chairman: Richard M. Schieken

Genetic influences on blood pressure in Blacks
C.E. Grim, R.M. Cantor

Cardiovascular responses to isometric exercise in large muscle groups
H. Verhaaren

Congenital heart defects in monozygotic twins
J. Burn

Genetics of cardiovascular reactivity
R.M. Schieken, L. Eaves, W.E. Nance

11:00 COFFEE BREAK

11:30 Symposium 3B
TWIN RESEARCH IN CANCER
Chairman: Thomas M. Mack

Concordance for cancer mortality in the NAS-NRC twin registry
C.D. Robinette, Z. Hrubec

Concordant cancer twin pairs discordant for cancer sites in the population based Danish twin sample
N.W. Holm, M. Hauge, O.M. Jensen

Reproductive history in twins discordant for breast cancer
B. Floderus-Myrhed, A. Wallgren, T.M. Mack, B. Johanson

Estrogen replacement therapy in postmenopausal twins discordant for breast cancer
T.M. Mack, D. Deapen, B. Langholz, D.C. Thomas

13:00 LUNCH BREAK

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ST JANS ROOM

14:00 Paper Session 3C
TWIN RESEARCH IN PSYCHOLOGY AND BEHAVIOR GENETICS
Chairman: Jacobus F. Orlebeke

A Finnish twin-family study of personality data
H. Langinvainio, S. Sarna, J.Kaprio, M.Koskenvuo, R.J.Rose

Consistency and change in adult personality: A six-year follow-up of the Finnish twin cohort
R.J. Rose, J.Kaprio, M.Koskenvuo, H. Langinvainio, S. Sarna

A developmental-genetic analysis of adult personality: Data from the Finnish twin cohort
M. Koskenvuo, H. Langinvainio, S. Sarna, J. Kaprio, R.J. Rose

A genetic analysis of personality questionnaires in Dutch twins and their parents
D.I. Boomsma, J. Couvee, A.J. Jenings, J.F. Orlebeke

Personality assessment in MZ and DZ twins
J. Karczag, J. Métneki

Assortative mating in a Finnish twin-family study
J. Kaprio, M. Koskenvuo, H. Langinvainio, S. Sarna, K. Romanov, R.J. Rose

The hereditary basis of mating preference: An investigation carried out on MZ and DZ twins
B. Chiarelli, E. Rabino Massa

Genetic and environmental contributions to anxiety: A twin study
A.M. MacDonald, R.M. Murray

4 SEASONS ROOM, I

Paper Session 3D-1
MANAGEMENT OF MULTIPLE GESTATION
Chairman: Louis Keith

Maternal cardiovascular adaptations to twin pregnancy
J.C. Veille, J.J.Morton, K.J.Burry

Incidence of hypertension in multiple pregnancies
R. Russo, P. Mancino

Multiple pregnancy and the use of regional analgesia for labour and delivery
F.P.Meehan, J.Sheil, M.O'Riordan

Cervical assessment in the management of twin pregnancy: A controlled trial
J.B. Neilson, C. Crowther, D.A.A. Verkuyl, C. Bannerman

Hormone reference intervals in uncomplicated twin pregnancy
B. Kappel, K.B. Hansen, J. Moller, J. Faaborg-Andersen

Maternal recognition of plural pregnancy
P.E.M. Malmstrom, E.J. Malmstrom, Y.E. Dotson

Antenatal cytogenetic analysis of twins
N.S. Mitter, E.J. Hallinan

Classification of twin pregnancies by ultrasound
M. Török, J. Métneki, M.Gy. Csakany, Zs. Turi, T. Rudas, E. Susanszky, I. Gati

Antepartum diagnosis of monoamniotic pregnancy
S. Mor Yosef, A. Brzezinsky, M. Granat

16:00 COFFEE BREAK

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La Voliere Room

14:00 Paper Session 3E
TWIN RESEARCH IN BIOCHEMISTRY, PHYSIOLOGY AND ANTHROPOLOGY
Chairman: Rune Frants

Genetic and environmental contributions to variation in biotinidase activity
K.A. Weissbecker, N.G. Martin, B. Wolf, W.E. Nance

Twin studies on human urinary pepsinogen
J.C. Pronk, R.R. Frants, D.I. Boomsma, G. Pals, J.F. Orlebeke, A.W. Eriksson

A study of lactose absorption capacity in twins
G. Flatz, J. Métneki, A. Czeizel, S.D. Flatz

The intrapair similarity of immunoglobulin levels in twins
K. Kouvalainen, I. Moilanen

Genotypic and phenotypic similarities in pulmonary function among family members of MZ and DZ twins
S. Redline, P.V. Tishler, F.T. Lewitter, S.T. Weiss, B. Rosner, F.E. Speizer

Genetic and environmental variation in menstrual cycle histories: A twin study
O.B.A. van den Akker, M.C.Neale, R.M. Murray, G.S. Stein

Psychosexual study on twins
J. Métneki, A. Czeizel

Anthropometric characteristics of reared apart twins: 50 years of research (1937-1986)
T.J. Bouchard Jr, D.T. Lykken, N.L. Segal, E.D. Eckert, L.L. Heston, A. Tellegen

4 Seasons Room, II

Paper Session 3F
TWIN RESEARCH IN SUBSTANCE EXPOSURE
Chairman: Christine A. Clifford

Smoking and drinking discordance and health conditions: Japanese MZ twins reared apart and together
K. Hayakawa, T. Shimizu

Arteriosclerosis of carotid arteries in MZ twins discordant for smoking habits
M. Koskenvuo, A. Haapanen, J. Kaprio, A. Kesäniemi

Psychosocial factors prior to diagnosis of alcohol abuse among male twin pairs
K. Romanov, M. Koskenvuo, R.J. Rose, J. Kaprio, H. Langinvainio, S. Sarna

A cotwin control study of alcohol related brain damage
C.A.Clifford, D.Maddocks, J.L.Hopper

Peripheral autonomic nervous system function in MZ twins discordant for exposure to neurotoxic solvents
E. Matikainen, J. Juntunen, M. Koskenvuo, M. Antti-Poika, J. Kaprio

Cerebral magnetic resonance (MR) imaging in occupational solvent exposure: A discordant twin study
J. Juntunen, L. Ketonen, M. Koskenvuo, M. Antti-Poika, E. Matikainen, J. Kaprio

16:00 COFFEE BREAK

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THURSDAY 18

St Jans Room

16:30 Paper Session 3C -- *Contd*

TWIN RESEARCH IN PSYCHOLOGY AND BEHAVIOR GENETICS

Twin pairs discordant for affective and anxiety disorder
S. Torgersen

Birth complications and later psychosis in discordant twins
S.W. Lewis

Cerebral ventricular enlargement in schizophrenic and control twins
A.M. Reveley, M.A. Reveley, B. Chitkara

Autonomous languages of twins
P. Bakker

A study of referential communication in twins
M.G. Carelli, B. Benelli

Dominance and submissiveness between twins
I. Moilanen

The effects of zygosity, sex and their interaction on the self-image of Chinese adolescent twins
C. Chang

Approach to the study of intraindividual relation in MZ twins: Preliminary results of a Rorschach test
M. Caporali, M.R. Alterio, G. Brenci, S. Parisi, P. Pes, C. Giovanelli

A complex etiological study on talent in twins
E. Susanszky, T. Rudas, A. Halasz, A. Czeizel

4 Seasons Room, I

Workshop 3D-2

UNIQUE ASPECTS OF HIGHER ORDER MULTIPLE BIRTHS

Chairman: Louis Keith

Program to be made available separately

SOCIAL PROGRAM: Banquet

20:00 Cocktails in the Van Gogh Room

20:30 Banquet in the Wintergarden

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La Voliere Room

16:30 Paper Session 3E -- *Contd*
TWIN RESEARCH IN BIOCHEMISTRY, PHYSIOLOGY AND ANTHROPOLOGY

Genetic variance estimates and familial resemblance for body size traits in a Punjabi population
K. Sharma

Selection of better limb and trunk skinfold combinations for body composition analysis based on twin studies
N.S. Mitter

Testing for the presence of genetic variance in factors of face measurements of Belgian twins
R.C. Hauspie, C. Susanne, E. Defrise-Gussenhoven

Dentofacial morphology in South Australian twins
G.C. Townsend, T. Brown, L.C. Richards, G.R. Travan, V.B. Burgess

Genetic variance and heritability of dental arch dimensions in Chinese adolescent twins
H.F. Chang, C.J. Chen

Incidence of double occipital hair whorls in twins and singletons
K. Sharma

Dermatoglyphic characteristics in Japanese twins
M. Okajima

SOCIAL PROGRAM: Banquet

20:00 Cocktails in the Van Gogh Room

20:30 Banquet in the Wintergarden

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FRIDAY 19

St Jans Room

08:40 LECTURE
The Future of Twin Research
Luigi Gedda

09:20 Symposium 4A
TWIN RESEARCH IN PSYCHIATRY
Chairman: Kenneth Kendler

Twins, fears, and phobias
G. Carey

Offspring of twin pairs discordant for psychiatric illness
A. Bertelsen, I.I. Gottesman

The interaction of environmental and genetic factors in schizophrenia
R. Murray, S. Lewis

A genetic multivariate analysis of self-report symptoms of anxiety and depression in twins
K.S. Kendler, A. Heath, N.G. Martin, L. Eaves

11:00 COFFEE BREAK

11:30 Symposium 4B
TWIN RESEARCH IN PHARMACOGENETICS
Chairman: Nicholas G. Martin

Twin studies in pharmacogenetics
A. Vesell

Structure and regulation of P450 genes
D. Nebert

Genetic factors in the psychiatric side-effects of oral contraceptive use
N.G. Martin, K.S. Kendler, A.C. Heath, L. Eaves

12:30 CLOSING SESSION

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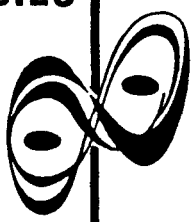
FIFTH INTERNATIONAL CONGRESS ON TWIN STUDIES



Abstracts

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A NEW METHOD FOR REPRESENTING MENTAL GROWTH

Ronald S. Wilson
Child Development Unit, University of Louisville, Kentucky, USA

A new method is described for plotting the growth in mental development from birth to adolescence. Using data from a large sample of twins followed since birth, a dimension of mental growth was constructed by arraying all tests in order of difficulty, then computing the average gain from age to age. The gain was expressed in standard-deviation units, which reflected the upward shift in the score distribution from time X to time X+1. When cumulated over ages, the scores generated a mental growth curve for the sample as a whole, as well as for each case individually. The curves displayed a very rapid gain in mental growth over the first 24 months of life, with the complexity of mental functions advancing by nearly 20 standard deviations from birth to two years. Thereafter the gain progressively tapered off until reaching a final increment of 0.5 SD gain between 15 years and adulthood. At this point, the terminal level of mental growth reached an average value of 31 SD units, with a spread of individual differences equal to ± 3 SD units. The scores at each age represented a combination of base level plus gain from the preceding age, and during infancy the gain scores were very large in relation to base. At later ages, however, the gain scores were comparatively small, both in absolute terms and in relation to base. These characteristics help explain the typical low-order correlations obtained among mental test scores during infancy, vs the progressively larger correlations obtained at later ages. Height data were also analyzed for these twins as a reference point for interpreting the mental growth data, and some interesting parallels were noted. The results are discussed in relation to concepts for developmental behavior genetics.

IQ RESEMBLANCE IN REARED APART TWINS: WITHIN PAIRS, BETWEEN PAIRS, AMONG STUDIES

T.J. Bouchard Jr.[1], D.T. Lykken[1,2], E.D. Eckert[2], L.L. Heston[2], A. Tellegen[1], N.L. Segal[1], K.J. Wilcox[3]
[1]*Department of Psychology,* [2]*Department of Psychiatry, and* [3]*Dight Laboratories, University of Minnesota, Minneapolis, USA*

The weighted mean intraclass correlation for IQ score for reared apart MZ twins, based on results from four separate studies, is approximately 0.72. The consistency of findings is impressive, given the variation among investigators, test instruments, and populations. Frequency of social contact, and similarities in the rearing environments of reared apart twins are repeatedly raised as alternative explanations to the genetic interpretation of the observed resemblance in IQ. Resolution of such issues is possible, in part, by examining relationships between key features of the twins' environments (eg, age at separation, age at reunion) and similarity in intellectual performance. An analysis of IQ resemblance and environmental similarities in MZ and DZ twin pairs participating in the Minnesota Study of Twins Reared Apart will be presented. Comparable findings from previous studies will be cited.

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TWIN STUDY OF TWO CULTURAL-FREE INTELLIGENCE SCALES ON CHINESE ADOLESCENTS

C. Chang
Department of Public Health, National Taiwan University, Taipei, Taiwan

A twin study was carried out to investigate the influence of environmental and genetic factors on intelligence development. A total of 176 twin pairs, 98 MZ (55 M, 43 F) and 78 DZ (36 M, 42 F), were selected among junior high-school students in Taipei city. Two cultural-free intelligence scales -- Cattel Cultural-Free Test and Raven's Standard Progressive Matrices -- were administered. Analyses include intrapair mean differences and intraclass correlation comparisons by zygosity and sex and on crude and sex-age-adjusted measurements. Results and implications will be discussed.

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BEHAVIORAL GENETIC ANALYSIS OF TEMPERAMENT AND PERSONALITY: DATA FROM TWINS REARED APART AND TWINS REARED TOGETHER IN THE SWEDISH ADOPTION/TWIN STUDY OF AGING

N.L. Pedersen[1,2], R. Plomin[2], G.E. McClearn[2]

[1]*Department of Environmental Hygiene, The Karolinska Institute, Stockholm, Sweden, and* [2]*College of Human Development, Pennsylvania State University, University Park, USA*

Data on the EAS temperament survey, the Swedish short form of Eysenck's extraversion and neuroticism scales, and a Swedish scale of impulsivity have been collected from 328 pairs of twins reared apart (TRA) and 372 pairs of twins reared together (TRT) participating in the Swedish Adoption/Twin Study of Aging (SATSA). For most of the scales, intraclass correlations standardized by age and sex were slightly greater in the TRA than in the TRT and significant heritability was detected. Estimates of h^2, E1 and E2 from model fitting analyses will be presented.

MODEL FITTING APPROACHES TO THE ANALYSIS OF EASI TEMPERAMENT RATINGS COLLECTED FROM THE PARENTS OF TWINS

M.C. Neale[1], J. Stevenson[2]

[1]*Department of Psychology, Institute of Psychiatry, London, and* [2]*Department of Psychology, University of Surrey, Guilford, UK*

Temperament ratings were obtained from the parents of 576 pairs of young twins. Parents each rated themselves, their spouse, and both of their twin children, using the EASI Temperament Survey. Preliminary analyses using model-free methods suggest a lack of rater bias and assortative mating, but some sex differences in variation. A number of path models are used to explore genetic and environmental components of variation and covariation. Specific hypotheses concerning sex differences and rater bias are tested with a maximum likelihood approach. The four temperament scales appear to show differences in heritability and sex associated variation. The results and their implications for developmental psychogenetics and for psychometrics are discussed.

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LONGITUDINAL RESEARCH ON TEMPERAMENT IN TWINS

Anne Mari Torgersen
Institute of Psychology, University of Oslo, Norway

Temperamental differences were previously studied in a sample of 53 twin pairs in infancy (2 and 9 months) and then again at the age of 6 years. Individuality was found in nine temperamental variables introduced by Thomas and Chess: activity, regularity, approach, intensity, adaptability, mood, threshold, distractibility, and persistence. A total of 44 of these twin pairs have now been studied again at the age of 15 years. This time, sociability, competence, and dominance within the pair have also been studied. The primary method of investigation at all age levels consisted in extensive interviews with the twins' mothers. An aspect of special interest has been considered, ie, whether variations within pairs at the age of 15 can be understood in the light of the temperamental differences observed at earlier ages. The results will be discussed in relation to shared and nonshared environmental factors in the life of the twins, as well as to hereditary factors.

DEVELOPMENTAL PERSPECTIVES ON TWIN TEMPERAMENT

Adam P. Matheny
The Louisville Twin Study, Child Development Unit, University of Louisville, Kentucky, USA

In the Louisville Twin Study, pairs of 3- and 4-year old twins were provided with standardized competitive or cooperative tasks in a laboratory setting. Some tasks required a pair of twins to share toys, other tasks fostered a more competitive engagement between the twins. Behavioral ratings identified temperament and social components at both ages, and between the two ages, there were transformations in the links between the components. Parental ratings of the twins' temperament at the same ages were moderately correlated with the laboratory observations, but the pattern of the relations changed from one age to the next. Combined sets of measures were subjected to twin analyses for 43 pairs of twins. The results are discussed in terms of the similarity of MZ and DZ pairs for the dimensions of temperament and the transformations of temperament.

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MATE SIMILARITY AND ITS EFFECTS ON TWIN DATA: THE MULTIVARIATE CASE

Gregory Carey
Department of Psychology and Institute for Behavioral Genetics, University of Colorado, Boulder, USA

Three nonexclusive mechanisms are proposed to account for correlations between mates. The first is assortative mating and may be subdivided into assortment based on phenotype, genotype, and antecedent environment, occurring singly or in combination. The second is common household environment and includes factors such as residence and shared diet. The third is direct phenotypic causal effects like imitation or contrast. The effects of some of these mechanisms for twin and family data are well understood in the univariate case. Here, the effects of these mechanisms on twin-based pedigrees are extended to the multivariate case.

Supported in part by NICHD grant HD-07289 and a grant from the Spencer Foundation to John C. DeFries.

PATH ANALYSIS OF SEVEN FEAR FACTORS IN TWINS AND THEIR PARENTS

K. Phillips[1], D.W. Fulker[1], R.J. Rose[2]
[1]*Institute for Behavioral Genetics, University of Colorado, Boulder; and* [2]*Department of Psychology, University of Indiana, Bloomington, USA*

A multivariate path model of genetic and environmental transmission was employed to derive expected covariances among adult twins and their parents and was fitted to fear factor data from 250 twin families, using a maximum-likelihood estimation procedure. The model includes parameters from parental cultural transmission, residual common twin environment, genotype-environment correlation, assortative mating, and genetic and environmental correlations. The full model involves 231 free parameters, but a reduced model omitting cultural transmission and genotype-environment correlation resulted in no loss of fit ($\chi^2_{38} = 57.36$, $P > 0.50$). This reduced model yielded very similar heritability estimates for all seven variables ranging from 0.19 to 0.33. A single factor accounts for most of the genetic covariance among the seven measures of fear.

Supported by NICHD grants HD-18426 and HD-19802.

CONSTRAINED MAXIMUM LIKELIHOOD ANALYSIS OF FAMILIAL RESEMBLANCE OF TWINS AND THEIR PARENTS

D.I. Boomsma[1], P.C.M. Molenaar[2]
[1]*Department of Experimental Psychology, Free University of Amsterdam, and* [2]*Department of Psychology, University of Amsterdam, The Netherlands*

When the univariate twin design is extended by including parents of twins, it is possible to assess additive genetic effects in the presence of assortative mating and genotype-environment correlation, the effects of parental influence, as well as the extent of residual shared environmental influences. The analysis of data obtained in such an extended twin design can be carried out by means of constrained maximum likelihood confirmatory factor analysis. Specifically, the structural model underlying this design is represented as a LISREL model with nonlinear constraints. This representation in terms of a constrained LISREL model offers the possibility to consider extended multivariate twin designs involving common genetic and environmental factors and assess, for example, the effects of assortative mating. The proposed method will be compared with multivariate path analysis of familial resemblance and will be illustrated with applications to simulated and real data.

SPECTRAL ANALYSIS OF TWIN TIME SERIES DESIGNS

P.C.M. Molenaar[1], D.I. Boomsma[2]
[1]*Department of Psychology, University of Amsterdam, and* [2]*Department of Experimental Psychology, Free University of Amsterdam, The Netherlands*

The analysis of twin designs involving physiological time series has to accommodate the presence of autocorrelation. This can be accomplished by means of orthogonal transformation of the series, thus enabling the use of standard twin analysis techniques for the sequence of uncorrelated transforms. In view of the oscillatory character which typifies various physiological time series, it is customary to invoke spectral techniques of analysis. It can be shown that spectral analysis constitutes an orthogonal transformation that asymptotically resembles principal component analysis and consequently enables again the use of standard twin design analysis methods for spectral transforms. This approach will be illustrated with simulated and real (heart rate) data for univariate twin time series. Furthermore, it will be indicated that the proposed analysis can be readily generalized to multivariate twin time series, thus leading to a frequency-dependent analogue of maximum likelihood confirmatory factor analysis.

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INNOVATIONS IN THE STATISTICAL ANALYSIS OF TWIN STUDIES

J.L. Hopper, P.L. Derrick, C.A. Clifford
Epidemiology Unit, Faculty of Medicine, University of Melbourne, Carlton, Victoria, Australia

Advances in computer technology have made possible a greater sophistication in the statistical analysis of pedigree data; however, this sophistication is not necessarily manifest by fitting more comprehensive causative models. Planned twin and family studies measure numerous explanatory variables, including perhaps genetic and DNA marker information status on all pedigree members, and the cohabitation of all pairs of individuals. A statistical analysis should examine the contribution of these measured factors in explaining the variation and covariation between individuals, concurrently with the postulated effect of unmeasured factors such as polygenes. We present two models that meet this requirement: the Multivariate Normal Model for Pedigree Analysis for quantitative traits, and a Log-Linear Model for Binary Pedigree Data. For both models, important issues are examination of fit, detection of outlier pedigrees and outlier individuals, and critical examination of the model assumptions. Procedures for fulfilling these needs will be discussed together with examples of modelling. The development of user-friendly statistical packages that implement these methods is proceeding.

BIVARIATE LIFETABLE MODELS FOR ANALYSIS OF GENE-ENVIRONMENT INTERACTIONS IN TWINS

D.C. Thomas[1], B. Langholz[1], B. Floderus-Myrhed[2], D. Deapen[1], T. Mack[1]
[1]*Department of Preventive Medicine, University of Southern California, Los Angeles, USA, and* [2]*Department of Environmental Hygiene, Karolinska Institute, Stockholm, Sweden*

Classical liability models in genetics for analysis of binary attributes have often ignored age of onset and environmental covariates. The former is particularly important in chronic diseases, where incidence rates rise rapidly with age and periods at risk often vary between individuals, and the latter is essential for unscrambling gene-environment interactions. Standard methods of survival analysis allow for both of these features, but have generally been restricted to independent individuals. Recent developments have extended "proportional hazards" model by the addition of an unmeasured covariate reflecting the shared genes and environments of related subjects. It is shown how this approach can be combined with traditional genetic models to estimate the main effects and interactions of measured and background genetic and environmental factors. Adaptations of the approach needed for various types of incomplete ascertainment are discussed. The approaches are discussed in relation to two sets of twin data: a cohort of about 13,000 female twin births in Sweden from 1885 to 1958, linked with the Swedish cancer registry from 1958 to 1982; and a set of 3735 twin pairs, one or both of whom have cancer, identified in the US and Canada by advertising in newspapers.

METHODOLOGY IN FAMILIES-OF-TWINS DESIGNS: ILLUSTRATIONS FROM A FINNISH TWIN-FAMILY STUDY

S. Sarna[1], J. Kaprio[1], M. Koskenvuo[1], H. Langinvainio[1], K. Heikkila[1], H. Rita[1], R.J. Rose[2]
[1]*Department of Public Health, University of Helsinki, Finland; and* [2]*Department of Psychology and Medical Genetics, Indiana University, Bloomington, USA*

In 1984, the Finnish Twin Cohort was linked to the computerized Central Population Registry to permit extended twin-family studies through the addition of the spouses, parents, children and sibs to the twin data structure. Initially, the families of 472 fecund twin parents, about equally divided by gender and zygosity, were selected for study; in each selected family, at least two adult children and their nontwin parent were available. A postal questionnaire, similar to that completed by the twins in 1981, was sent in two mailing rounds during 1985. One or more members responded from 98.3% of the families including at least one child from each side in 224 of the 236 twin kinships. The data set includes 1367 adult children and 401 spouses of the selected twin parents. Here, we describe methodological considerations including (1) evaluation of the representativeness of the selected twins relative to control twins matched on age, gender and zygosity; (2) checks for adoption/remarriage; (3) tests for homogeneity of the four types of twin kinships; (4) matching of twin samples to offspring for model-fitting; and (5) potential of our population-based twin-family data structure for epidemiological research.

DETECTING THE CONTRIBUTIONS OF MEASURED AND UNMEASURED GENOTYPES AND ENVIRONMENTS AND THEIR INTERACTIONS FOR LIABILITY FOR A DISEASE

N.G. Martin, L.J. Eaves, A.C. Heath
Department of Human Genetics, Medical College of Virginia, Richmond, USA

Concordance for a disease in twins may be low and similar in MZ and DZ pairs, yet genes may still have a large influence on risk through interaction with environmental factors. We consider a study of MZ and DZ pairs ascertained because one or both twins have a disease. Genotypes at a major marker locus are known and putative environmental risk factors have been measured for all individuals. The power of the study to estimate the effect on liability of the measured and residual genetic and environmental effects (Gm, Gr, Em, Er) and all two-way interactions between them (except Gr x Er) is estimated by simulation. If liabilities can be indexed on a continuous scale (eg, blood pressure as an index of liability to hypertension), then a study of 600 MZ and 600 DZ pairs would have sufficient power to detect quite subtle interaction effects, even if ascertainment were greatly biased toward MZ twins. If liabilities cannot be measured and only affection status is known, then the power of the study would be lower, although not impracticably so. There appears to be no advantage in augmenting the twins with a sample of control individuals. The argument is developed in terms of the utility of the design for research into hypertension, breast and skin cancer.

Supported by NIH grants GM32732, GM30250, AA06781, AG04954.

THE ANALYSIS OF MARITAL INTERACTION IN TWIN DATA

A.C. Heath, N.C. Martin
Department of Human Genetics, Medical College of Virginia, Richmond, USA

In twin data, the genetical consequences of assortative mating and the effects of family environment are confounded. Twin data are therefore commonly supplemented by data on spouses, often obtained from a separate sample of unknown age structure, to provide an estimate of the importance of assortative mating. The correlation between spouse pairs may, however, be a consequence of social interaction between spouses rather than, or in addition to, assortative mating. Path models, allowing for reciprocal interaction between spouses, are used to show how expected twin covariance matrices differ for concordant married, discordant, and concordant unmarried twin pairs. The detection of marital interaction in twin data is illustrated for Conservatism, alcohol consumption and smoking. Alternative explanations of findings, including genotype x environment interaction (where the relevant environmental feature is marital status), will be discussed. A more satisfactory resolution of competing hypotheses is possible when data on twin pairs and their spouses are collected.

ZYGOSITY TESTING BY DNA AND BLOOD GROUP POLYMORPHISMS

R.R. Frants[1], J.F. Orlebeke[2], I. Hendrikse[3], A.J. Jeffreys[4], A.W. Eriksson[1]
[1]*Department of Human Genetics and* [2]*Department of Psychology, Free University of Amsterdam;* [3]*Central Laboratory, Blood Transfusion Service, Amsterdam, The Netherlands; and* [4]*Department of Genetics, University of Leicester, UK*

Application of blood group and other genetic protein polymorphisms for various identificatory purposes, eg, forensic medicine, paternity and zygosity testing, is well established. Depending on the gene frequencies, the information content of each genetic system varies, and to reach a high degree of reliability a considerable number of markers have to be tested. For zygosity determination, additional criteria can be applied, such as placentation, anthropology and fingerprinting. DNA polymorphisms provide a new efficient tool with the additional advantage of technical uniformity. In the present study, we have applied minisatellite probes to determine the zygosity of twins for a psychophysiological stress study. In parallel, the conventional blood group analysis approach was followed. DNA was isolated from peripheral blood lymphocytes, digested with Hinf I, electrophoresed in 0.6% agarose and blotted to nitrocellulose filters. Probes (33.6 and 33.15) were labelled with P32; hybridization and washing were performed according to standard procedures. To date, 32 twin pairs and their parents have been studied with the DNA and the conventional polymorphism approach. No discrepancies have been noted. The simplicity and reliability of the present method is stressed.

A COMPARATIVE STUDY OF THE PHYSICAL, EMOTIONAL AND FINANCIAL DISADVANTAGES OF TRIPLET FAMILIES COMPARED WITH FAMILIES OF THREE CLOSELY SPACED CHILDREN

P.A. Stewart[1,2], J. Hennessy[2]
[1]*University of New South Wales, and* [2]*The Multiple Birth Study Centre, Australia*

The physical, emotional and financial demands of pregnancy, confinement and the rearing of triplet children is well known to sympathetic health personnel, social workers and voluntary organisations such as the worldwide Parents of Multiple Birth Groups. Even so, in Australia, repeated applications to the Federal Government for financial and domiciliary aid were refused on the grounds "that there was no evidence to suggest that families with triplets were at a greater disadvantage than that of families with three closely spaced children." This paper presents the results of a comparison survey between such families, which influenced a change in Government policy, and highlights the areas of greater disadvantage among families with triplets for further assessment.

THE SOCIAL CONSEQUENCES OF HAVING HIGHER MULTIPLE BIRTHS IN THE FAMILY

J.B. Buckler, J.M.H. Buckler
Department of Pediatrics and Child Health, University of Leeds, UK

As an outcome of visiting over 200 pairs of twins and 30 sets of triplets, we have identified various problems which are more apparent with higher order multiples than with twins. These include the difficulties of giving each member of the set the same degree of interest, attention and discipline, not only by the family itself, but even more so by society in general. This is particularly so when there is a discordant child in a DZ triplet set. Similar problems arise for singletons within the sibship. It proves much more difficult to control and watch three in the street and shops than two. Financial limitations prevent many families from undertaking activities that otherwise would be open to them. Little financial assistance is offered to these families by the state or commercial organisations.

THE SPECIAL SITUATION OF MOTHERS WITH TRIPLETS

Helga Grützner-Könnecke
ABC Club e.V., Darmstadt, FRG

Following the foundation of the ABC-Club four years ago, I asked 268 mothers of triplets, quadruplets and quintuplets about their situation. Most of them were in Germany and Switzerland, and some in Austria, Italy, The Netherlands, and France. The mothers were of different age and of different social background. Most of them have had no hormonal treatment, but some have, and there also was a small group with in-

vitro fertilization. Mothers of triplets have more problems, and different ones, than mothers of twins. High number of children includes special difficulties by itself. Today, there are more problems than in the past. A generation used to plan its own life is shocked, in most cases, by the early ultrasound diagnosis of multiples. Women may decide to carry out the pregnancy or not. A big question is to get help, which is not available in most of the countries.

THE EXPECTATION AND PARENTAGE OF TWINS: A STUDY ON THE LANGUAGE DEVELOPMENT OF TWIN INFANTS

Britta Alin-Akerman
Stockholm Institute of Education, Department of Educational Research, Stockholm, Sweden

Expecting a baby could be a revolutionary situation. Expecting twins could be more of both positive and negative expectations. Positive expectations could be the feeling of "richness" and tension to really have the possibility to take care of two children. Negative expectations can consist of fears about the possibilities of handling the task both physically and psychically and anxiety for the limitation of freedom which can result from the birth of twins. It is very important to be aware of what kind of reactions the parents may have when they get the diagnosis of twins. Very strong negative reactions can easily give a sense of guilt to the mothers and can make their burden grow.
To be twins also means something special. Two persons are born at the same time in the same family with the same training side by side. The psychological situation for both of them would likely influence them more than other children who are not twins. Even the most important time for the development of personality is different to baby twins than to other babies. A twin is hardly ever the sole focus of the family.
The purpose of this project is to 1) illustrate the experiences pairs expecting twins have, and 2) describe the development of the personality of the twins and possible differences at different ages. Similar prospective and longitudinal studies have not, to my knowledge, been made. I started by meeting 35 pregnant twin mothers and fathers. The investigation is done at the mothers' clinic in the Karolinska Hospital in Stockholm. The development of the 35 twin pairs at 9 months of age is also described.

THE EFFECT OF TWINS ON FAMILY RELATIONSHIPS

A.C. Sandbank
Child Guidance Clinic, Guilford, Surrey, and TAMBA Medical and Education Group, UK

The results of the Bene-Anthony Family Relations Test on 75 pairs of twins and siblings, as well as an analysis of personality inventories obtained from their parents will be presented. It is shown that weight

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and birth order can effect not only personality and the way in which twins interact with each other, but can also be demonstrated to effect family interaction. Particular attention has been given to the effect on and of the preceding sibling.

THE BEREAVED TWIN

Joan M. Woodward
West Midlands Institute of Psychotherapy, Uffculme Clinic, Birmingham, UK

A 3-year study has been conducted on the responses in adult lone twins, MZ and DZ, to the loss of their twin at varying stages of life. The study is based on individual interviews of over 200 lone twins from all over England and Wales.

SUPPORT FOR PARENTS WHO LOSE A NEWBORN TWIN

Elizabeth Bryan
Twins and Multiple Birth Association (TAMBA), Lillington, Leamington Spa, Warwickshire, UK

Following a study of the needs of mothers who lose a newborn twin, an attempt was made to improve the support given to such bereaved parents.
1) A leaflet, "The Loss of Your Baby Twin," was produced.
2) A self-help group was established which arranges contacts and continuing support for newly bereaved parents.
3) Widespread publicity through the popular media and medical journals was given to 1) and 2), and the particular needs of the parents were highlighted. These include the need for parents to have their loss fully acknowledged (and not thought to be compensated for by another baby); to distinguish the dead baby from the living with tangible reminders; to grieve and talk about the dead baby; to continue to regard the survivor as a twin and to be helped to support this child through his often complex reactions.

ESSENTIAL NONMEDICAL PERINATAL SERVICES FOR MULTIPLE-BIRTH FAMILIES

P.E.M. Malmstrom, E.F. Davis, P. Wagner
TWINLINE, Berkeley, California, USA

Twinline is a professional service agency which provides a variety of services and research-based materials to help parents of twins and multiples cope with their unique stresses. Services include a hotline, classes, support groups, networking, and a respite program. Information will be given on the characteristics of Twinline's heterogeneous client population and methods of meeting their diverse needs.

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RESPITE CARE: A LIFELINE FOR LOW-INCOME MULTIPLE BIRTH FAMILIES

P.E.M. Malmstrom, M.W. Wedge, E.F. Davis, J.M. Knudsen, P. Wagner
TWINLINE, Berkeley, California, USA

Twinline's unique Respite Care Program provides low-income families with relief from round-the-clock care of twins, other multiples, and often other siblings. During the past 8 years, Twinline has found that the single most important component of healthy family life for multiple-birth families is having help with the physical care of their children during the early months and years. While some families are fortunate enough to have a network of relatives, neighbors, and hired help to relieve them, about 10% of all multiple-birth families lack such resources. Consequently, they are at a very high risk for family breakdown: drug and alcohol abuse, child and spousal battering. In this high-risk category are single parents, teenage mothers, abandoned spouses, refugees, and parents of triplets and quadruplets. Short-term respite care provides an inexpensive, direct and dramatically positive intervention for this target population. This program fills a critical gap in the "safety net" of social services.

ISTS COLLECTIVE MEMBERS AND RESEARCH COMMUNICATIONS

Joyce E. Maxey
Illinois Organization of Mothers of Twins Clubs (IOMOTC), USA

The Illinois Organization of Mothers of Twins Clubs, Inc, established its Twin Registry in 1964 and currently has statistical information on 550 sets of twins and 12 sets of triplets. There is an increasing need to develop a universal research data form to standardize the information in various registries and thereby give a uniform base for researchers to draw upon. This idea has been under discussion since the very first Congress held in Rome in 1974. IOMOTC has developed a form for use by researchers who wish to have access to its twin resources. It is of the utmost importance that a schedule of communications be established between ISTS and the multiple birth organizations. It is not beneficial to focus on communications only at the time of a Congress: this must be ongoing. Communications can open new roads to research, if we but open research communications.

THE HANDPRINT/FOOTPRINT RESEARCH

Joyce E. Maxey
Illinois Organization of Mothers of Twins (IOMOTC), USA

The handprints and footprints of over 3000 sets of twins and their families have been collected since 1974 for a study designed to identify and describe major genes for dermatoglyphic features and to develop a simple zygosity test. This research was originated by Dr Warner Kloepfer, who died in 1982 before the study could be completed. The collection of prints has continued toward the goal of 4000 sets of twin handprints and footprints. These prints are available for use

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by other scientists, while the search for a geneticist interested in completing the original project continues. The paper will identify the methods used to collect the prints, assure quality control, and estimate zygosity. Information will also be provided on the number and type of twin sets for which prints are available as of May 1986. Information on sets for which prints are available on parents, siblings and other family members will also be given.

LIAISON FOR THE INTERNATIONAL SOCIETY FOR TWIN STUDIES

Joyce E. Maxey
The National Organization of Mothers of Twins Clubs (NOMOTC), USA

It is suggested that the privilege of being a Collective Member of ISTS carries with it implications of obligations other than the payment of dues. ISTS and the international multiple birth organizations share a concern for the growth and development of twin research; but how is that mutual concern expressed? The proposal to create liaisons for ISTS Collective Members offers the opportunity for constructive action that would strengthen both ISTS and its Collective Members. The sharing of research would be ongoing from Congress to Congress and the papers presented would reflect the cooperative input in their preparation. An outline will be presented showing the interaction of the Liaisons for ISTS and the resulting mutual enrichment.

RESEARCH AT THE AUSTRALIAN MULTIPLE BIRTH ASSOCIATION

Aileen Enticott
Australian Multiple Birth Association (AMBA), Coogie, NSW, Australia

This report will review research conducted and endorsed by the Australian Multiple Birth Association, Inc, over the past three years. Such research has included bereavement, educational research, and triplet survey.

DEVELOPING TWIN PARTICIPATION IN TWIN STUDIES

Kay Cassill
The Twins Foundation, Providence, Rhode Island, USA

A primary goal of the Twins Foundation has been the establishment of a voluntary National Twin Registry, eventually to become available to qualified researchers both on and off premises. To achieve this it began (1) an early program concentrating on membership and development, offering a variety of benefits not available to the twin community before; (2) enlisting over two dozen well-known personalities to provide support for its publicity program; and (3) by establishing

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The Twins Letter, a quarterly publication as the initial serial of its publication arm. Results to date include: the Twin Registry contains information on over 12,000 registrants, computerization has begun, and expansion on a state-by-state basis has been planned. The data base is designed to offer access by zygosity, geographic distribution, age, education, familial twinships, marital status, skills/interests, medical history, and so forth. Registrants seem highly motivated to participate. Data has been gathered through questionnaire, correspondence and interview. Through student internships and a volunteer network, as well as liaisons with various institutions, oral histories are planned as in the development of a support network through Focus Seminars during the Foundation's three-year Development Phase.

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VIETNAM ERA VETERAN TWINS: A NEW REGISTER

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A Vietnam Era (1965-1975) Twin Register of American male-male veterans born between 1939 and 1953 is providing the study sample for research evaluating the impact of Vietnam service on medical and psychosocial aspects of health. By extrapolation from a pilot study of the twin register from the state of Connecticut, there exists a total of 46,000 twin pairs where both brothers are Vietnam era veterans. The register will be composed of 8,000 twin pairs, selected from military and civilian computerized data bases. Twins will be identified by same last name, different first name, same date of birth, and similar social security number. Twin status will be confirmed by review of military records. The register will include data about zygosity, military experience, postmilitary social adjustment, current sociodemographic information, and past and current health. The register will be an important resource for future twin research.

ASCERTAINMENT BIAS IN THE VIETNAM ERA TWIN REGISTER

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An examination of ascertainment bias in the identification of twin pairs in the Vietnam Era Twin Register has been conducted. A complete listing of all male-male Vietnam era (1965-1975) veteran twin pairs born in Connecticut between 1939 and 1953 was obtained (N=150). An attempt was then made to match these pairs with a listing of Vietnam era veteran twin pairs ascertained from the US Department of Defense (DOD) computer files. The results indicate that the DOD files identified only 46.7% of the 150 Connecticut born Vietnam era veteran pairs. Statistically significant differences ($P<0.05$) between pairs found on the DOD files were observed for the following variables: (1) year of discharge from military service; (2) total length of active military service; (3) branch of service; (4) foreign service. The implications of the ascertainment biases in the Vietnam Era Twin Register will be discussed.

ASCERTAINMENT BIAS IN A NONRANDOM REGISTRY OF TWINS WITH DISEASE

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The population-based twin registry is a powerful tool for the study of disease concordance, of relative disease incidence in relation to prior exposure, and of the past experiences of affected and unaffected cotwins. However, such a resource is expensive to initiate and difficult to maintain in a state of complete disease ascertainment. Furthermore, the size of population-based twin registries has not been sufficiently large to permit the study of unusual exposures in relation to truly rare diseases. A disease with an annual incidence of 1:100,000 would produce only 20 cases in a population of 100,000 twins followed for 20 years. Yet, the largest extant twin registry comprises only a fraction of this number of pairs. It will take many years of ascertainment before this approach will be adequate for the study of a relatively uncommon disease like multiple sclerosis (MS) or systemic lupus erythematosus (SLE). Using an alternative approach, the USC International Twin Registry has identified over 1000 pairs of twins with MS and over 180 pairs with SLE, mostly in the US and Canada, through notices published in newspapers. Such a large number, if representative, would provide a powerful means of estimating disease concordance. Recognizing that concordance estimation in a volunteer registry is subject to bias of various kinds, we are attempting to evaluate sources of bias and to estimate the degree and direction of the resultant effects. Crude and adjusted concordance rates for MZ and DZ twins with chronic disease will be presented and compared with estimates from other sources.

DUTCH STUDY OF CANCER IN TWINS

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In 1985, the Dutch branch of the International Twin Study started. The study is being carried out at the same time in the USA, Canada and the Scandinavian countries. The study consists of a series of case-control studies of various cancer sites, within sets of MZ and DZ like-sexed twins discordant for disease (ie, cancer). Twins are enrolled in the study by means of newspaper ads. Each twin is then asked to independently fill out a detailed written questionnaire. This includes questions on demographic and environmental characteristics of the families, the medical characteristics of the twinships, the medical history and the traits pertinent to risk from the specific cancer. The unique capacity of twins to provide information of a comparative (intra-twin) nature is exploited as well. In the presentation, the results will be shown of this (in the Netherlands) unique way of case ascertainment. Until now, about 225 pairs of twins have volunteered to participate. About 50% of these are MZ twins. The first results of the case-control studies among twins with breast cancer and digestive tract tumors will be presented.

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PREGNANCY HISTORY CHARACTERISTICS OF NORWEGIAN TWINS

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Reproductive history information was obtained by questionnaire from 830 MZ and 902 DZ female twin pairs, in addition to the spouses of members of 459 MZ and 464 DZ male twin pairs. Analyses were limited to those twin pairs where reproductive history information was available for both female twins or for the spouses of both male twins. In general, there was no evidence that twin mothers were any more or less likely than nontwin mothers to experience complications of pregnancy. The observed pattern of association in the presence or absence of nausea during pregnancy as reflected by estimated tetrachoric correlations for female MZ (0.54 ± 0.05) and DZ (0.24 ± 0.05) twins and for spouses of male twins (0.03 ± 0.06) suggests that genetic factors may be important determinants of a woman's predisposition for this problem. A similar pattern of association was also observed for the presence or absence of hypertension or toxemia during pregnancy, with tetrachoric correlations of 0.56 ± 0.08, 0.21 ± 0.11 and -0.03 ± 0.13 being obtained for MZ female twins, DZ female twins, and spouses of male twins respectively.

TWIN STUDIES IN THE MINNESOTA COMPREHENSIVE EPILEPSY PROGRAM

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[1]*Dight Laboratories,* [2]*Department of Neurology,* [3]*Department of Laboratory Medicine/Pathology, and* [4]*Department of Psychiatry, University of Minnesota, Minneapolis; and* [5]*Sergievsky Center, Columbia University, New York, USA*

A population-based study of patients with recent onset of seizures or epilepsy identified 1047 probands, including 19 twin-born. Other twin-born probands were located through clinic files. Five of these twin families had extensive seizures activity in first- and second-degree relatives. Analyses of biochemical, neurological and clinical variables in all the twin families will be presented. A second series is being collected through the Minnesota Twin Registry, based on same-sex pairs born in Minnesota from 1936 to 1955. A sample of 35 with a history of seizures has been identified, and another 115 are expected. A third series is projected through an international Epilepsy Twin Registry.

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HERITABILITY OF REFRACTIVE ERRORS: A POPULATION-BASED TWIN STUDY

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A total of 16,067 adult same-sexed twin pairs from the Finnish Twin Cohort Study were linked with the police record of obligation to wear glasses for far correction when driving a motor vehicle. Overall heritability index calculated by the classic twin method for refractive errors was 0.34. A total of 51% of the twins had a driving licence, the percentage being higher in men than in women. 13.2% of male and 19.5% of female twins had to wear glasses when driving a motor vehicle. The two sexes did not differ from one another in the distribution of the obligation to wear glasses. Age is statistically significantly associated with the probability of wearing glasses when driving. The heritability in this study is lower than previously calculated heritability indexes for myopia. We assume that the results of this study can be referred to myopia, since other refractive errors play epidemiologically a minor role in the defects of far vision.

TWIN STUDY ON MYOPIA

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In order to elucidate the roles of heredity and environment in the determination of ocular refraction, about 70 MZ and 30 same-sex DZ pairs of twins were studied with respect to corneal curvatures, axial length and ocular refraction. Concordance rates, correlation coefficients and heritability indices were calculated. Heredity was shown to play some role in the determination of myopia, but the diversity of intrapair differences in MZ twins with age and refraction pointed to the importance of the environment.

SERUM CHOLESTEROL LEVEL IN MZ TWINS REARED APART

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Identical twins reared apart (MZA) have been identified in the Finnish Twin Cohort. Serum cholesterol and its constituents (HDL, LDL, ULDL) were measured in 16 pairs (9 male, 7 female). The mean age of the MZA twins was 45.6 yr (range 28-64). An age-sex matched control group was selected from identical pairs reared together (MZT) and living in the province around Helsinki. The mean age of the MZT twins was 45.3 yr (range 28-62). The mean level of total serum cholesterol was 6.61 nmol/l (SD 1.53) in MZA and 4.99 (SD 0.96) in MZT (P=0.0012).

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Intraclass correlations for serum cholesterol were 0.30 in MZA and 0.38 in MZT twins. The mean intrapair difference of total serum cholesterol was 1.41 (SD 1.12) in MZA and 0.82 (SD 0.65) in MZT twins (P=0.078). The correlation between age and intrapair difference of cholesterol was 0.12 in MZA and 0.48 in MZT twins. According to a 7-day dietary diary, the composition of the diet of MZT twins represented the ordinary Finnish diet. The diet of MZA twins was not studied as they live throughout Finland. MZA pairs had mainly spent their childhood in farming families, and their educational level was lower than that of MZT pairs.

APOLIPOPROTEINS A1 AND B IN ADOLESCENT TWINS

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Low concentrations of apolipoprotein A1 (apoA1) and raised levels of apoB have been reported in survivors of myocardial infarction. High levels of apoA1 have been associated with a decreased risk of coronary heart disease. Conflicting evidence for and against the presence of a single locus or polygenic loci influencing plasma apoA1 and apoB levels has been published. We evaluated apoA1 and apoB levels in 37 11-yr old twin pairs and their parents. In adults, weekly alcohol consumption was positively correlated with apoA1 levels. Girls generally had lower levels than boys of apoA1. Black twins had lower apoA1 levels and higher apoB levels than white twins. Heavier children had in general lower apoA1 levels. There was a tendency in both parents and children for those with a positive family history of premature cardiovascular death to have lower apoA1 and higher apoB levels, but these findings did not reach statistical significance. Marital and DZ twin correlations were nonsignificant for apoA1 and apoB. Mother-child correlations were of borderline significance. Father-child correlations were significant (r=0.58, P<0.05) for apoA1 but not for apoB. MZ twin correlations were significant for apoA1 (r=0.69, P<0.001) and apoB (r=0.46, P<0.05). These findings give support to the existence of genetic and environmental influences on these apolipoproteins and suggest a possible relationship with risk for future coronary disease.

GENETICS OF CARDIOVASCULAR RISK FACTORS

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Data are currently being gathered in order to study the genetics of known risk factors for the development of cardiovascular disease.

Subjects are adolescent MZ and DZ twins and their parents. Blood pressure and several indices of cardiovascular functioning (such as ECG) are measured during resting and laboratory stress conditions in all subjects. In addition, blood samples are collected to determine several lipoprotein fractions (total-, HDL- and LDL-cholesterol and triglycerides). Smoking behavior and family history of cardiovascular disease incidence are assessed by questionnaires.

BLOOD PRESSURE DISCORDANCE AND LIFE STYLE: JAPANESE MZ TWINS REARED APART AND TOGETHER

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In Japan, it was not rare until the 1940s to rear twin babies separately. In this study, the subjects are adult MZ twins born before 1935. Blood pressure, food intake and life style factors were studied in 198 MZ twin pairs. Their age at separation ranged from 0 to 30. The concordance rate of blood pressure was highly associated with their age at separation and with other life style factors.

ATRIAL ACTIVITY AND CARDIOVASCULAR RESPONSE TO STRESS IN A SET OF TRIPLETS

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[1]*Institute of Medical Pathology, First University of Rome; and*
[2]*The Gregor Mendel Institute, Rome, Italy*

High-resolution electrocardiography has again been conducted on a set of triplets already examined three years ago and previous individualities and similarities have been confirmed. The handgrip test, cold pressor test and mental stress test have also been conducted and the individual responses compared.

NONINVASIVE RECORDING OF A-V CONDUCTION IN MZ AND DZ TWINS

S. Villatico-Campbell[1], F. Di Maio[1], A. Sciarra[1], A. Sciacca[1], G. Brenci[2], L. Gedda[2]
[1]*Institute of Medical Pathology, First University of Rome; and*
[2]*The Gregor Mendel Institute, Rome, Italy*

Standard electrocardiography has shown a substantial concordance in the tracings of MZ twins, higher than that in DZ twins. An attempt to confirm this finding through high-resolution electrocardiography has now been conducted and 12 twin pairs (6 MZ, mean age 17.5, and 6 DZ, mean age 25 yr) have been compared. The results are in agreement with previous findings and confirm a higher similarity in the tracings of MZ than DZ twins.

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THE MECHANISMS OF MZ AND OF DZ TWINNING IN THE LIGHT OF MOLECULAR BIOLOGY

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The recent finding of the modulation of the action of cell-adhesion molecules (CAM) offers new insights into the mechanisms of MZ and DZ twinning and its inheritance.

SOCIOBIOLOGY AND MULTIPLE BIRTHING: r VERSUS K REPRODUCTIVE STRATEGIES

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Using symbols from population biology, it is possible to distinguish a continuum of reproductive strategies that organisms engage in ranging from r, the production of large numbers of offspring with minimal care provided, to K, the production of few offspring intensively nurtured. Compared with other animals, humans are at the K end of the continuum. It has been proposed, however, that some people are genetically more K than others. The present paper suggests that the concept of r vs K strategy may help explain a number of known correlates of multiple egg production in humans. Compared to mothers of singletons, mothers of DZ twins typically have a lower age of menarchy, a shorter menstrual cycle, a higher number of marriages, a higher rate of coitus, more illegitimate children, a closer spacing of births, and a greater fecundity. Further, twins are known to have a shorter gestation period, a lower birth weight, and a greater incidence of infant mortality. Finally, multiple births occur more frequently in families of lower than of higher social status, and in those of African than of European, and especially than of Oriental descent. These are all seen to be predictable relationships if multiple egg production is considered part of an r-strategy approach to reproduction.

PLACENTAL STRUCTURE AND ZYGOSITY IN TWINS

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A monochorionic twin placenta is widely regarded as an indicator of monozygosity. This assumption is undermined by a number of earlier reports, particularly that of Bieber et al (1980) on an acardius with a coexisting normal male monochorionic twin where cytogenetic analysis revealed support for polar body twinning in this situation. Other rare examples (Edwards et al 1966, Lejeune et al 1962) of monochorionic twins with sex differences or discordant genetic syndromes are explicable on the basis of somatic mutations. This study describes a review

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of 37 twin sets over a 12-month period in which all twins defined as monochorionic by placental examination had extensive blood group antigen profiles constructed from their cord bloods. A total of 12 minor blood groups in addition to ABO, Rhesus and Coombs testing, were included in the profile as genetically determined phenotypic characters. Discrepancies were noted in 25% of the twin pairs, indicating that monochorionic twins display genetic differences in 1/4 of cases. Thus, the terms monozygous and monochorionic should not be used interchangeably, unless it is stressed that monozygosity does not necessarily imply identicality in genetic terms.

FETAL MEMBRANES IN MZ AND DZ TWINNING

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The causal relation existing between the type of placentation and zygosity in twin pregnancies is reexamined through the registry of the First Obstetric Clinic of the University of Rome.

SEASONALITY OF CONCEPTION IN MONOCHORIAL AND DICHORIAL MONOZYGOTIC TWINS

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The predictions of the Seasonal Preovulatory Overripeness Ovopathy (SPOO) hypothesis have been analysed in a month-of-birth study on 1117 pairs of MZ twins (724 monochorial and 393 dichorial) deriving from the Prospective Twin Survey (PTS) sponsored by the local Society of General Practitioners of East Flanders (Belgium). The survey covers 68% of all twins born between 1 October 1964 and 30 September 1985 in East Flanders. Zygosity and choriality were tested by a placental membrane study and genetic markers. The pregnancy duration was noted in 81% of cases. The SPOO hypothesis is based on the circumstantial evidence of (1) a circannual alternation of ovulatory and anovulatory seasons, (2) transitional stages between them being characterized by non-optimum maturation of the oocyte, and (3) its teratological consequences having been shown to lead to identical twinning in animal experiments. According to this hypothesis, particularly the monochorial MZ twins (ie, the intermediate and late splitting ova) are conceived more frequently during the transitional stages, ie, seasonally bound restoration and inhibition stages of the ovulatory seasons and less during stages of ovulatory stabilisa-

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tion. Divergence of the month of birth frequencies of monochorial and dichorial MZ twins -- apart of those of DZ twins -- can explain inconsistencies and even apparent absence of seasonal fluctuations in previous month-of-birth twin studies.

SEASON OF CONCEPTION AND RISK OF TWINNING

Jean Golding
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National data on deliveries of live- and stillbirths in 1973 were compared for Sweden, New Zealand, Hungary, 6 states of the USA, and Cuba. The estimated month of conception of twins (mode 36 weeks gestation) and singletons (mode 40 weeks) enabled the risk of a conception being a twin to be calculated for each month. Contrary to early reports from Finland of an increase in twinning when conception occurs in the summer (with a presumed effect of light on the hypothalamic-pituitary centres), in Sweden the risk of twinning was highest in February or March and lowest in high summer. There were bimodal peaks in New Zealand and Cuba, but in Hungary and the USA the peak incidence was between April and July. There was no evidence for any of the countries to support a suggestion that the seasonal variation in twinning is similar to that of singletons, but more pronounced with higher peaks and lower troughs.

SEASONALITY IN TWIN BIRTHS IN DENMARK FROM 1936 TO 1984

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Seasonality was studied in Denmark in 45550 twin deliveries out of 3,679,932 (12.37 per 1000) for the years 1936-1984. The results of different statistical methods were compared. There was little evidence of seasonality according to a simple harmonic curve (Edwards). However, a significant fit was found to a 4th-5th degree polynomial curve with a maximum peak in twin births in May-June, a lower peak in December, and troughs in February and September. A falling trend in the twinning rate broke off in Denmark around 1970, and from 1970 to 1984 a significantly increasing trend was found.

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MONTHLY FREQUENCY DISTRIBUTION OF TWIN VS SINGLE BIRTHS IN ITALIAN REGIONS, 1981-1982

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Monthly frequency distributions of twin births and single births have been compared, considering the monthly data as historical series by means of Fourier transformations and taken as a whole. No differences were found. When the analysis is carried out regionally, differences are found due to genetic and sociocultural factors.

CHANGES IN BIRTH SEASONALITY OF TWINS DURING 1971-1984 IN JAPAN

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We have previously reported that the twinning rate was generally higher in the summer-fall season for the years 1924-1980 in Japan, and this seasonal variation was occasionally lost within a short period, 1973-1975. To confirm this phenomenon, birth dates of 1536 twin pairs born in 1971-1984 were obtained from the members of an association of twins' mothers. The seasonal variation of twinning changed every 2-4 years. Years when the twinning rate was higher in summer-fall (1971-72, 1976-77, 1982-84) and those when a peak of the rate was not observed (1973-75, 1978-81) appeared alternately. In the years with the summer-fall peak, this peak was detected for twins from both primiparas and multiparas, as well as in both like- and unlike-sex and MZ and DZ pairs. These results suggest the possibility that seasonal factors influencing the twinning rate do not induce multiple ovulation but rather abortion, since a similar seasonality was observed in MZ and DZ twins. These factors might be epidemic ones which prevail and wane alternately within several years.

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INCIDENCE OF TWINNING: VARIABILITY AND INTERPRETATIONS

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The factors traditionally held to influence the variability of twinning rates within populations -- specifically maternal age and parity -- still appear to be unable to account for at least part of this variability. A number of interpretations have been proposed to account for the peaks and troughs observed in the DZ twinning rate in a number of cases, and particularly for the decline observed in recent decades in industrialized countries. However, no consensus has yet been reached. Meanwhile, even the MZ twinning rate, traditionally held to be fairly stable, has appeared to have been recently increasing. A critical review of the various interpretations in the light of the literature and of the available evidence from a 110-year secular study on Italian vital statistics indicates that other factors might be at work.

THE NON-DECLINE IN U.S. TWIN BIRTH RATES, 1964-1980

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Detailed twin birth rates for the USA are available only for 1964. In 1980 the crude twinning rate was lower than in 1964, but there had been great changes in maternal age and parity. Standardization directly for maternal age and indirectly for birth order provides twinning rates that can be compared over the entire period. The adjusted rates for Whites show a continuous increase except in a 2-year reporting hiatus, 1969-1970, when rates dropped back 10%. If that discontinuity is an artifact, the year 1964 appears to be approximately the low point for twinning in the USA. In Blacks, aside from the same 1969-70 shift, the adjusted rate was stable until 1972 and increased thereafter. The distributions of rate increases by year, maternal age, and race argue against effects of medical ovulation stimulants, but an accentuated increase of triplets argues for such effects.

TWINNING RATES AROUND YEARS OF PRIVATION

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We studied the twinning rate in some Nordic populations around years of severe crop failures with death rates 2-3 times higher than the average. During the chronic shortage of food before and during the

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hard years of the Great Northern War (1701-1721), the twinning rates in the Aland Islands, estimated by moving averages, were markedly decreased. Several demographic crisis years with excess of deaths over births occurred around 1740 in Nordic countries as a consequence of war, crop failures and famines. In 1742 and 1743 the death rate in Aland was around 7%. During this period the twinning rate (18.4/1000) did not deviate significantly from the average rate in adjacent years (21.4/1000 for 1700-1799). The year 1773, which was preceded by failure of the crops, involved a catastrophically high mortality in Sweden that later has not been surpassed. The rates of multiple maternities during 1771-1775 were at unusually low levels for Aland (14.7/1000) but not for Sweden (16.5/1000). At the end of the 1860s the sufferings of the Fennoscandian populations were very severe after some years with bad harvests. In 1868 famine was especially severe in Finland where almost 8% of the whole population died and the birth rate was about 30% less than the average. During the years of severe famine, 1867-1868, the twinning rate in Finland was not significantly decreased (14.9/1000) but the triplet rate in 1868 was the lowest observed (0.07/1000) for any year from 1841 until the 1930s. It is noteworthy that in 1869 there was a peak in the twinning rate in Finland, in spite of the fact that 1868, the year in which the majority of these twins was conceived, was a very severe famine year. During the last world war, neither in total, age-standardized, nor in DZ twinning rates in Finland, any significant decrease was noted during or after the years with relatively low caloric intake of food. The noted decrease in the DZ twinning rate in the Netherlands in 1945, following the food shortage of the war winter 1944-1945, will be further analyzed.

SOCIAL CLASS AND TWINNING

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Information from vital records in Hungary, New Zealand and Austria for 1973 and from a national Birth Survey in the UK (1970) were analysed to assess whether the incidence of twinning was associated with socioeconomic status. Data on parental education and occupations were used. After standardization for maternal age and parity, there was some evidence for an association between increased twinning incidence and low educational attainment, and where either mother or father worked in agriculture, but reduced incidence in the professional occupations. There was no evidence that prior to the introduction of fertility drugs women in upper socioeconomic classes were at increased risk of multiple birth in the countries considered.

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HIGH TWINNING RATE IN MEXICAN-AMERICANS: A REPRODUCTIVE ELITE?

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This study investigates the present-day twinning rate of Mexican-Americans in Denver, Colorado. Gene frequency estimates show approximately 35% Mexican Indian contribution and 65% European contribution to the Denver Mexican-American gene pool. Given the Asian origin of the New World Indians, one would expect that the Mexican-American twinning rate would be intermediate between the Asian and the European rates. The study population consisted of all births over 20 weeks gestation occurring in Denver in 1980 (N = 16,430 births). The variables of maternal race, age, gravidity, parity, and sex were collected for the twin subsets (N = 156 pairs) from hospital records. The twinning rates are: 13.0 in Mexican-Americans (N = 40 pairs), 9.3 in Blacks (N = 13 pairs), 9.1 in Anglos (N = 101 pairs), and 2.7 in Asians (N = 2 pairs). Thus, Mexican-Americans have the highest twinning rate rather than the predicted low to intermediate rate. Given the higher fertility, in general, of the Mexican-Americans, the hypothesis that the Denver Mexican-Americans are a reproductive élite (ie, have increased fecundability) was tested. If the Mexican-American mothers are members of a reproductive élite, it was predicted that mothers of twins would be younger and have lower gravidity and parity in Mexican-Americans than in Anglos. Mexican-Americans do have a lower maternal age than Anglos (24.68 vs 27.60, P = 0.005). However, there is no difference in gravidity and parity status for the two populations. Thus, the data neither support nor reject the hypothesis that Mexican-Americans are members of a reproductive élite.

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NATURE-NURTURE INTERACTION IN DIFFERENT TYPES OF SCHOOL ENVIRONMENTS

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A model of nature-nurture interaction in school situations emanating from a longitudinal Swedish twin project is presented. This model implies that interactional effects measured by MZ-DZ within-pair comparisons over time are related to the type of behavior studied, as well as teacher and pupil influences at different levels. In a more permissive and stimulating school situation, hereditary factors are hypothesized to be more influential (decisive for behavioral variation) than in a more restrictive and nonstimulating situation. A study of such interactional effects will require longitudinal measurements of pupil behavior as well as teacher and parental influences. To acquire a variation in permissiveness/restrictiveness and stimulation/nonstimulation at the societal level, comparisons are made between twins attending grade 4-6 in compulsory schools in Sweden and twins of the same age attending Israelian kibbutz schools.

SIMILARITIES OF KIBBUTZ TWINS AND SINGLETONS IN PERCEPTION OF THEIR ENVIRONMENT

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This research compares similarities and differences in MZ and DZ twins, and in singleton controls, on individual perceptions of extent of restriction imposed by parents, teachers, and peers with regard to the children's choices, plans, and actual activities. During the past two years, the parents of all kibbutz twins in Israel, of ages 1 to 18, were contacted by us. They provided background information about themselves and their twin children. In each kibbutz, two control singletons were selected of the same age and sex for each twin pair, yielding a "quartet". With the aid of a mapping sentence, questionnaires were constructed to help ascertain the child's role in life areas such as: family, friendship, school, hobbies, work, amusement. Questionnaires with the same facet design are being administered to children (twin and singleton) mothers, fathers, teachers, and caretakers. In addition, each child is given a battery of tests -- including the verbal WISC, Block Design, Raven Matrices, and Reading Apprehension. The children will be interviewed and tested in three successive years, beginning either in grade 4 or 5. Data will thus be obtained on changes in perception of permissiveness-restrictiveness during ages 9-13.
This project is part of a cross-cultural study with Siv Fischbein of the Stockholm Institute of Education, on "A Cross-cultural Comparison of Interaction Between Heredity and Environment".

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EARLY INFLUENCE ON THE SCHOOL SOCIAL ADJUSTMENT OF TWINS

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The birth of twins is often accompanied by complications which may affect both twins equally, eg, prematurity, or which may establish differences between the twins, eg, one coming home from hospital first. Parents' ratings of behavior may reflect and even perpetuate the influence of such variables and it is of interest to see if people less familiar with the twins' early history can observe any long-term effects. In the La Trobe Twin Study, 1949 teachers have completed the Bristol Social Adjustment Guide, an assessment of social maladjustment in children aged 5-16 yr. Prematurity and problems at delivery were generally associated with the Underreaction syndrome -- the child who is unforthcoming, withdrawn and especially depressed. Withdrawal, depression and maladaptive behavior to classroom peers were much more common among those twins who came home from hospital after their cotwin. A major mediating factor was that the parents admitted to greatly preferring the one to come home first. These results raise questions both about the practice of bringing twins home separately (which occurred in 24% of cases) and about intervening variables in studies of personality and temperament.

DIVERSITY, DEVELOPMENT AND DETERMINISM

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Each of us is characterized by numerous behaviors that appear minor and often highly idiosyncratic in nature. Examination of casual photographs of an individual, accumulated over many years, will sometimes reveal a pattern of postures and gestures that are both stable and unique. Analysis of verbal protocols can highlight the consistent use of particular terms and phrases. A single item of this type is sometimes sufficiently salient to "stamp" an individual's personality, ie, the "Johninan qualities of John". Observed in identical twins reared together (MZT), such characteristics are often overlooked. Observed in identical twins reared apart (MZA), however, they are very striking and difficult to ignore. Why these reactions? The answer is simple: trivial idiosyncratic similarities found in ordinary identical twins are easily explained away as the result of common learning. When seen in MZA twins, they raise a host of interesting questions. Many psychologists accept the evidence showing that a wide variety of traits (eg, measures of personality and mental ability) are significantly influenced by genetic factors. Such measures, however, generally reflect a high level of aggregation. It is believed that at the item level, genetic effects are modest. Observations of idiosyncratic behavior in MZA twins, while not definitive, suggest that the problem of level of analysis is not entirely solved by aggregating items. The implications of this point of view for studying genetic influences on individual differences and development will be elaborated from the perspective of study of MZA twins.

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THE SWEDISH ADOPTION/TWIN STUDY OF AGING (SATSA): A STUDY OF ADULT DEVELOPMENT

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Surprisingly little is known about the relative influence of genetic and environmental factors in the etiology of individual differences in functioning during the last half of the life span. The Swedish Adoption/Twin Study of Aging is a program of research in gerontological genetics utilizing a sample of 365 pairs of twins (DZ as well as MZ) reared apart (TRA) and 386 pairs of twins reared together. The average age of the twins is nearly 60 years.
SATSA is a two-phase project. The first phase involved mailed out questionnaires concerning medical history, legal drug use, personality measures, occupational history, early environment, physical and mental health and activities of daily living. Phase II involves in-person assessment of biomedical and cognitive variables and is currently in progress. The paper will present an overview of results from Phase I. The presentation will include three types of results: 1) hierarchical multiple regression analyses that consider zygosity and twin resemblance as they react with age, gender and measures of separation; 2) simple twin correlations for the four groups of twins; and 3) maximum-likelihood, model-fitting analyses that provide parameter estimates for additive and nonadditive genetic variance, environmental influences not shared by twins reared together, environmental influences shared by twins reared together, and selective placement (the extent to which reared-apart twins share similar environments.)

RESEARCH STRATEGIES FOR THE RESOLUTION OF DEVELOPMENTAL GENETIC MODELS

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Three different research strategies for obtaining developmental genetic data are compared. Cross-sectional data obtained using two-generation experimental designs (eg, twin pairs and their parents; twin pairs and their offspring) will allow some simple developmental genetic models to be tested. Cross-sectional data provide no test of the contribution of intragenerational shared environmental effects to behavioral consistency over time. They also cannot resolve multiple common genetic factor models which allow for the influence of several independent dimensions of genetic variability on development. Whilst the traditional longitudinal twin study avoids these shortcomings, sample attrition (and continued availability of funding) can be a serious problem. A two-generation cohort sequential study, in which different age cohorts (and their parents) are studied simultaneously, and followed longitudinally over a shorter time period (eg, two or three years) provides a

viable alternative to the longitudinal study. Results of power calculations are presented, which illustrate the advantages of this approach.
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MODELLING DEVELOPMENTAL CHANGE IN QUANTITATIVE PHENOTYPES

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Most models for quantitative inheritance assume that the phenotype is stable over time, that individuals are measured at a constant age, or that standard regression techniques can be used to remove the effects of age statistically. Such models and methods are no use when the trait being studied is subject to developmental change in the expression of genetic and environmental effects. Traditional treatments of developmental change in longitudinal data have had no basis in a quantitative theory of development. As a result, findings have mostly been descriptive and ad hoc. A model for developmental continuity and change is described which, with changes in the same basic parameters, can predict different patterns of developmental change in family resemblance. Thus, the model can resolve crucial hypotheses about the causes of developmental change. A problem with the analysis of family resemblance with developmental models is the specification of the effects of cultural inheritance and assortative mating, the consequences of which may depend on the timing of crucial life events of leaving home, marriage, and bearing children. Such effects violate the equilibrium conditions often assumed in the analysis of family resemblance. A preliminary approach to the inclusion of assortative mating and cultural inheritance in developmental models is provided by the theoretical treatment of some special cases in which it is assumed that the crucial life events occur at the same age in every member of the population.
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DEVELOPMENT OF PREMATURE TWINS AND TRIPLETS

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Eighteen twin pairs and three sets of triplets were followed from birth. All were premature by gestational age and weight, the smallest being 840 g and 940 g. All had a complicated perinatal course and were managed in the neonatal I.C.U. of a tertiary care hospital. There were 26 females, 10 sets were MZ. Two died in their first year. The survivors (43) were followed for at least 3 years by a multidisciplinary team, three-monthly in the first year, six-monthly thereafter. Developmental testing was comprehensive and repeated. All except one

had normal growth parameters; 34 infants were normal, 2 mentally retarded, 4 had a significant neurological handicap, and 3 had both mental retardation and cerebral palsy.
Personality differences were repeatedly recorded -- 7 normal twin pairs and one in 6 normal twin pairs. The 6 affected twin pairs had such neurological damage that personality differences were considered secondary. The most significant factor in predicting outcome was their neurodevelopmental status on leaving I.C.U. Speech delay was prominent in infants under 1000 g. They may still develop subtle learning and language problems. Close following of such at risk infants is recommended at least until ages 6-7 years.

SPEECH AND LANGUAGE DEVELOPMENT IN PRESCHOOL TWINS

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While language, articulation and reading problems have been well documented in young twins, it is not clear how extensive such problems can be or how early in childhood they become evident. 2.5 yr old twin boys in the La Trobe Twin Study were 8 months behind matched singletons and twin girls on expressive language and 6 months behind on verbal comprehension. They were also 5 months behind on symbolic play and this delay is closely related to language. "Secret" language characterised most of the twin boys but not the girls and the relation of this to articulation delays is discussed. To examine if exposure to other children helps the twin boys, 3.5-4.5 yr old twins and singletons were matched on the Columbia Mental Maturity Scale at the time of starting preschool. The twin boys had more articulation problems and all twins scored much lower on a Sociability questionnaire completed by the teacher. After eight months at preschool, all children had advanced in Sociability, but the twins remained just as far behind with poor Sociability relating to poor articulation. The role of an intervention program involving speech therapy is discussed.

MULTIVARIATE ANALYSIS OF GENETIC AND ENVIRONMENTAL INFLUENCES FOR LONGITUDINAL HEIGHT AND WEIGHT DATA

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A multivariate analysis of genetic and environmental influences on longitudinal height and weight data from a Swedish twin sample is presented. Genetic and environmental correlations are calculated for the relationship between each time point and the starting point. Similar patterns are found for boys and girls for height, whereas for weight there is a difference between sexes. Implications of these results are discussed.

FETAL GROWTH IN MZ AND DZ TWIN PREGNANCIES

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722 measurements of fetal abdominal circumference (AC) have been made with ultrasound in 65 consecutive twin pregnancies. Zygosity was established in 85% of cases. There was no difference in the growth of mean AC between MZ and DZ pregnancies. In both cases, the pattern of growth was linear until term, in contrast to that predicted by birthweight for gestational age charts. There was no evidence that such linearity could be explained by an increased incidence of fetal growth retardation in those pregnancies ending before term, and it is suggested that increasing trunk flexion in late twin pregnancy distorts accurate AC measurement. The findings in this study are contrasted with those of an earlier investigation in which inclusion of an index of fetal flexion provided more sensitive prediction of small-for-gestational age twins than does AC alone.

INTRAUTERINE GROWTH OF MULTIPLE GESTATIONS

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From 30-32 weeks onwards, children of twins and triplets are, as compared to singletons, growth-retarded. Crowding of the uterus or insufficiency of the maternal supply line has been held responsible for this retardation of intrauterine growth. From 1500 twins, 75 triplets and 3000 singletons the obstetrical data were known. Two important observations were made from these cross-sectional data: (1) until 37-38 weeks, placentas in multiple gestations are related to the fetal weights relatively small, as compared to singletons (which means a relatively low placental index); and (2) from about 24 weeks, placentas in multiple gestations are smaller than placentas in singletons. The conclusion is made that the retardation of the intrauterine growth of multiple gestations is due to a relatively poor early placental development (placental crowding of the uterus).

PLACENTAL MATURATION IN TWIN AND SINGLETON PREGNANCIES: A COMPARATIVE ULTRASONOGRAPHIC STUDY

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The sonographic evidence of placental maturation of 158 twin pregnan-

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cies and 474 singleton pregnancies were compared at different gestational ages. A higher percentage of cases with Grade III placentas was found in the twin group throughout the third trimester (P=0.001). Considering the reported association of Grade III placentas with advanced gestation, as well as fetal lung maturity, the present study suggests earlier maturational changes in twin fetuses compared to singletons.

FETAL LUNG MATURATION IN TWIN GESTATION

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Clear amniotic fluid was collected at cesarean sections and the lecithin/sphingomyelin (L/S) ratio was used to evaluate fetal lung maturation in 42 twin gestations. The L/S ratios of twin pairs were usually similar in both numerical value and predictive accuracy, except when the greater L/S ratio from one member of a pair indicated borderline lung maturity. Twin fetal lung maturation was found to be independent of sex, zygosity, and birth weight discordance. Comparison of mean L/S ratios in twins to those of uncomplicated singleton pregnancies revealed that fetal lung maturation occurred several weeks earlier in twins.

SURVEILLANCE OF THE TWIN PREGNANCY WITH DOPPLER VELOCIMETRY

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The surveillance of the twin pregnancy represents an important challenge in obstetrics. Doppler velocimetry identifies normal from abnormal umbilical artery circulation. The velocity waveform of the umbilical arteries was measured in 52 pairs of twins. The S/D ratio reflects the resistance to velocity flow distal to the point of measurement. By using a Δsystolic/diastolic (S/D)ratio, the problem of twins moving to different positions is eliminated. All placentas were examined by a pathologist. Δweight difference of more than 350 g and ΔS/D ratio $\leq$ 0.4 was defined as an abnormal test. The specificity was 81% and sensitivity was 73%. Two cases of twin-to-twin transfusion were diagnosed. The SGA twin has higher ratio than AGA twins. Thus, velocimetry is a useful tool for evaluation of the twin pregnancy for the diagnosis of an SGA twin and a twin-to-twin transfusion.

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PROPHYLACTIC SICK-LEAVE IN TWIN PREGNANCY: AN IMPROVED PROGNOSIS FOR THE TWINS?

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During 1981, 856 twin deliveries occurred in Sweden. Seventy-eight of the women (Group A) had been treated with prophylactic sick-leave during pregnancy to prevent preterm labour and delivery. To evaluate the effect of this measure on gestational length and birth weight of the twins, 78 matched controls (Group B) were randomly selected from the rest of the twin pregnant population. The control was characterized in the following way: a woman who, at the gestational week of prophylactic sick-leave prescription in the case, had not yet been in sick leave and who was never prescribed prophylactic sick leave. No difference between Group A and Group B was found concerning maternal age, parity, or socioeconomic factors. The women in Group A, on the average, were prescribed sick leave for 61 days; prophylactic treatment and severe diagnoses such as partus prem.imm., hydramnios, preeclampsia, or bleeding are included. The corresponding figure for Group B was 24 days. No significant difference in gestational length (on the average two days shorter for Group A) or birth weight (50 g less for the twins in Group A) between the two groups was found. The results of this retrospective study thus indicate that an increase in duration of sick leave from 24 to 61 days in twin gestation to prevent preterm labour and delivery seems to be without effect on gestational length or birth weight of the twins.

PERINATAL MORTALITY ASSOCIATED WITH MULTIPLE PREGNANCY: A 12-YEAR REVIEW, 1972-1984

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During a 12 yr period, a total of 72 babies were lost from 921 multiple births, giving a perinatal mortality rate of 78.2/1000, of which 34 (3.69%) of the total babies delivered were stillbirths, and 38 (4.13%) neonatal deaths. There were 32 mothers with a gestational age of less than 37 weeks and 19 where gestational age was more than 37 weeks. When one considers that the incidence of multiple pregnancy has remained constant, the finding that 55 (76.38%) of these babies were lost in the years 1972-1978, proves that with the introduction of intensive antenatal care, intensive monitoring in labour and better neonatal pediatric services, the perinatal mortality in multiple pregnancies can be reduced.

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THE OUTCOME OF MULTIPLE PREGNANCY IN GALWAY, IRELAND

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A retrospective analysis of the case records of 32,654 patients delivered during a 12 yr period showed 458 (1.40%) multiple pregnancies, an incidence of 1/71 pregnant women. The number of patients whose gestational age was less than 37 weeks was 113 (24.67%) vs 345 (84.06%) over 37 weeks gestation. Labour was induced in 138 (30.13%) and accelerated in a further 148 (32.31%) patients. The methods of induction/acceleration are discussed. The duration of labour, time interval between births, type of delivery, and birth weights, are described in detail, and the outcome with regard to the Apgar scoring and perinatal mortality further evaluated.

COMPARISON BETWEEN ULTRASOUND FINDINGS AND OUTCOME IN PREMATURE TWINS

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Between January 1982 and January 1986, a total of 676 infants with a gestational age of 34 weeks or less were admitted to the Neonatal Intensive Care Unit of the Hammersmith Hospital. A total of 181 of these (26.7%) were part of a multiple pregnancy. All infants had a regular cranial ultrasonography from the first day of life. The incidence of perinatal death, abnormal cranial ultrasound findings and outcome was compared between infants who were singletons and those who were a product of a multiple pregnancy. Differences between the first and second twins were also investigated. The results of these data will be discussed.

THE NORTHWESTERN UNIVERSITY MULTIHOSPITAL TWIN STUDY: V. TWIN DELIVERIES AT PRENTICE WOMEN'S HOSPITAL AND MATERNITY CENTER, 1979-1984

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The Northwestern University Multihospital Twin Study was initiated to assess the relationship of various factors which might affect the outcome of twin pregnancies. In November 1975, the Prentice Women's Hospital and Maternity Center (PWHMC) began to provide Level III perinatal services to 24 outlying hospitals and serve as a referral source for high-risk mothers and their infants. The study population

to be described delivered between 1969 and 1984, and consisted of 264 consecutive twin deliveries.Included were women who received antenatal care at PWHMC, as well as referred patients and transports. Exclusions were made if there had been an antenatal stillbirth, infant weight less than 750 g, less than 26 weeks gestation or incomplete data. The paper will describe maternal demographic and obstetric data and outcome parameters as a background for future in-depth analysis of specific points.

Supported in part by The Center for Study of Multiple Birth, Chicago.

THE NORTHWESTERN UNIVERSITY MULTIHOSPITAL TWIN STUDY: VI. FACTORS RELATING TO LOW APGAR SCORES IN TWIN DELIVERY

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Data from 264 twin pregnancies delivered between January 1st, 1977, and April 30th, 1983, were analyzed. Newborns were divided into two groups: 1) those with normal 5 min Apgar scores (ie, 7-10), and 2) those with abnormal scores (ie, 1-6). Subsets for each group were established according to the presence/absence of cord blood pH values less than 7.20. Similar analysis was performed for Apgar less than 5. Maternal and newborn records were reviewed for the presence of a series of 20 maternal, fetal or obstetric factors which might contribute to poor outcome. Factors were considered in light of whether they were unavoidable vs possibly preventable vs clearly preventable.

EARLY DEVELOPMENTAL PROGRESS OF PRETERM TWINS DISCORDANT FOR BIRTHWEIGHT AND RISK

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The results of twin studies have shown that birth order and the degree of discordance in birth weight are related to an increase in the discordance of developmental progress in the twin pairs. In addition to the effects of birthweight and birth order, the developmental progress of preterm twins is impacted by the earliness of gestation and the extent of accompanying postnatal medical complications. In this study, we report the outcome of 45 twin pairs born between 26 and 37 weeks gestation, and whose birthweights ranged from 840 to 2000 g. They were administered the Neonatal Behavioral Assessment Scale at 36 weeks conceptional age, the Bayley Scales of Infant Development (BSID) at 3, 6 9, 12, and 24 months, and the Stanford-Binet Intelligence Scale (SBIS)

at 3 years of age. Weight discordance, birth order, and the extent of medical risk as measured by the Parmalee Postnatal Complications Scale did not significantly differentiate between twins at any given age. However, twins born at 26-31 weeks gestation had significantly lower BSID mental indices at 24 months and SBIS IQ scores at 3 years than did twins born at 32-37 weeks gestation. This finding suggests that the degree of prematurity, rather than birthweight or postnatal medical complications, may be the most potent variable in predicting the developmental outcome of preterm twins.

BIRTHWEIGHT EFFECTS ON TWIN TEMPERAMENT AND MATERNAL REWARDS

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The greater the intrapair weight differences at birth, the more likely is the mother to form a closer relationship with the heavier child. The preference usually occurs immediately or very soon after birth and is likely to be prolonged. When the smaller baby is preferred this develops later and is short-lived. The rewards experienced by the mother in caring for each baby differ according to whether the child is the larger or smaller at birth. The greater the weight difference, the higher the frequency of temper tantrums displayed by the smaller baby. Sequence, sex, zygosity, separation of one or both babies from the mother at birth, and social class, age and parity of the mother, are not found to be significant in affecting these results.

TRANSFUSION SYNDROME AND THE PHYSICAL AND COGNITIVE DEVELOPMENT OF MZ TWINS

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Monochorionic MZ twins may differ from dichorionic ones because of the transfusion syndrome and the timing of the cleavage of the zygote. The effects of these on physical growth and on verbal, spatial and memory tests are examined in 7-15 yr old MZ twins in the La Trobe Twin Study, using full placental data where available. Results of cognitive and of dichotic studies of a subsample of the children are discussed in terms of the putative relation between hemispheric specialization and the time of splitting. However, the poor concentration span of most MZ twins complicates any accurate assessment of dichotic functioning. For most twins anomalies in asymmetry have more lasting influence on abilities than any medical complications of the transfusion syndrome per se. This work adds further doubts as to the validity of any assumption of developmental equivalence between MZ twins and the general population.

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GROWTH CHARACTERISTICS IN TWINS AND HIGHER ORDER MULTIPLE BIRTHS

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Height measurements have been obtained on over 200 pairs of twins and over 35 higher multiple birth sets each on one occasion at various ages between 3 and 18 years. These heights have been related to the appropriateness of birth weight for gestational age. The twins, evaluated as a total group, have an average height slightly above the average of the standards for a British population, but not when parental height is taken into consideration as the parents too are of above average tallness. The triplets overall were of average height but again slightly less than expected in terms of parental height as these parents were even taller. A marked difference was found when the appropriateness of birth weight for gestational age was taken into consideration. Twins and triplets whose weight at birth was appropriate for gestational age were above the average height for comparable singletons, but those with progressive degrees of lightness for dates grew less well, although only occasionally was there a serious degree of growth retardation. Comparison will also be made with the heights of siblings.

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NEW HYPOTHESES FOR TWIN STUDIES OF CONGENITAL ANOMALIES

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Twin studies of congenital anomalies are becoming increasingly popular. Review of recent reports makes it clear that such studies report discordance rates in MZ twins and increased incidence of twinning in certain congenital disorders, but innovative etiologic hypotheses are not being generated nor tested. A new, imminently testable hypothesis about the incidence of, and discordance for, neural tube defects in MZ twins is the possibility that fission of the zygote at certain points in time is more likely to lead to maldistribution of polypeptide products from homeotic genes. A combination of in vitro fertilization, manipulation of animal zygotes, and Western blotting could investigate this. Recent observation of the association of apparent MZ twinning and the lethal pterygium syndrome raises the possibility that a primary gene defect in cellular ground substances could lead to instability of the zygote, and also eventuate in pervasive dysmorphogenesis of connective tissues. Finally, study of concordance rates in DZ twins for syndromes of obscure etiology could allow screening for the role of teratogens in the causation of disorders such as Rubinstein-Tayibi syndrome.

TWINNING, NONRIGHTHANDEDNESS AND FUSION MALFORMATIONS: EVIDENCE FOR HERITABLE CAUSAL ELEMENTS HELD IN COMMON

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A particular group of common congenital malformations which are in excess among twins are also excessive in first-degree relatives of twins. They are also familially associated with each other. Like twinning, they are familially associated with nonrighthandedness (NRH). This conjunction of associations suggests that twinning, nonrighthandedness, and this group of malformations share heritable causal elements. These malformations share the additional, central fact that they affect structures which are built by the fusion of bilateral embryonic halves and then remodeled under major influence of neural crest mesenchyme. Embryogenic body symmetry determination and neural crest mesenchyme functions may be mechanisms unifying these effects.

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THE BRITISH COLUMBIA EXPERIENCE WITH NEURAL TUBE DEFECTS AND TWINS

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Neural tube defects can be divided into primary and secondary neurulation problems. Among 526 cases of neural tube defects, 10 indexed cases were one of a twin pair. Eight out of the 10 were clearly primary neurulation problems and all of these cases were comparable with monozygous twinning.

MATERNAL AGE AND CONGENITAL MALFORMATIONS IN SINGLE AND MULTIPLE BIRTHS

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The incidence of congenital malformations of a genetic nature has been examined in Italian vital statistics for the 5-year period, 1969-1972. The incidence appears to be higher in newborns born to mothers aged 35 years or more, and more so in single than in multiple births.

EARLY STRUCTURAL DEFECTS IN MONOZYGOSITY; CLEAVAGE DISORDERS OF THE "MIDLINE FIELD"

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We present a case of triplets discordant for normality, holoprosencephaly, and fetus papyraceous. The family was originally ascertained because of a maternal 13/14 Robertsonian translocation. Amniocentesis was performed for fetal chromosomal analysis; however, only one sample of amniotic fluid could be obtained from the two sacs present. Chromosome results on the sample were 46,XX. At delivery, the initial presumption was that triplet "C", the fetus papyraceous, had trisomy 14; triplet "B", with holoprosencephaly, had trisomy 13; and triplet "A" was the chromosomally normal fetus tested at amniocentesis. Chromosome study of triplets A and B ultimately disproved this presumption showing normal 46,XX patterns and indistinguishable chromosome polymorphisms. Additionally, their hematocrits were 75% and 10%, respectively, indicating an artery-vein transfusion sequence. Since triplet "C" shared its sac with triplet "A", we must presume that all three infants were MZ. It has been proposed that early structural defects, such as holoprosencephaly, and monozygosity are etiologically related cleavage defects of the "midline field". These infants lend support to this concept. We will review studies which discuss structural disorders

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in MZ twins in order to heighten the morphologist's awareness of the etiologic relationship between monozygosity and cleavage defects of the midline field. Determining the etiology of structural defects in multiple or singleton births is necessary in counseling families regarding recurrence risks for these disorders.

TWINNING RATE IN SIBSHIPS WITH THE TURNER SYNDROME AND THE KLINEFELTER SYNDROME

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In 65 sibships of patients with the Turner syndrome and 121 of patients with Klinefelter syndrome, the occurrence of multiple maternities was studied from genealogical records. Among the 66 patients with Turner syndrome, the frequency of twinning was 2:65 maternities (3.1%). Among the sibs of Turner syndrome patients so far traced, the rate was 2:200 (1%). Among the 121 probands with Klinefelter syndrome no twins were found. Among the sibs of these probands the twinning rate was 4:539 (0.74%). These twinning rates are not significantly different from the mean frequency of 1% to 1.3% in the Dutch population from 1925 to 1969. Three of the four twin pairs found among the sibs of Klinefelter probands were definitely DZ, being of different sex. The increased twinning rate found among Turner probands (3.1%), although not statistically significant, might underline previous publications in which a high twinning rate was reported. The other findings mentioned above do not indicate an increased risk of chromosomal aberration in the progeny due to nondisjunction on one hand, and the tendency for twinning on the other.

APPARENTLY BALANCED, DE NOVO TRANSLOCATION WITH MINOR POSITIONAL EFFECTS AS EVIDENCE OF MONOZYGOSITY

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A 5-months-old white girl was cytogenetically studied because of minor dysmorphic features including megalocephaly, two nevus flemmeus, one café-au-lait spot, hypoplastic maxilla, and a pinched face. GTG-banded prometaphase chromosomes revealed an apparently balanced reciprocal translocation between chromosomes 4 and 8. No other structural abnormalities were seen. Subsequent analysis of parents revealed her father, who is a twin, to be a carrier of the same balanced translocation. Since he and his twin brother also had the same facial dysmorphism as the proband, the twin brother was also cytogenetically tested. He carried the same balanced translocation. Both parents of these twin brothers, ie, the paternal grandparents of the proband, were found to

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have normal chromosome complements, proving thereby that the translocation in the twin brothers was a de novo occurrence. At the same time, it also provided an indirect proof of monozygosity of the twins. Review of literature shows very few such cases where MZ twins have a de novo chromosomal rearrangement.

UNUSUAL VASCULAR MALFORMATION OF THE KIDNEY IN BOTH TWINS OF A MONOZYGOTIC PAIR

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Various types of family malformation of the kidney have been described in the literature, including several cases of double monolateral renal vessels, generally because of inferior polar branches. To our knowledge, only two cases of agenesis of both kidneys and ureters have been reported in twins, but no anomalies of renal vessels. A case of double bilateral renal vessels in both twins of an MZ pair is reported for the first time. Even in nontwins, the anomalies reported so far involved the inferior polar arteries in agreement with the embryological development. The two male twins, examined at the age of 14 yr, had simultaneously developed a marked hypertension at the age of 8 yr. Zygosity was determined by bloodgroup and HLA analyses and various clinical tests were carried out to diagnose the condition. It is suggested that the anomaly is the result of a genetically induced early block in embryonic development.

FOLLOW-UP IN A PAIR OF TWINS AFFECTED BY SITUS VISCERUM SPECULARIS CONDUCTED WITH HIGH-RESOLUTION ELECTROCARDIOGRAPHY

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A pair of MZ twins affected by situs viscerum specularis has been examined twice in the course of three years in order to verify the efficiency in the course of time of the cardiovascular system in the dextrocardiac and the normocardiac twins. High-resolution atriograms, previously found to be similar in identical twins, differ in these two twins. No substantial modifications have been found with respect to the previous observation.

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THE EPIDEMIOLOGY OF CONJOINED TWINNING IN SOUTHERN AFRICA: A REVIEW OF 32 CASES

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In the period, February 1974 to May 1985, 32 sets of conjoined twins were born in Southern Africa. There was a striking increase in incidence in 1974 and 1975. No ethnic or social predilection could be detected, but clustering of cases occurred in a remote area of Zimbabwe. No etiological agent was discovered and there was no seasonal variation in the time of conception. Female conjoined twins accounted for 62% of cases, and 20 sets were of the thoracopagus type. Four pairs were surgically separated, three of which were of the xiphopagus type and have survived. Frequent obstetric complications occurred, details of which will be discussed further.

INCIDENCE, EPIDEMIOLOGY AND ETIOPATHOLOGY OF CONJOINED TWINS IN HUNGARY

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Thirty-five conjoined twin pairs were registered in the Hungarian Congenital Malformation Registry in 1970-1985, corresponding to an incidence of conjoined twinning of 1:70,000 births. The types of conjoined twinning associated congenital anomalies (which occurred in approximately 70% of twins) were evaluated on the basis of autopsy. Epidemiology data were obtained by personal interview. The family history and events during pregnancy were analysed from an etiopathogenetic point of view. A separated ischiopagus who was operated in West Germany will be illustrated in detail.

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STATISTICAL MODELS FOR THE TWINNING RATE

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It is well known that the MZ twinning rate is rather constant but that the DZ twinning rate is strongly influenced by several factors, especially the maternal age and parity. These variations in the DZ twinning rate are discernible in the total twinning rate. Maternal age and parity are strongly correlated and therefore their effects are difficult to separate. This difficulty has caused disagreements in the literature concerning the magnitude of these effects. In order to simultaneously estimate these effects, multiple regression models are built. The quality of available data from different countries varies strongly but the models are tested on different data sets in order to obtain general conclusions. These more advanced statistical analyses confirm the results given by the authors in an earlier paper. Furthermore, it is stressed that aggregated data are rather worthless for studies of this kind.

MATERNAL AGE AND PARITY AS DETERMINANTS OF HUMAN TWINNING RATE: AN ANALYSIS OF DUTCH POPULATION DATA

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In Dutch population data covering the period, 1975-1984, maternal age and parity as determinants of human twinning rate were studied. By stepwise linear logistic regression analysis an attempt has been made to assess the relative importance of these factors. DZ and MZ twinning rates as estimated by Weinberg's differential rule have been analyzed separately. The collection of data from different periods and perhaps different populations is still in progress. At this stage it seems that most, but not all of the association between parity and DZ twinning rate can be explained by the strong correlation between parity and the factor that appears to be the main determinant of DZ twinning rate, maternal age.

DOES THE USE OF ORAL CONTRACEPTION DEPRESS DZ TWINNING?

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A fall in the DZ twinning rate has been reported from many countries in the past 20 years. In reviewing the data for Scotland, MacGillivray (1981) showed that the fall was established before oral contraception became readily available in 1964. He concluded that reduced age and

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reduced parity were the main factors responsible for the fall but considered the possibility that oral contraception was having an adverse effect on the pituitary. Hemon et al (1981) reported a study involving several hospitals in France where after delivery mothers of twins, matched by the mothers of the preceding singleton births, were asked about the use of oral contraception. Although they showed that use of oral contraception depressed DZ twinning, they were guarded in accepting a causal relationship without better documentation. Preliminary analyses of data from Aberdeen showed that there was significantly lower oral contraceptive use among multiparous women who gave birth to DZ twins compared to multiparous women who gave birth to singletons (Thomson et al 1984), but several possible confounding factors were uncontrolled. This study examines the relevant data for the total population of Aberdeen City District, 1969-1983 with appropriate random controls identified from the Aberdeen Maternity and Neonatal Data Bank. Zygosity for twins has been determined from blood and placental samples. The results will be presented.

DIFFERENTIAL INTRAUTERINE ENVIRONMENTAL CORRELATION IN MZ AND DZ TWINS

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The common assumption of environmental factors equally applicable to both MZ and DZ twins has been tested by analysing the secular trend of twin concordance in late fetal death. Official vital statistics on the outcomes of multiple births during the last decades have been collected for UK, USA and Sweden. While the late fetal death rate dropped very rapidly in both types of twins, in MZ twins the incidence of outcomes in which both are dead still exceeds the one expected under the assumption of comparable incidence of genetic factors. This observation revealed that MZ and DZ twins experience different environmental conditions during their intrauterine life. Under these circumstances, heritability estimates of late fetal losses would have shown secular instability, due to the difficulties in treating environmental factors acting differently in the two types of twins. A specific model has been set up in which different effects of the intrauterine environment of the two types of twins can be estimated within a hypothetical range of incidences for genetic factors. The results demonstrated that intrapair correlation for environmental factors during the intrauterine life is much higher in MZ than in DZ twins.

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INTRICATE RELATIONSHIPS AMONG TWINNING, PERINATAL MORTALITY AND INBREEDING

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Earlier studies on birth statistics collected on 3.4 million births from different parts of India had suggested that the MZ twinning rate had declined (from 3.3 to 2.8 per 1000) and the DZ rate increased considerably (from 7 to 12.8 per 1000). Recent family studies covering 4112 mothers aged 30-50 yr and their 15880 offsprings have indicated that increasing inbreeding also increases fecundability and twinning frequency. But twinning and survival decline as soon as inbreeding reaches F=0.03 or more. Obviously, inbreeding influences early termination of twin and singleton pregnancies by increasing the perinatal load. In addition to stillbirths, abortions and infant deaths, sporadic bleeding during pregnancy (SBDP) has been detected to be yet another important factor of perinatal load. In the general population of mothers, 215 out of 15,880 exhibited this phenomenon. SBDP could in fact be the cause of the "vanishing twin" condition reported in various countries.

THE MZ TWINNING RATE: HOW NEARLY CONSTANT?

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Weinberg's difference method, applied to twin birth statistics, usually shows a dependence of the MZ rate on maternal age, like a thin shadow of the DZ rate. Some of this MZ variation can be explained away by James' finding of more same-sex than opposite-sex DZ twins, the excess being mistakenly classified as MZ by Weinberg's assumption of equal numbers. By several methods, one can extract a constant value for the MZ rate and a constant or nearly constant value for the DZ SS/OS ratio, but these "constants" are not the same in different populations.

INCREASING TREND IN THE MZ TWINNING RATE

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The incidence of MZ twinning estimated with Weinberg's differential rule is essentially the same (around 3.5 per 1000) throughout the world and is hardly influenced by maternal age and parity. In contrast to DZ twinning rates, the MZ rates show tendencies to rise in many countries, particularly over the last 20 years. By comparing data of the time of onset and the quantity of oral contraceptives (OC), attempts are being made to test the hypothesis whether the

longitudinal changes in the incidence of MZ twinning can be related to the use of OC. It has been suggested that conceptions which take place shortly after cessation of OC, unintentional use of OC in early pregnancy or "breakthrough" pregnancies, may result in delayed implantation of the fertilized ovum so that early division occurs, resulting in two embryos (Emery 1986). Results from Norway, Denmark, UK, the Netherlands, Belgium and Switzerland are in accordance with this hypothesis. In the Netherlands, eg, an increase of 0.04 per 1000 per year in the MZ twinning rate was observed over the period 1960-1984. However, the Federal Republic of Germany shows a moderate increase (about 0.024 per 1000 per year) over the period 1961-1984, preceded by a markedly stranger increase (about 0.06 per 1000 per year) over the decade 1950-1959 (both trends highly significant). A secular study on the Aland Islands (Finland) over the period 1653-1949 also showed a highly significant, though slower increase of the MZ twinning rate (about 0.01 per 1000 per year).

A RECENT TREND OF MULTIPLE BIRTHS IN JAPAN

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Multiple birth rates in entire Japan were analyzed using vital statistics for 1951-1968 and 1974-1984, and the "Survey on Socioeconomic Aspects of Vital Events--Plural Births in 1975". Before 1968, data on multiple births are obtained as twin pairs, triplet sets, and quadruplet sets in Japan. However, after 1975, data on multiple births are obtained as twin, triplet, and quadruplet individuals because of computerization for certificate records since 1969. Then, the numbers of pairs or sets are obtained from those of individuals divided by two, three, or four. Twinning rates per 1000 births are 6.47 in 1951, and remain nearly constant up to 1968 when the rate is 6.17. However, the rate decreases down to 5.83 in 1974 and then gradually increases to become 6.54 in 1984. On the other hand, the triplet birth rate is nearly constant from 1951 to 1974, when the rate per million births is 58.3, to increase gradually up to 1980 (76.2) and then rapidly up to 1982 (103.8), to decrease thereafter. Similarly, the quadruplet rate is nearly constant from 1955 to 1968, when the rate is about 1 per million births, to rapidly increase thereafter until 1975-1977 (5.10) and then decrease. In conclusion, triplet and quadruplet birth rates increased up to 1982 and 1977, respectively, and then decreased.

TWINNING RATES IN TAIWAN

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Analysis of delivery records of public hospitals in Taiwan showed

a gradual decline of DZ twinning rates and a cyclic fluctuation of MZ twinning rates during the period 1947-1980. MZ rates were found higher in urban than in rural areas, while both MZ and DZ rates were lowest in areas where aborigines clustered. Screening of birth certificates in Taipei City from 1972 to 1977 indicated higher MZ than DZ rates (3.2 vs 1.3 per 1000) in the Chinese population. Both MZ and DZ rates, either crude or adjusted for birth order, increased with maternal age. Similarly, the higher the birth order, the higher the crude and maternal-age-adjusted MZ and DZ rates. While little monthly variation was observed for DZ rates, MZ rates peaked in May and leveled off from June to October in a year. International comparison indicated racial differences to be more striking for DZ than MZ rates by maternal age.

THE INCIDENCE OF TWINS IN THE PACIFIC REGION

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Although reliable twinning rates are available for the larger islands on the Asian and Australasian periphery of the Pacific, there is only scanty information on twinning from the smaller islands of Melanesia, Polynesia and Micronesia. Reported twinning rates throughout the Pacific region, some of them unusually high, are critically reviewed and discussed in the context of the mixed Mongoloid/Australoid origins of indigenous Pacific Islanders. When races with different twinning rates mix, studies in Hawaii and elsewhere have suggested that the resultant twinning rate is closer to the race with the lower rate. The evidence so far available from the South Pacific does not lend support to this belief.

TWINNING IN EGYPT

Nemat Hashem
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Preliminary survey places Egypt among the high twinning incidence populations. The difference in twinning rates among populations of different racial origin stands for a genetic component in the etiology of twinning. Variable environmental components should also be investigated, however.

HISTORICAL DEMOGRAPHY AND GENEALOGY OF TWO POPULATIONS WITH EXCESSIVE TWINNING

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The comparison of historical parameters in separate populations with excessive twinning may emphasize nonclinical factors in the incidence of twin maternities. As previously summarized, a Scottish island community and a rural American genealogy show twinning rates of 2%-5%. The paper further compares and contrasts the two historical samples by data source, sex composition, inbreeding/outbreeding, birth order, parental ages, and ethnohistory.

TWINNING IN NEW ENGLAND IN THE 17TH AND 18TH CENTURIES

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Baptism registers of Saybrook and Plymouth in New England in the 17th and 18th centuries were investigated. Among 8562 maternities there were 81 multiple births, the twinning rate being 0.95%. The twinning rate was lower in lower compared to higher birth orders. When mothers with 6 or more children were selected, twinning rates were still lower in the lower than in the higher birth orders. Those mothers who had 4 or 5 children showed the highest twinning rate. Those who had 7 or more children showed the lowest twinning rate in total, but an extremely higher one at their last births. Twin maternities seemed to be a strong risk factor to terminate reproduction, particularly after 6 or more children had been delivered.

INCIDENCE OF TWINNING IN LONDON, 1581-1760

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The twinning rate was investigated in baptism records of parishes in London and its vicinities from 1581 to 1760 (168,238 maternities). There were 1863 multiple births, with an estimated rate of 1.1%, 0.8% DZ and 0.3% MZ. The total and the DZ rates increased slightly over the 180 years, with fluctuations of about 30-year intervals. The MZ twinning rates also varied, with a significantly lower rate in the early 17th century (1621-1640). Significant seasonal variations were observed. DZ twins were born more frequently in spring and fall. This pattern is similar to that of low-twinning rate decades in Görlitz, East Germany. In 1621-1640 MZ or like-sexed twins were apparently less frequent in summer (April to October). This result could be explained by a decrease of MZ twins and/or a greater loss of the like-sexed among the DZ twins. Although MZ twins are generally believed to be less vulnerable by environmental factors as compared to DZ twins, the MZ twinning rate might also be influenced by some seasonal factors.

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TWIN RESEARCH IN CORONARY HEART DISEASE

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Traditional twin studies have resulted in higher concordance rates for premature coronary heart disease (CHD) in MZ than in DZ twin pairs. This is in agreement with strong evidence from several other studies, that genetic factors are of importance in the etiology of early onset CHD. Also, in a study of 291 Norwegian twin pairs the concordance rate for hypertension was 0.36 in MZ and 0.08 in DZ pairs. Relationships between diseases and traditional gene markers have been extensively studied and several associations have been uncovered for CHD. Our group has developed a method to examine a possible permissive or restrictive effect of single genes on the degree of variation that environmental and/or life style factors can cause in a given parameter. This method for studying gene-environment interaction is based on the fact that MZ twins are identical with respect to genes, so that any difference between the two members of an MZ pair must necessarily be caused by environmental or life style factors. The possibility that a given gene influences the degree of variability in a parameter such as cholesterol is examined by comparing the within-pair difference in cholesterol level between MZ pairs possessing, and MZ pairs lacking the gene in question, and results of such studies will be presented. New possibilities to study restriction fragment length polymorphisms (RFLPs) at apolipoprotein loci have added a new dimension to research on genetics of CHD and hyperlipidemias. Association between apolipoprotein B, cholesterol and fasting triglyceride levels on one hand and DNA variation at the apolipoprotein B locus on the other has been found. We have studied RFLPs at apolipoprotein loci in twin families. The results will be presented.

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GENETIC INFLUENCES ON BLOOD PRESSURE IN BLACKS: TWIN STUDIES

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Blood pressure (BP) is higher in blacks (B) than whites (W). In W, the major source of variation in BP appears to be due to heritable factors. We have used the power of the classic twin model to estimate the relative contribution of genetic and environmental factors to BP distribution in 29 sets of B twins (19 MZ).BP was measured by two trained and certified observers using the auscultatory method (Korotkoff Phases 1 and 5). Twin sets were seen on the same morning (fasting). BP was determined in triplicate after 10 minutes of recumbency and then again after sitting for 10 minutes. These six BPs were averaged for analysis. BP did not differ by twin type. The within-twin-pair difference in systolic BP was only 3.9 mm Hg in MZ twins, but was 12 mm Hg in DZ twins. The intraclass correlation was r=0.81 in MZ and r=0.28 in DZ twins. Calculated heritability was 75%. Analysis of variance (ANOVA) estimated h^2 at 83%. The within-twin-pair difference in diastolic BP was 4.3 mm Hg in MZ and 11 mm Hg in DZ twins. The r for diastolic BP was 0.88 in MZ and 0.54 in DZ twins and h^2 was 71%. ANOVA estimated h^2 at 83%. Hypertension (>149/90 mm Hg or on therapy) was diagnosed in 5 sets of MZ twins and in all pairs both were affected. Hypertension was diagnosed in 2 sets of DZ twins. In neither case were the twins concordant. Although these results are derived from a small sample size, it appears that about 80% of the population variance in blacks is due to genetic factors. Thus, as in whites, it appears that genetic factors play a major role in determining BP distribution in blacks.

CARDIOVASCULAR RESPONSES TO ISOMETRIC EXERCISE IN LARGE MUSCLE GROUPS

H. Verhaaren
Ghent, Belgium

Abstract not received.

CONGENITAL HEART DEFECTS IN MONOZYGOTIC TWINS

John Burn
Consultant Clinical Geneticist, University of New Castle Upon Tyne, UK

Abstract not received.

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THE GENETICS OF CARDIOVASCULAR REACTIVITY (CVR)

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To determine the genetic and environmental contributions to resting and stress levels of blood pressure (BP) and heart rate (HR), we studied the systolic BP (SBP), diastolic BP (DBP), and HR of 90 pairs of 11-yr old twins (40 MZ, 50 DZ) at rest, during handgrip (HG), bike exercise (B), and mental arithmetic (MA). The resting SBP, DBP and HR corrected for body size were highly correlated for MZ (r = 0.58*, 0.62*, 0.65*) while for DZ (r = 0.25, 0.34, 0.62*) much lower. The average SBP, DBP and HR during HG, B, MA were all correlated within and between twins (r = 0.58), DZ values did not correlate. Resting values were compared with the slope of the increase during stress (CVR). In MZ, but not DZ, correlations were found for DBP (r = 0.42) and HR (0.51). These data suggest a large genetic component to both resting and stress CVR. Analysis of the interclass correlations among the stress responses of individual twins suggest that different genes control the hemodynamic changes elicited by different stress modalities. Further studies are required to answer whether the genetic control of CVR in children is predictive of future hypertension.

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CONCORDANCE FOR CANCER MORTALITY IN THE NAS-NRC TWIN REGISTRY

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Mortality through 1984 has been ascertained and twin concordances for cancer have been determined in the NAS-NRC registry of about 16,000 pairs who are veterans of World War II. There is no clear evidence for an excess of concordance among MZ twins compared to DZ twins for cancers without clearly documented environmental etiology.

CONCORDANT CANCER TWIN PAIRS DISCORDANT FOR CANCER SITES IN THE POPULATION BASED DANISH TWIN SAMPLE

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In the Danish Twin Register all like-sexed twins born during the period, 1881-1920, have been identified. Based on hospital records, death certificates and a record linkage with the Danish Cancer Register, cases of malignant neoplasms in this twin cohort have been identified. Included as probands in this study are like-sexed twins with cancer of the breast, stomach, colon, rectum, uterus, and leukemia diagnosed 1920-1977, in all 1060 probands. Besides, a follow-up of all cotwins of probands with regards to cancer all sites has taken place. The observed number of cases in cotwins has been compared with the expected number according to age, sex, and calendar time specific incidence rates in the general population. By application of the analytical principles of the classical twin method, it is possible to elucidate common etiological factors for cancers of the same and/or different sites. The analyses indicate that none of the proband cancers seem to be causally related to one another or to other malignant neoplasms to any significant extent. Especially, this population-based twin study lend no support to the so-called cancer family syndrome.

REPRODUCTIVE HISTORY IN TWINS DISCORDANT FOR BREAST CANCER

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The Swedish twin cohort, comprising about 13,000 unselected female twin pairs, was matched against the cancer registry and 565 cases of breast cancer (BCA) were identified, of which 507 pairs were discordant for the disease. The diagnoses were verified by hospital records including the pathologist's report. All pairs born 1900 and later were included in the study, provided that at least one in a pair was alive

at the initiation. In 117 cases both twins were interviewed. Among the discordant pairs another 143 single interviews were performed. The interview covered in principle all known risk factors for BCA including those for reproductive history. Based on pairs where both twins were interviewed, the following results were obtained. For age at menarche, both twins agreed that the BCA twin got regular periods before the partner twice as often as the reverse (n.s.); the mean age difference was 0.53 yr (n.s.). In those where both had had a natural menopause, the BCA twin had a later menopausal age (mean diff., 1.39 yr, P=0.047). The BCA twin had a later age at first livebirth (mean diff., 1.89 yr, P=0.012) and significantly more often an abortion preceding the livebirth or as the only pregnancy (OR=7.0, P=0.002). No difference was found for total number of abortions. Unexpectedly the BCA twin had more often had an artificial menopause (OR=2.0, P=0.017). The interrelationship between these factors will be further explored. These data indicate that hormonal factors known to play a role in the development of breast cancer are not explained by genetic and early environmental factors, to the extent these are controlled for in twins.

ESTROGEN REPLACEMENT THERAPY IN POSTMENOPAUSAL TWINS DISCORDANT FOR BREAST CANCER

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Because the occurrence of breast cancer is linked to reproductive events which also partly determine use of estrogen replacement therapy, the role of exogenous estrogens taken for menopausal symptoms in the etiology of breast cancer has proved difficult to study. As of April 1986, 1549 twin pairs with breast cancer are among the roughly 6000 pairs with cancer that have identified themselves to the International Twin Study. Completed detailed questionnaires have been returned from the members of 900 of these, among which are 773 breast cancer discordant pairs, each with questionnaires returned from all living twins. These include 254 pairs in which both were postmenopausal at diagnosis. One or both twins in 121 pairs had used exogenous estrogen replacement therapy (mostly conjugated estrogens) prior to diagnosis. Of these 242 individuals, 63 had never used estrogens and 93 had used them for at least 5 years, and of the 137 users who could report the usual dose taken, 79 had taken high doses (over 1.25 mg of conjugated estrogens daily). The median interval between the last menstrual period of cotwins was 4 years, and for concordantly parous twins, the median interval between the dates of first full-term pregnancy was 3 years. In 50 pairs at least one twin had had prior oophorectomy; in 8 both had. Benign breast disease had previously been diagnosed in both members of 11 pairs and 13 other pairs were discordant for that disease. Breast cancer had occurred in other members of 34 of the 121 families and 63 of the 121 appear to be MZ twins. Information from these twin pairs will be used to assess the role of estrogen replacement therapy in the genetics of postmenopausal breast cancer.

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A FINNISH TWIN-FAMILY STUDY OF PERSONALITY DATA

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Personality data from a Finnish families-of-twins study have been analyzed for N=2200 members of 58 M-MZ, 55 M-DZ, 60 F-MZ, and 51 F-DZ twin kinships. The analyses focus on neuroticism (N) and extraversion (E) from the EPI and self-rated hostility (H); data were obtained from a 1981 survey of the 448 twin parents and a 1985 survey of their families. Scores from the N, E, and H scales were age-banded separately by sex and subjected to z-score transformations prior to the analyses. Parent-offspring and uncle/aunt-niece/nephew correlations and the intraclass correlations of sibs, half sibs and cousins were derived from multivariate estimates appropriate for unbalanced pedigrees. Following tests for homogeneity of the four types of parents, possible effects of maternal influences were evaluated by comparing the relative similarity of half siblings and first cousins nested in maternal and paternal twin kinships.

CONSISTENCY AND CHANGE IN ADULT PERSONALITY: A SIX-YEAR FOLLOW-UP OF THE FINNISH TWIN COHORT

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A longitudinal follow-up was made for the dimensions of extraversion and neuroticism from questionnaire data available on the Finnish Twin Cohort. Surveys in 1975 and 1981 included the short form of the EPI as standardized in the Swedish-Finnish twin registries. Data are available from more than 2800 pairs of twin brothers and about 3000 pairs of twin sisters who, at baseline, were aged 18-43 yr. Consistency and change in the two dimensions of personality were assessed in four cohorts of twin brothers and sisters accross age bands chosen to maximize sample size while comparing developmental periods from late adolescence to mid-adulthood. The longitudinal analysis yields estimates of the influence of genetic factors in mediating age-to-age stability of adult personality.

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A DEVELOPMENTAL-GENETIC ANALYSIS OF ADULT PERSONALITY: DATA FROM THE FINNISH TWIN COHORT

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To evaluate genetic influences on adult personality and the modulation of gene effects by age and gender, we performed a multiple linear regression analysis of data from the Finnish Twin Cohort. Included were scores from the extraversion (E) and neuroticism (N) scales of the EPI and a self-attribution of hostility shown (elsewhere) to be a risk factor in coronary heart disease. A double-entry matrix of the data was formed so that each twin's response was predicted from that of the cotwin and that pair's age, zygosity, gender, and frequency of their social contact. Data were available on more than 2800 pairs of twin brothers and about 3000 twin sisters who, at the time of testing, were aged 24-49 yr.

A GENETIC ANALYSIS OF PERSONALITY QUESTIONNAIRES IN DUTCH TWINS AND THEIR PARENTS

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As part of a large study on the genetics of cardiovascular disease, several questionnaires were administered to a group of adolescent twins and their parents. In general, these questionnaires are thought to be related to physiological measures, such as cardiovascular reactivity. The following questionnaires were studied: the Dutch version of Spielbergers Trait-State Anxiety Inventory and Trait-State Anger Scale; the Dutch version of the Jenkins Activity Survey (to measure type-A behavior); a Coping Style Questionnaire; the "Amsterdamse Biografische Vragenlijst", a Dutch personality questionnaire which measures neuroticism and extraversion-introversion.

PERSONALITY ASSESSMENT IN MZ AND DZ TWINS

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Cattell's 16 Personality Factor Questionnaire was administered to 33 MZ and 27 DZ unselected twin pairs aged 20-40 yr as part of a larger psychological study. The evaluation considered the following two points: (1) can any special personality traits be found in twins? and (2) is it possible to identify twin A and twin B simply on the basis of personality profiles? While it appeared that an answer to the first question would require a larger sample and more selective tests, a positive answer was surprisingly found to the second question, especially in the case of DZ twins.

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ASSORTATIVE MATING IN A FINNISH TWIN-FAMILY STUDY

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Marriages of twins yield informative data sets for analyses of nonrandom mating. Twins of each zygosity and gender yield four correlations representing twin pairs, twins with their spouses, twins with spouse of cotwin, and, lastly, between spouses of each twin pair. Expected values of these correlations can be expressed in terms of additive genetic and environmental variances, components of marital and twin correlations attributable to environmental influences specific to these relationships, and to the tendency of twins to assort concordantly. We present analyses of the 16 correlations derived from a sample of adult Finnish twins and their spouses who have completed standardized questionnaires assessing medical and behavioral variables. Included were 854 spousal members of 120 MZ and 107 DZ twin kinships. Complete data were obtained from 96 pairs of twin brothers and 77 pairs of twin sisters and their spouses; the spouse of one twin completed the questionnaire in 54 additional kinships. Following age-sex adjustment, indices of body size, drinking habits, and personality dimensions (scales E and N from the EPI) were analyzed.

THE HEREDITARY BASIS OF MATING PREFERENCE: AN INVESTIGATION CARRIED OUT ON MZ AND DZ TWINS

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The existence of a genetic basis in the choice of a sexual partner was examined by comparing the physiognomic preferences of 62 twin pairs (31 MZ, 31 DZ). The twins were questioned separately on their preference of 13 physiognomic traits. An analysis of their responses was undertaken to determine whether MZ twins were more concordant than DZ twins in their preferences. By discussing simple and crossed concordances, there was 68.6% concordance for MZ twins and 57.5% for DZ twins (significant at 0.01 level). This lends support to the hypothesis that the preference for some physiognomic traits has a hereditary basis.

GENETIC AND ENVIRONMENTAL CONTRIBUTIONS TO ANXIETY: A TWIN STUDY

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A study is in progress, examining whether the genetic contribution to anxiety neurosis is through an effect on certain subtypes, eg, panic disorder, or via an underlying "neurotic" susceptibility with the

different phenomena determined by environmental factors. The study involves a sample of 200 twin pairs, drawn from the Maudsley Twin Register, where at least one twin has received an "anxiety" diagnosis. We report on the aims, methodology and progress to date.

TWIN PAIRS DISCORDANT FOR AFFECTIVE AND ANXIETY DISORDER

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A study of 24 completely discordant MZ twin pairs where the index twin has an affective disorder and 15 completely discordant MZ pairs where the index twin has an anxiety disorder is presented. The discordance analysis displayed much of the same pattern for the two disorders. However, some differences appeared. The affective index twins were more often stronger attached to the cotwin, more sensitive and more restless. The index twin having an anxiety disorder, however, was more often lighter as a child, physically weaker, less quick-tempered, more obedient and more passive. It will be demonstrated that a clinical case study is more revealing than the simple discordant analysis when etiological factors are studied.

BIRTH COMPLICATIONS AND LATER PSYCHOSIS IN DISCORDANT TWINS

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A series of adult MZ and DZ twins discordant for schizophrenia and other psychoses is being appraised. The relevance of comparative birthweight, birth order and other indices of perinatal injury to the later development of psychotic illnesses is under investigation. Preliminary results suggest that these factors are predictive of illness in discordant pairs and possible mechanisms are discussed.

CEREBRAL VENTRICULAR ENLARGEMENT IN SCHIZOPHRENIC AND CONTROL TWINS

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We have undertaken a series of studies on the relationship between ventricular enlargement and schizophrenia, using a series of MZ twins discordant for schizophrenia. We suspect ventricular enlargement, where it is found to be implicated in the etiology of schizophrenia, and suspect that anoxic brain damage in the neonatal period is implicated in the process. Twins are more at risk for perinatal hazards than individuals of single birth. However, there is no evi-

dence sofar that twins are at increased risk for developing any psychotic disorders. However, as our studies progressed, it became evident that twins, whether schizophrenic or not, appeared to have larger cerebral ventricles than nontwins. We examined ventricular size in 25 unrelated schizophrenics of MZ twin birth; 25 schizophrenics of similar severity, age and length of illness, of nontwin birth; 18 unrelated MZ normal twins; and 30 normal nontwin controls, again age matched. Among the controls, the twins had significantly larger cerebral ventricles than the nontwins, even after excluding those who reported hazardous birth. Similarly among the schizophrenics; the twins had significantly larger ventricles than the nontwin schizoprenics and both groups of controls. The significance of this surprising finding is discussed.

AUTONOMOUS LANGUAGES OF TWINS

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Twins are regularly reported to invent languages of their own, unintelligible to others. These languages are known as autonomous languages, cryptophasia or idioglossia. Despite current belief, this is not a rare phenomenon. Autonomous languages exist in about 40% of all twins, but often disappear soon. In this study ten autonomous languages are compared: the circumstances in which they emerge, how these languages relate to the parents' language (the model language) and how they are structured. The prototypical situation is one in which two or more siblings (not necessarily twins) grow up closely together during the language acquisition period. If an adult model language is frequently absent, the children use each other as a model and acquire the model imperfectly. The language may stabilize at that level. If a model is completely absent, the children probably do not create a language. In all cases known, the language consists of onomatopoeic expressions, some invented words, but for the greatest part of words from the adult language adapted to the constrained phonological possibilities of young children. These words being hardly recognizable, the language may turn out to be completely unintelligible to speakers of the model language. Structurally these languages differ from the model languages, but they resemble each other in that they lack morphology and that word order is based on pragmatic principles such as saliency and the semantic scope of words. Neither the structure of the language nor its emergence can be explained by other than situational factors.

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A STUDY OF REFERENTIAL COMMUNICATION IN TWINS

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Twin children show highly efficient interactive capacities between each other. Therefore, using simple referential communication tasks, such as games involving different rules, objects, etc., a study has been conducted to clarify: (1) if the more developed communicative skills also refer to referential communication; (2) if the latter is specific to the twin pair or may be generalized to interaction with other children; (3) if there are differences between MZ and DZ twins. The following conditions have been considered: (A) twin child interacting with cotwin; (B) twin child interacting with singleton; (C) twin child interacting with twin child of another pair; and (D) singleton interacting with singleton. The results will be discussed.

DOMINANCE AND SUBMISSIVENESS BETWEEN TWINS

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In a follow-up study of 235 twin pairs, now aged 12-20 yr, the development of intertwin relationships was analyzed in relation to perinatal factors and mild neurological abnormalities found ten years ago. The parents and the twins were asked to evaluate the dominance-submissiveness aspect of intertwin relationship from three separate points of view, those of physical and psychic dominance and the role of spokesman. The most submissive members of the twin pairs were found to have suffered from some perinatal complications more often than the dominant ones. In thorough neurological examinations at the age of 2-10 yr, they had had mild abnormalities more often than their cotwins. Now, on the basis of the parents' reports, the more submissive members of the twin pairs suffered more often from psychosomatic symptoms, while the twins who themselves reported to be most submissive also scored highest in the Kovacs Depression Inventory. The contributing factors leading to submissiveness and the consequences in adolescence and adult life of always having resigned oneself to the leader's will are also discussed.

THE EFFECTS OF ZYGOSITY, SEX AND THEIR INTERACTION ON THE SELF-IMAGE OF CHINESE ADOLESCENT TWINS

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The purpose of this study is to examine whether the environmental or hereditary factor affects the mirroring or identity effects of twins. 176 pairs of twins (98 MZ, 55 M and 43 F, and 78 DZ, 36 M and 42 F) aged 13-15 yr and junior high-school students in Taipei city, were

studied. Through Osgood's Semantic Differential, the subjects rated themselves and their cotwins. No significant differences were found for zygosity, sex and their interaction for the four self-perception combination groups: the self vs projected of cotwin, the self vs cotwin's self, the self vs projected self by cotwin, and the projected self by cotwin vs projected of cotwin. However, there is statistical difference between the four groups, especially the lower scores of the self vs projected of cotwin group. That means the twins rated themselves as much close to what they rated their cotwins, more similar to the real self vs real cotwin. Thus, the subjects tended to project their own self image on to their twins independently of sex or zygosity.

APPROACH TO THE STUDY OF INTRAINDIVIDUAL RELATION IN MZ TWINS: PRELIMINARY RESULTS OF A RORSCHACH TEST

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MZ twinning represents a natural experimental situation for the deep study of the identity problem. A Rorschach test analysis has been performed in individual members of MZ pairs, following which both members were invited to agree on a common interpretation of each test table. The results will be discussed.

A COMPLEX ETIOLOGICAL STUDY ON TALENT IN TWINS

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Purpose: to elaborate methods for the detection of genetic ability early in life and to develop optimally the recognized ability of the twins. Approach: family study (index of patients and first degree relatives) of twins by demographic, sociological, psychometric, personality, educational methods. Sample: MZ and DZ pairs aged 3 yr (before kindergarten), 6 yr (before primary school), and 11 yr (after the first four grades), taken at random from the Budapest Twin Register.

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MATERNAL CARDIOVASCULAR ADAPTATIONS TO TWIN PREGNANCY

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The effect of multiple gestation on left ventricular size and function was assessed longitudinally in 16 twin gestations in the second and third trimester using M-Mode echocardiography. M-Mode echocardiography was performed in left lateral recumbency to measure left and diastolic dimension (LVEDD), left ventricular and systolic dimension (LVESD), fractional shortening (%ΔD) and Cardiac Index (CI). These measurements were compared to 17 singleton pregnancies (X ± SD).

SECOND TRIMESTER	HR (min^{-1})	MAP (torr)	EDD (cm)	%ΔD	STROKE VOLUME (ml)	CARDIAC INDEX ($L \cdot min^{-1} \cdot m^{-2}$)
T(n=N)	86±11	81±10	4.9±0.3	45±4	84±15	4.6±0.6
S(N=16)	75±10	77±8	4.9±0.3	37±4	76±13	3.7±0.7
p	<0.05	NS	NS	<0.001	NS	<0.025

THIRD TRIMESTER	HR (min^{-1})	MAP (torr)	EDD (cm)	%ΔD	STROKE VOLUME (ml)	CARDIAC INDEX ($L \cdot min^{-1} \cdot m^{-2}$)
T(n=14)	81±10	78±4	5.0±0.4	46±4	93±16	4.9±0.7
S(N=17)	74±9	75±6	4.9±0.3	34±5	71±12	3.3±0.6
p	<0.025	NS	NS	<0.001	<0.001	<0.001

Conclusions: (1) Heart size in multiple pregnancies is not different than in singleton pregnancies; (2) Cardiac Index is higher in multiple pregnancies both in the second and third trimester because of a significant increase in heart rate and stroke volume; (3) Increased maternal heart rate and contractility suggest that cardiovascular reserve is reduced during multiple gestations.

INCIDENCE OF HYPERTENSION IN MULTIPLE PREGNANCIES

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The incidence and degree of hypertension have been compared in two samples of pregnant women, one of multiple and one of single gestations. The results will be presented.

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MULTIPLE PREGNANCY AND THE USE OF REGIONAL ANALGESIA FOR LABOUR AND DELIVERY

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We report on the findings from 133 (29.10%) multiple pregnancy patients who were given regional analgesia for labour and delivery out of a total of 458 such patients delivered during the 12 yr period, 1972-1984. The number given caudal analgesia was 106 (79.69%) vs 27 (20.30%) who were given lumbar epidural analgesia.
Booked patients numbered 127 (95.49%) vs 6 (4.51%) who were unbooked and 121 (90.98%) were diagnosed as having a multiple pregnancy, whilst 12 (9.02%) were undiagnosed until labour and/or delivery. The age group categories are described and it is shown that 37 (27.82%) were on their first pregnancy and this is the largest single group. The number of patients of less than 37 weeks gestation was 26 (19.54%) vs 107 (80.45%) of more than 37 weeks gestation. Spontaneous labour occurred in 25 (18.80%) of the mothers in this series. Both of these features will undoubtedly have contributed to the lower perinatal mortality figures in patients given regional analgesia. The number of patients in whom labour was induced numbered 59 (44.36%), and a further 49 (36.84%) patients had labour accelerated. The methods of induction/acceleration are described. Only 6 (4.51%) of the 133 patients had a labour lasting longer than 12 hr and 127 (95.49%) attained vaginal deliveries, and 6 (4.51%) had emergency L.S.C.S. The delivery methods are described and include the breach and forceps breakdown. The Apgar scores and the time difference between births are presented as are the birth weights and the birth weight difference between twin pairs. The perinatal mortality rate was 41/1000.

CERVICAL ASSESSMENT IN THE MANAGEMENT OF TWIN PREGNANCY: A CONTROLLED TRIAL

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Preterm delivery is the major cause of the high perinatal mortality rate associated with twin pregnancy. Regular antepartum cervical assessment has been performed in 172 patients with twin pregnancies, certain gestational age and spontaneous labour, to calculate the "Durban cervical score": length minus dilatation. A cervical score of less than -2 before 34 weeks predicted spontaneous preterm delivery with a sensitivity of 42%,specificity of 84%, and predictive value of 71%. Having identified a group of twin pregnancies at especially high risk of preterm delivery, there remains the question of whether delivery can be postponed and fetal survival improved. Adequately controlled studies have failed to demonstrate improved outcome when bedrest is applied as a routine in all twin pregnancies, and we have therefore mounted a prospective randomised controlled trial to assess the value in this subgroup at especially high risk. The outcome of the first 79 pregnancies in the trial will be described.

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HORMONE REFERENCE INTERVALS IN UNCOMPLICATED TWIN PREGNANCY

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Reference intervals for human placental lactogen and dU-estrogens in uncomplicated twin pregnancy are presented. The reference intervals are found at a higher level that for singleton pregnancies, and the reference limits are more extended. Significantly more monoplacental than diplacental pregnancies, and significantly more MZ than DZ pregnancies showed hPL values below the median on the normal range curve. The same was not found for dU-E. Significantly more growth-retarded fetuses were found in monoplacental than diplacental pregnancies. The benefit of measuring the two parameters in order to identify the intrauterine growth-retarded twin fetus was evaluated in terms of sensitivity and specificity. Both parameters were not found very suitable for the purpose.

MATERNAL RECOGNITION OF PLURAL PREGNANCY

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In a survey of 336 mothers of recently born multiples, 71% reported suspicions of plural pregnancy prior to medical confirmation. Results suggest maternal reports of symptoms may be utilized to significantly increase the early diagnosis of the presence of multiples.

ANTENATAL CYTOGENETIC ANALYSIS OF TWINS

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A total of 10 twin pregnancies were referred to cytogenetic analysis on amniocytes out of 1765 consecutive referrals. Six of these were indicated because of advanced maternal age, 2 because of a family history of chromosomal disorders, 1 because of polyhydramnios, and 1 because of discordant growth between twins. Seven of these proved to be same-sexed twins, 3 female and 4 male pairs. Only 2 of the 10 pairs were discordant for karyotypic abnormalities. One, a same-sex pair, had a de novo abnormality of an isochromosome 13q replacing a normal chromosome 13, ie, essentially a trisomy 13 in one twin. The other discordant pair had a balanced familial Robertsonian translocation between chromosomes 13 and 14 in one twin. Eight pairs were karyotypically normal. No polymorphic differences were noted. These incidences are discussed in comparison to other studies.

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CLASSIFICATION OF TWIN PREGNANCIES BY ULTRASOUND

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Perinatal events in twins differ according to sex, zygosity and placentation. Unfortunately, this information cannot be obtained before delivery. Therefore, a selective method has been worked out by ultrasounds and seven groups of twins have been identified: I, monoamniotic twins; II-1, diamniotic males with fused placentas; II-2, diamniotic males with separate placentas; III-1, diamniotic females with fused placentas; III-2, diamniotic females with separate placentas; IV-1, unlike-sex fetuses with fused placentas; IV-2, unlike-sex fetuses with separate placentas. The method is presented, its effectiveness rated, and its clinical utilization discussed.

ANTEPARTUM DIAGNOSIS OF MONOAMNIOTIC PREGNANCY

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A case of monoamniotic twin pregnancy complicated by preeclampsia is presented. Early diagnosis was achieved at the 16th gestational age by ultrasonography. The pregnancy was terminated at term by a cesarean section. Both twins survived with excellent outcome. It is therefore recommended that routine ultrasound examination of twin pregnancies, preferably prior to 24th week of gestation, should include an effort to demonstrate two amniotic sacs. Early diagnosis of monoamniotic twins should lead to efforts for a closer surveillance of each of the fetuses separately. This would enable early detection of fetal distress associated with conditions such as fetal transfusion syndrome. A cesarean section should be liberally considered in order to avoid intrapartum umbilical cord complications, which can be fatal during vaginal delivery.

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GENETIC AND ENVIRONMENTAL CONTRIBUTIONS TO VARIATION IN BIOTINIDASE ACTIVITY

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Biotinidase, the enzyme responsible for the recycling of the vitamin, biotin, is deficient in individuals with late-onset, multiple carboxylase deficiency. To determine the relative contributions of genetic and environmental factors to normal variation in biotinidase activity, we measured enzyme activity in 106 twin pairs (78 MZ and 28 DZ), who ranged in age from 2 to 66 years. Mean biotinidase activity was significantly higher in males (6.84±1.58 nmol p-aminobenzoate formed/min/ml serum) than in females (5.89±1.55, $P<0.001$). Alternative genetic and environmental models to account for the observed within and among pair variances were tested by the method of iterative least squares. Initially, models were fitted to male and female data separately. For both sexes environmental models (E1 and E1E2) were strongly rejected in favor of the model including individual environmental and additive genetic variance components (E1,VA). A chi-square test for heterogeneity of the variance components between the sexes was nonsignificant, indicating the same parameter estimates were appropriate for both males and females. Subsequent model fitting combining data from twins of both sexes as well as opposite-sexed DZ twins, again strongly favored the E1VA model ($\chi^2=8.11$; 8df; $P=0.42$). Overall, individual environmental variance (E1) accounted for 17.5% of the total variance, of which 21.1% (or 3.1% of the total variance) could be attributed to analytical error. Additive genetic variation accounted for the remaining 82.5% (±3.4%) of the total variance. These results indicate that genetic differences are an important cause of variation in biotinidase activity in the sera of normal subjects. The extent to which the observed heritable variation can be explained by individuals who may be heterozygous for a deficiency allele, remains to be determined.

TWIN STUDIES ON HUMAN URINARY PEPSINOGEN

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Human pepsinogen consists of two biochemically different groups of isozymogens, PGA and PGC, the precursors of pepsin A (EC 3.4.23.1) and pepsin C (EC 3.4.23.3). PGA and PGC are identical to the immunologically defined PG I and PG II. Electrophoretic patterns of PGA show considerable interindividual variation in number and relative intensities of bands. Genetic studies, performed in urine, have produced a number of, sometimes conflicting, genetic models. PGA phenotypes with strong intensity of the Pg5 isozymogen seem associated with stomach cancer and its precursors. However, different control groups, eg, healthy volunteers vs general hospital populations, show different distributions of phenotypes indicating that other (nongenetic) factors may be involved in the expression of (some of the) isozymogens. We collected urine and blood samples from MZ and DZ twins

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and their parents. Zygosity determination was done by questionnaire and determination of blood groups and serum factors. Pepsinogen levels in the blood were studied with a recently developed ELISA system. Urinary samples were studied with polyacrylamide electrophoresis. After analysis of urine from 42 MZ twins, 40 pairs showed completely identical patterns. Slight variation was observed in the relative intensity of one of the isozymogens (Pg5) in two pairs. The results of these extended studies will be presented.

A STUDY OF LACTOSE ABSORPTION CAPACITY IN TWINS

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In a previous study, high primary adult lactose malabsorption rate (36%) was found in the Hungarian population. Lactose absorption capacity was determined by lactose tolerance tests with hydrogen determination in 102 healthy, adult, Hungarian pairs of twins, in order to test monogenic Mendelian inheritance of the absorptive lactase phenotypes, lactose absorber and lactose malabsorber. Of the total, 52 pairs were MZ and 50 DZ of the same sex. All MZ twins were concordant with respect to lactase phenotypes. Among DZ twins, the distribution of lactase phenotypes was in agreement with Hardy-Weinberg expectations derived from the frequencies of the hypolactasia gene in twins and in the general Budapest population.

THE INTRAPAIR SIMILARITY OF IMMUNOGLOBULIN LEVELS IN TWINS

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In a ten-year follow up study, levels of immunoglobulins IgG, IgA, IgM and IgE were estimated in 8 MZ and 14 DZ twin pairs at the age of 6-11 yr, 12-17 yr, and 15-20 yr. The intrapair similarity of immunoglobulin levels was found to be higher in MZ than DZ pairs, especially in the case of IgA. Therefore, a more detailed IgA specific antibody determination was performed in the third phase of the study. The results indicate that the levels of immunoglobulins are genetically controlled.

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GENOTYPIC AND PHENOTYPIC SIMILARITIES IN PULMONARY FUNCTION AMONG FAMILY MEMBERS OF MZ AND DZ TWINS

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Population studies have demonstrated that obstructive airway disease aggregates within families. To gain a better understanding of the underlying genetics of pulmonary function (PF), we compared the correlations in PF level among eight groups of relatives sharing varying degrees of genetic relatedness. Totally, 1449 members from 414 families of adult twins (256 MZ, 158 DZ) enrolled in the Greater Boston Twin Registry were studied. Levels of PF were adjusted for age, sex, height, and smoking, and expressed as z scores for sex-specific age categories. Significant interclass correlations of z scores for FEV_1 and FVC were observed for all relatives predicted to share $\geq$25% of their genes. There was a direct relationship between shared genotype and magnitude of the estimated familial correlations for pulmonary function. For example, for FEV_1, the correlations were: 0.65 for MZ twins (100% shared genotype); 0.26-0.33 for DZ adult twins and MZ and DZ child sibships (50% shared); 0.22 for half-sibs (25% shared); 0.08 for cousins (12.5% shared); and -0.13 for spouse pairs (0 shared assuming consanguinity). Furthermore, a significant relationship between a child's PF level and that of his MZ twin parent's PF was observed ($P<0.05$); this was almost identical to the relationship with his MZ aunt/uncle's PF level. These data suggest that phenotypic similarities in PF directly relate to genetic relatedness, and are consistent with a multifactorial mode of inheritance. Influences of environmental determinants on PF will be discussed.

GENETIC AND ENVIRONMENTAL VARIATION IN MENSTRUAL CYCLE HISTORIES: A TWIN STUDY

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Questionnaire data were collected by post from over 400 female twin pairs. The twins were either members of the Institute of Psychiatry volunteer register or of the Birmingham population based register. These two samples were compared. A number of menstrual cycle related variables, such as premenstrual tension, length of menstrual cycles, number of days bleeding and age at menarche were investigated with univariate and multivariate methods. The relationship between these variables and personality, mood and sociodemographic characteristics was examined. Maximum likelihood estimation was used to fit simple models of genetic and environmental variation to these data. Preliminary findings and implications for further research will be discussed.

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PSYCHOSEXUAL STUDY ON TWINS

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The purpose of the study was to determine the occurrence of psychosexual problems in twins and to use the twin model for the evaluation of heritability in ejaculation precox and frigidity (anorgasm). The beginning (menarche) and main steps of sexual life were also clarified in the study sample (210 like-sexed twin pairs: 113 MZ, mean age 29, and 97 DZ, mean age 27 -- 147 female and 63 male pairs)through an anonymous questionnaire filled in within a group consultation in our Institute. The heritability of ejaculation precox was found to be 0.41 and that of female anorgasm to be minimal.

ANTHROPOMETRIC CHARACTERISTICS OF REARED APART TWINS: FIFTY YEARS OF RESEARCH (1937-1986)

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This year marks the fiftieth anniversary of major research on reared apart twins. Four major studies, conducted in three different countries by six principal investigators, have provided us with a valuable wealth of physical and behavioral data. The most recent ongoing study, the Minnesota Study of Twins Reared Apart, will present analyses of anthropometric characteristics for 49 MZA twin pairs and 20 DZA pairs, and compare these findings with results from the three previous studies (Newman et al 1937, Shields 1962, Juel-Nielsen 1966). Some measures available for participants in the Minnesota study but not obtained by the earlier investigators (eg, ponderal index, brainwave spectra), will also be examined. These data will be additionally appraised in light of anthropometric findings on MZ and DZ twins reared together.

GENETIC VARIANCE ESTIMATES AND FAMILIAL RESEMBLANCE FOR BODY SIZE TRAITS IN A PUNJABI POPULATION

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In order to study the genetic contribution to complex body size traits, the intrafamilial correlation and regression analyses in an extended twin approach have been used. The data are based on a sample of 45 MZ and 101 DZ twin pairs, their 125 singleton siblings, 104 fathers and 103 mothers in 146 Punjabi families living in Chandigarh, India. There is no evidence of inequality of means and variances between twin zygosities. Within-pair genetic variance ratios, correlations and regressions of offspring on midparent and single parent are all significant at 0.1%, thus indicating strong genetic component. Heritability estimates are higher for longitudinal body traits than

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the breadth dimensions. The resemblance of the children with the parents of either sex is not equal. Higher maternal influence is indicated for a number of body traits. The results on familial correlations do not support the hypothesis of sex-linked inheritance for any of the traits considered in this investigation. These results have been compared with those from other such studies.

SELECTION OF BETTER LIMB AND TRUNK SKINFOLD COMBINATIONS FOR BODY COMPOSITION ANALYSIS BASED ON TWIN STUDIES

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Various combinations of limb and trunk skinfold measurements have been reported to estimate total body fat from anthropometric data. The formulation of these combinations is usually based on regression analyses with densitometric estimation of total body fat. However, a more rigid selection of these combinations should be based on relative extent of their genetic determination. We tested eight simple combinations of eleven limb and trunk skinfolds without regression coefficients for their genetic determination. The skinfold measurements included in the study were biceps (Bi), triceps (Tri), midaxillary (Mdax), subscapular (Ss), juxtanipple (Jn) (only males), suprailiac (Si), forearm (Fa), calf (Cs), subcostal (Sc), abdominal frontal (Abfr) and abdominal navel (Abnv). Sixty-five pairs of same-sexed twins (10 MZ and 28 DZ male, and 12 MZ and 15 DZ female pairs) were studied. A model of differential indices of genetic determination from twin studies was applied. The results indicate a high genetic determination for five combinations for males: (1) Tri+Mdax+Ss+Jn, (2) Bi+Tri+Mdax+Ss, (3) Log(Bi+Tri+Ss+Si), (4) Bi+Tri+Fa+Cs, (5) Tri+Cs. For females, only two combinations showed moderately high genetic determination: (1) Mdax+Ss+Abfr+Abnv, (2) Sc+Abfr+Abnv. In females, calf skinfold alone was the best indicator.

TESTING FOR THE PRESENCE OF GENETIC VARIANCE IN FACTORS OF FACE MEASUREMENTS OF BELGIAN TWINS

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Factor analysis with VARIMAX rotation was used to analyze 15 face measurements in Belgian same-sexed twins, aged 18-25 yr: 39 DZ and 57 MZ male and 42 DZ and 67 MZ female pairs. According to Christian's model, we used the ratio of the within-mean squares of DZ and MZ pairs to test for the presence of a genetic component in the variance of the facial dimensions as well as in the VARIMAX rotated factors. The F values of most of the facial dimensions and of all the rotated factors were statistically significant (0.05 level), suggesting a genetic component in the variance. The probabilities of the F values

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were generally lower in males than females. The factor analysis yielded five main factors of which three were well separated: face height, ear size and lips. The two others were breadth factors, but were less clearly defined, probably due to a bad selection of variables. A comparison of the F values of the factors with those of their contributing variables seemed to indicate that well-defined factors may better describe genetically determined structures than the original variables can.

DENTOFACIAL MORPHOLOGY IN SOUTH AUSTRALIAN TWINS

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A study of the dentofacial characteristics of South Australian twins has commenced, one objective being the development of methods to quantify and analyse morphological asymmetry using both two- and three-dimensional data. Records collected include dental models, finger and palm prints, stereophotographs of the face, extra- and intraoral colour photographs, blood samples, as well as information relating to laterality and perinatal events. Using the technique of stereophotogrammetry we have generated contour maps of the faces of twins and produced computer images from coordinate sets which can then be displayed and manipulated. The methods for shape comparison described by Sneath and Siegel have been applied to match homologous coordinates from the faces of MZ and DZ twin pairs. This approach has enabled facial asymmetry within individual twins to be quantified without the need to define a mid-facial axis, and it has also allowed the phenomenon of mirror-imaging to be assessed mathematically. Bocklage has provocatively stated that "MZ twins, DZ twins, and singletons are not the same kind of people when the question is about the way their heads are built." We believe this study will provide the data needed to test this hypothesis.

GENETIC VARIANCE AND HERITABILITY OF DENTAL ARCH DIMENSIONS IN CHINESE ADOLESCENT TWINS

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In order to estimate genetic variance and heritability of dental arch width and arch depth, a total of 167 (57 male and 54 female MZ, 23 male and 33 female DZ) twin pairs, collected from 12 junior high schools in Taipei, were studied. Statistically significant genetic variance was observed for maxillary molar width (MxMW), maxillary canine depth (MxCD) and maxillary molar depth (MxMD). After adjustment for age and sex factors, genetic variance of adjusted MxMW, McCD and MxMD was still significant, while significance was also found for the mandibular molar

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depth (MdMD). Heritability estimates of unadjusted MxMW, MxCD and MxMD were 0.60, 0.70 and 0.48, respectively. After adjustment for age and sex, the heritability estimates of MxMW, MxCD, MxMD and MdMD were 0.61, 0.93, 0.53 and 0.18, respectively.

INCIDENCE OF DOUBLE OCCIPITAL HAIR WHORLS IN TWINS AND SINGLETONS

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This study is based on observations on a sample of 122 twin pairs and 166 singletons for incidence of double occipital hair whorls. The data were drawn from an urban Punjabi population of Chandigarh. The observed frequency of double occipital hair whorls was much higher in twins than in singletons, and these differences were statistically significant (P<0.01). Such an association between twins and double occipital hair whorls attains great significance genetically in view of the finding of Torgersen (1951) of an integration between genes influencing twinning and head shape.

DERMATOGLYPHIC CHARACTERISTICS IN JAPANESE TWINS

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Various dermatoglyphic traits were studied in Japanese twins, which are filed at the Twin Register (Tokyo 12-year-old Twin Register) at the Institute of Brain Research, University of Tokyo. Subjects examined are the homolateral comparison of finger pattern types, the number of whorls, the total finger ridge counts, the metacarpo-phalangeal crease, the seam figure in the hallucal area, the absence of palmar digital triradius d, the minutia count on the palm and in the calcar area, and the frequency of forks in minutiae on the palm and in some volar areas. The concordance ratio and the intraclass correlation coefficient were obtained to compare the MZ and DZ twin groups. The results revealed that the appearance of these characteristics is to a considerable extent determined genetically. The author is now attempting to introduce an experimental model to the dermatoglyphics using inbred strains of the rat, in which individuals are genetically identical each other as MZ twins but essentially different from twins in the construction of alleles.

SMOKING AND DRINKING DISCORDANCE AND HEALTH CONDITIONS: JAPANESE MZ TWINS REARED APART AND TOGETHER

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A total of 536 like-sexed pairs of adult twins were drawn from the twin registry of Kinki University School of Medicine consisting of 1237 pairs born before 1935. Subjects were mostly in their 50s or 60s. Smoking, drinking, and health conditions were studied. Concordance rates of smoking and drinking were slightly related with the age of separation.

ARTERIOSCLEROSIS OF CAROTID ARTERIES IN MZ TWINS DISCORDANT FOR SMOKING HABITS

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Duplex-doppler-sonography is a newish, noninvasive, ultrasonic method for examining blood vessels. It includes both a high-resolution real time image of the artery and a pulsed doppler with sprectrum analysis. Several papers have proved it to be an accurate method for evaluating the arteriosclerotic process of extracranial carotid arteries. Smoking is generally considered to be a factor promoting arteriosclerosis. We have made duplex-sonographic examinations of carotid arteries in identical twins discordant in smoking habits. Measurements have also been made of common femoral and popliteal arteries. At the time of this submission, 60 persons (30 pairs) have been examined: 5 pairs were female, 25 pairs male. The ages of the twins ranged between 38 and 77 years. A difference in the grade of arteriosclerosis was seen in 27 pairs, in every case to the benefit of nonsmokers. The most striking difference was a diffuse thickening of the intima of arteries in smokers. The number of plaques and stenoses was greater in smokers. Three smokers were found to have an obstructive lesion in lower extremity arteries.

PSYCHOSOCIAL FACTORS PRIOR TO DIAGNOSIS OF ALCOHOL ABUSE AMONG MALE TWIN PAIRS

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Male twin pairs of the Finnish Twin Cohort Study were linked to the hospital discharge register from years 1975-1983 to find twins discordant for alcohol abuse (diagnosis of alcoholism, alcohol intoxica-

tion, alcohol psychosis, hepatic cirrhosis, and pancreatitis). A total of 118 DZ and 28 MZ pairs were found. The psychosocial and socioeconomic variables were analyzed to characterize the groups by zygosity. The psychosocial variables used were extraversion, neuroticism, A-type behavior, daily stress index, and life satisfaction. The employment history, quality of sleep, use of medicines (pain relievers, sleeping pills, tranquilizers, and antacids), and smoking and drinking habits of the probands were also included in the analysis. All independent variables were obtained by a mailed questionnaire in 1975, ie, before the first diagnosis of alcohol abuse.

A COTWIN CONTROL STUDY OF ALCOHOL RELATED BRAIN DAMAGE

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It is well known that chronic high levels of alcohol consumption can lead to brain damage in some cases. However, recently it has been suggested that low levels of alcohol use (so-called "social drinking") may also result in measurable cognitive impairment. The present study utilizes the cotwin control method in an attempt to answer this question. At the same time, the study allows examination of the genetic and environmental determinants of cognitive functioning in a large group of adult twins. The neuropsychological test battery employed in the present study is very extensive and a detailed analysis of human cognitive abilities will be discussed.

PERIPHERAL AUTONOMIC NERVOUS SYSTEM FUNCTION IN MZ TWINS DISCORDANT FOR EXPOSURE TO NEUROTOXIC SOLVENTS

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In a previous study we have demonstrated slight abnormalities in autonomic nervous system (ANS) function in symptomatic patients occupationally exposed to organic solvents. In this study we measured cardiovascular responses to changes in intrathoracic pressure induced by normal and deep breathing, Valsalva manoeuvre and postural change, among 38 MZ twins. The twin pairs were discordant for occupational exposure to organic solvents. Estimation of exposure was based on duration of exposure, long-term average level of exposure, and exposure index expressed as a number of hygienic standard years. All of the subjects were healthy, asymptomatic, and the general level of exposure was not very high. The results were compared with those of nonexposed referent twins (32 MZ twins). The measurements were performed using a HP 9000/200 technical computer. No significant statistical differences were observed between the discordant twin pairs.

The results suggest that at these exposure levels no abnormalities occur in ANS function in genetically homogeneous subjects.

CEREBRAL MAGNETIC RESONANCE (MR) IMAGING IN OCCUPATIONAL SOLVENT EXPOSURE: A DISCORDANT TWIN STUDY

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Cerebral MR imaging was performed in 14 pairs of MZ twins discordant for long-term low-level occupational exposure to a mixture of solvents. The results were compared with those of nonexposed referent twins (16 pairs). Estimation of exposure was based on duration of exposure, long-term average level of exposure and exposure index expressed as a number of hygienic standard years (theoretical duration of exposure had the level been constant at 100% of the hygienic standards). All of the subjects were healthy workers and the general level of exposure was not very high. The prototype MR imaging device (Instrumentarium Corp., Helsinki) used in this study operates with a main field of 0.17T (corresponding to 7.13MHz) produced by a superconducting magnet. The imaging method was two-dimensional Fourier transformation. Morphological assessments were made from selected sections by a neuroradiologist unaware of the exposure data. No major abnormalities were observed. According to a detailed analysis of various morphological parameters from the MR images, no significant differences attributable to solvent effects could be demonstrated. These preliminary observations from the material so far examined suggest that occupational solvent exposure among these subjects has not caused morphological changes in the brains.

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TWINS, FEARS, AND PHOBIAS

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In psychiatric genetics, it is not well understood whether pathological conditions represent a deviant disease process or extremes of normal variation. Many times; this distinction is unimportant, but in other cases, like the identification of high-risk individuals by scores on a quantitative variable, the distinction is crucial. The study of fears and phobias in twins presents an apt model for relating quantitative variates (fears) to liability to a pathological condition (phobias). Empirical twin and family data are presented and methods for studying the association between quantitative and qualitative variables are discussed.

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OFFSPRING OF TWIN PAIRS DISCORDANT FOR PSYCHIATRIC ILLNESS

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A refinement of the twin method is the investigation of the risk of similar affection in the offspring of affected and nonaffected MZ and DZ twin partners. In the Danish twin studies on schizophrenia and on manic-depressive disorder, the morbid risks were of the same size in the children of affected and nonaffected MZ twins, and of affected DZ twins, whereas the children of the normal DZ twins showed considerably lower risks. Although the total numbers of affected offspring are small, the findings are in favour of a predominant genetic factor in schizophrenic and manic-depressive disorder.

THE INTERACTION OF ENVIRONMENTAL AND GENETIC FACTORS IN SCHIZOPHRENIA

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Abstract not received.

A GENETIC MULTIVARIATE ANALYSIS OF SELF-REPORT SYMPTOMS OF ANXIETY AND DEPRESSION IN TWINS

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Traditional multivariate methods describe the pattern of psychiatric symptoms seen in a population, but do not provide insight into the causes of symptom covariation. We here apply multivariate genetic analysis to resolve the pattern of symptom covariation that is due to genetic vs environmental factors. Examining self-report symptoms of anxiety and depression in a large volunteer twin sample, traditional factor analysis reveals separate depression and anxiety factors. Multivariate genetic analysis indicates that genes largely contribute nonspecifically to overall levels of psychiatric distress. By contrast, the nonfamilial environment has discrete depressogenic vs anxiogenic effects. These results replicate across sexes and suggest that separable anxiety and depression symptom clusters in the general population result largely from the impact of the environment.

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TWIN STUDIES IN PHARMACOGENETICS

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Twin studies in pharmacokinetics of more than a dozen drugs have been performed in different laboratories. All results showed that among normal subjects under carefully controlled near basal environmental conditions, genetic factors primarily control large interindividual variations. The magnitude of these variations in rates of drug elimination extend from 4-fold to 12-fold. Since most of these drugs are biotransformed by multiple metabolic pathways, each catalyzed by a genetically distinct enzyme, the fundamental principle of studying as closely as possible primary gene products would best be served by measuring in twins rates of formation of each main metabolite, rather than just disappearance of parent drug. Therefore, twin studies were performed on the main metabolites of antipyrine and theophylline. The results suggested that genetic factors control large interindividual variations in the rates of formation of each metabolite of antipyrine and theophylline. Finally, family studies supported a monogenic hypothesis in which large interindividual variations in rates of formation of antipyrine and theophylline metabolites were regulated by two alleles at a single autosomal locus.

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P450 GENES: STRUCTURE, REGULATION AND RELATIONSHIP TO HUMAN CANCER

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P450 proteins are monooxygenases important in the biosynthesis of many endogenous substrates, as well as innumerable drugs and environmental carcinogens. At least eight families in the P450 gene superfamily have been documented so far by sequencing and chromosomal mapping. Positive and negative trans-acting regulatory control regions have been identified in the mouse and human P_1450 upstream sequences. In laboratory animal studies, certain procarcinogens are known to be converted by specific P450s to ultimate carcinogenic intermediates (such as combustion products including benzpyrene for P_1450). In man it appears that enhanced P_1450 inducibility is correlated with increased risk of cigarette smoking-induced bronchogenic carcinoma. From eight MZ and eight DZ pairs, cultured lymphocytes were treated with mitogen plus 3-methylcholanthrene and shown to exhibit genetic differences in inducible P_1450 activity {aryl hydrocarbon (benzo(a)pyrene) hydroxylase (AHH)} within the human population. AHH inducibility is highly correlated with P_1450 mRNA concentrations that have been quantitated by slot blot analysis. Human P_1450 and more than ten other human P450 genes have been isolated, sequenced, and used as probes to localize their chromosomal sites. It might be possible to correlate restriction fragment length polymorphism (RFLP) patterns of one or more of these genes with increased individual risk of cancer caused by a certain class of environmental chemicals.

GENETIC FACTORS IN THE PSYCHIATRIC SIDE-EFFECTS OF ORAL CONTRACEPTIVE USE

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In a large sample of adult female twins, oral contraceptive (OC) related side effects of depression and irritability were among those most commonly reported. In 715 MZ and 416 DZ pairs concordant for OC usage, genetic but not shared environmental factors could be shown to be of etiological importance for OC-related depression and also for a number of physical side-effects including weight gain and edema. Conventional factor analysis indicated that OC-related psychiatric symptoms were largely distinct from either basal levels of psychiatric symptoms (as measured by the EPQ Neuroticism score and scores on the DSSI Anxiety and Depression subscales) or OC-related physical side-effects. Multivariate genetic analysis revealed that environmental and genetic factors influence covariation among these symptoms in qualitatively different ways. Environmental factors which influenced psychiatric symptoms experienced on OC's were related to those which affect certain OC-related physical symptoms but not to those which influence basal levels of psychiatric symptoms. On the other hand, genetic factors which affect liability to OC-related psychiatric symptoms were, in large part, separable from those influencing physical symptoms and also from those acting on basal levels of psychiatric symptomatology.

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