Behavior Genetics Association

The purpose of the Behavior Genetics Association is to promote scientific study of the interrelationship of genetic mechanisms and behavior, both human and animal; to encourage and aid the education and training of research workers in the field of behavior genetics; and to aid in the dissemination and interpretation to the general public of knowledge concerning the interrelationship of genetics and behavior, and its implications for health, human development and education.

For additional information about the Behavior Genetics Association, please contact Dr. George Vogler, Division of Biostatistics, Washington University School of Medicine, Box 8067, 660 S.Euclid Avenue, St. Louis, MO 63110, (314) 362-3642.

Executive Committee

<table>
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<tbody>
<tr>
<td>President</td>
<td>Lindon J. Eaves</td>
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<tr>
<td>President-Elect</td>
<td>David Blizzard</td>
</tr>
<tr>
<td>Past President</td>
<td>Carol B. Lynch</td>
</tr>
<tr>
<td>Secretary</td>
<td>John K. Hewitt</td>
</tr>
<tr>
<td>Treasurer</td>
<td>Laura Baker</td>
</tr>
<tr>
<td>Member-at-Large</td>
<td>George P. Vogler</td>
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<tr>
<td>Member-at-Large</td>
<td>Peter Driscoll</td>
</tr>
<tr>
<td>Member-at-Large</td>
<td>Joanne Meyer</td>
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</tbody>
</table>

Previous Presidents

- Th. Dobzhansky 1972-1973
- John L. Fuller 1973-1974
- Gerald E. McChesney 1974-1975
- J.P. Scott 1975-1976
- Irving I. Gottesman 1976-1977
- W.R. Thompson 1977-1978
- Lee Ehrman 1978-1979
- V. Elving Anderson 1979-1980
- Norman D. Henderson 1981-1982
- John C. DeFries 1982-1983
- David W. Fulkerson 1983-1984
- Steven G. Vandenbark 1984-1985
- Sandra Scarr 1985-1986
- Ronald S. Wilson 1986-1987
- Peter A. Parsons 1987-1988
- Robert Plomin 1990-1991
- Carol B. Lynch 1991-1992

Previous Dobzhansky Awardees

- Steven G. Vandenbark 1977
- Elliot Slater 1978
- Ernst W. Caspi 1979
- Benson E. Ginsburg 1980
- Sheldon C. Reed 1981
- Gardner Lindzey 1982
- Peter L. Broadhurst 1983
- Leonard L. Heston 1984
- Nikkii Erlenmeyer-Kimling 1985
- Raymond Cattell 1986
- J.L. Fuller & J.P. Scott 1987
- Lee Ehrman 1988
- Gerald E. McChesney 1989
- Irving Gottesman 1990
- John Loehlin 1991
- Gerald E. McChesney 1992

Local Hosts

- Richard Osborne & Benson Ginsberg/1971
- University of Connecticut/1972
- Gerald E. McChesney/1973
- William S. Pollitzer/University of N.Carolina/1974
- Sandra Scarr/Minneapolis, Minn./1975
- Jan Brunel/Univ. of Texas/1976
- John DeFries/Univ. of Colorado/1977
- Ronald Wilson/Louisville/1978
- Thomas Kleind/Univ. of California/1979
- Carol Lynch/Wesleyan University/1980
- R.Darrell Bock/Chicago/1981
- Lee Ehrman/Univ. of New York/1982
- Donald Nash/Colorado State/1983
- David Fulker/London, England/1984
- Richard Rose/Bloomington, Illinois/1985
- Carol Lynch/State College, Penn. 1986
- Godfrey Ashton & Ronald Johnson/1987
- Richard Osborne & Benson Ginsberg/1988
- University of Minnesota/1989
- Richard DeFries/State College, Penn. 1990
- Leonard Heston, Minneapolis, Minn. 1991
- Sjeng Kerbusch/Nijmegen, Netherlands 1992
- Sandra Scarr/Univ. of Virginia 1993
- Pierre Robert/Alzheimers, France 1994
- George Vogler/Wash. Univ., St. Louis 1995
- James Wilson/Univ. of Colorado 1996
Behavior Genetics Association
22nd Annual Meeting

July 2-5, 1992
(Plus "Genetics & Alcohol Symposium" held July 1-2. Symposium registration is free to BGA XXII registrants)

Clarion Harvest House Hotel
Boulder, Colorado USA

Local Hosts: Jim Wilson, Gene Erwin, John DeFries & David Fulker

Venue: The 22nd Annual Meeting of the Behavior Genetics Association will be held July 2-5, 1992, in Boulder, Colorado, USA. The venue is the Clarion Harvest House Hotel, 1345 28th Street, Boulder, CO 80303 USA. As one arrives in Boulder on Highway 36 from Denver, the highway turns due north and becomes 28th Street. The Clarion is on the left, about 0.7 kilometer north after the highway becomes 28th Street. The Clarion is a full-service hotel, and is located between the main campus of the University of Colorado, and the Institute for Behavioral Genetics, in the east campus research park, on 35th Street. See enclosed Boulder map for further location information. There are a few restaurants near the Clarion, and many others within a mile (1.5 Km). The Clarion is located about 4 blocks south of Boulder's largest shopping mall, "Crossroads Mall," which begins at 1600 28th Street, and about 2.5 Km southeast of Boulder's gentrified "Pearl Street Mall." Boulder is nestled against the front range of the Rocky Mountains, with easy access to hiking, climbing and scenic drives. Typical weather is warm (90° Fahrenheit, 32° Celsius), with clear mornings and thundershowers in the afternoons.

Genetics & Alcohol Symposium: A symposium to commemorate the 25th anniversary of the founding of the Institute for Behavioral Genetics will be held at the Clarion the day prior to the regularly scheduled BGA meeting. All BGA registrants are cordially invited to attend the Symposium and associated festivities free of charge. All BGA registrants should have received a "Genetics and Alcoholism" brochure announcement during November, 1991. Please contact the local hosts if you need further Symposium information.

Registration/Hotels: Separate forms for early registration and for hotel arrangements were included in the registration mailing. The early registration form should be completed and mailed, with cheque, to the local host, James Wilson. (The special early registration fee is $100, in US dollars; with cheques made out to University of Colorado Box 447.) The early registration period ends May 15, 1992; subsequent to that date, the regular registration fee of $150 will be charged. The hotel arrangements form should be sent directly to the Clarion Hotel. The special room rates at the Clarion available to BGA registrants are: Single - $60; Double - $79; Triple - $89; and Quad - $99 (plus 9.5% accommodations tax). Registered participants and their families or guests can stay at the Clarion at the same reduced rates for up to three days prior to and after the meeting. The Clarion does have rental cars available on site. Members are advised to take the "Airporter" transport service ($9.50/person) from Denver/Stapleton Airport directly to the Clarion, and then rent a car there when one is needed. A taxi from Denver/Stapleton airport to the Clarion costs about $45! The telephone number for the Clarion is 1-800-545-6285 or (303) 443-3850 or fax to (303) 443-1480.

Information: For further information, contact:
James Wilson, BGA Local Host
Institute for Behavioral Genetics
University of Colorado Box 447
Boulder, CO 80309-0447 USA

or telephone (303) 492-2841: fax (303) 492-8063: email to DVJ@VAXF.COLORADO.EDU

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Genetics and Alcoholism Symposium

All BGA '92 registrants are cordially invited to attend a special symposium, Genetics and Alcoholism on Wednesday evening, July 1st, and all day Thursday, July 2, 1992, sponsored by the Institute of Behavior Genetics (IBG). The IBG was founded in 1967 at the University of Colorado, Boulder, by Gerald E. McClearn, who directed the Institute until 1980. Since its inception, IBG faculty and students have pioneered the use of animal models for studying components of alcohol addiction. IBG faculty are key participants in the Colorado Alcohol Research Center, which is funded by the National Institute on Alcohol Abuse and Alcoholism. To celebrate the 25th anniversary of its founding, the IBG is pleased to sponsor this symposium with a reception, dinner, and plenary address by Dr. Enoch Gordis, Director of NIAAA, Wednesday evening, July 1, 1992. The symposium and associated activities are free of charge to all BGA registrants and will be held at the Clarion Harvest House Hotel, in Boulder. An open house and reception will be held at IBG on Thursday evening. The meeting will continue July 3-5, 1992, with the regular annual meeting of the Behavior Genetics Association.

Central City Opera

Built in 1878 by Cornish and Welsh miners, The Central City Opera House is a Victorian Jewel that has been beautifully restored to reflect its original glory. Seating 756 patrons in historic hickory chairs, many of which are named after Colorado's pioneer families as well as illustrious figures in the performing arts, the Central City Opera House is unique for its perfect acoustics, elaborately frescoed ceiling and for its location high in the Rocky Mountains (Elevation 8450 ft.), less than one hour's drive west of Denver, Colorado.

Actress Lillian Gish opened the first Festival in 1932, producer and stage director Robert Edmund Jones was instrumental in bringing stars from the Broadway stage to Central City for performances in both opera and theater. A countless array of distinguished performers have trod the boards at the Central City Opera House including Cyril Ritchard, Lynn Redgrave, George Gobel, Helen Hayes, and Nannette Fabray in plays while Samuel Ramey, Sherrill Milnes, and Beverly Sills appeared in operas here early in their careers.

Following the BGA meeting on Sunday, July 5th, you are invited to join local hosts, Byron and Judy Jones to sample a unique feature of the local cultural environment, the Central City Opera.

Thrill to the romanticism of Gounod's FAUST conducted by John Moriarty, followed by dinner in the newly restored Teller House's gourmet restaurant featuring international cuisine. After dinner try your luck in the casino.

Price of $60.00 includes transportation, opera ticket and dinner. Reservations must be made by pre-registration deadline. Make checks payable to Central City Opera House Association and mail to Judy Jones at 1428 Willowbrook Drive, Boalsburg, PA 16827-1672.

Behavior Genetics Association 1992 - Page 3
Behavior Genetics Association

22nd Annual Meeting

Thursday Afternoon and Evening, July 2

8:00-7:00 Registration/Help Desk
(Also open 8:00-5:00 Friday and Saturday)
Sunshine Room

4:15-6:15 Executive Committee Meeting
Executive Board Room

4:15-5:00 Informal Meeting of Associate Members
Canyon Room

5:00 Poster Area open to place posters for Session A
Reception Area

5:00 Reception and Open House
Institute for Behavioral Genetics
89, 30th Street between Boulder Creek and Arapahoe Road

Friday Morning, July 3

8:00-10:00

Paper Session: Animal Models of Ethanol Use and Abuse
Chair: Byron C. Jones
Flagstaff Room

- Are GABA, receptors subunit mRNA in mammalian brain differentially polyadenylated? (7) NJ Karl & AL Mermel
- Ethanol teratogenesis in three inbred mouse strains.
  DM Gilliom & KJ Chase

Paper Session: Psychopathology
Chair: Nicholas G. Martin
Canyon Room

- Increase in prevalence and extent of obesity in post-World War II birth cohorts: Implications for genetic analyses. EE Price
- Seasonal change in mood and behavior: A twin study. (7) PA Madden, AC Heath, NE Rosenthal, & NG Martin
- The influence of life events on depressive symptoms over time. (7) JM Fielder-Hiser, B Poirim, P Lichtenthal, NE Pedersen, & GE McClearn
- The transmission of depressive symptoms in multi-generation families. (7) MC Stalling, LA Baker, & M Gatz
- Genetic etiology of comorbid substance abuse and attention deficit hyperactivity disorder. (7) JJ Gleta, JC DeFries, SF Pennington, & JW Silzer
- Pedigree analysis of antisocial symptoms, alcohol abuse symptoms, and drug abuse symptoms in adolescent substance abusers and their families. G Corey
- Evidence for a major gene for obsessive-compulsive disorder. BM Cantor, MA Spence, G Ronn, V Vieland, & H Nicolin
- Susceptibilities to schizophrenia: Neuropsychological studies. MF Pogue-Geile, AH Garett, JJ Brumme, JH Wolf, JH Crow, & N Huleatt
- Detection of Fragile X chromosome in leukocyte cultures. RY Yan, JH Hersh, & B Weiskopf
- The effects of acute stress on ethanol ablation rates. (7) SA Minnick & JM Warner

Page 5 - Behavior Genetics Association 1992
### Friday Morning, July 3

<table>
<thead>
<tr>
<th>Time</th>
<th>Session/Activity</th>
<th>Description</th>
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<tbody>
<tr>
<td>10:00-10:30</td>
<td>Coffee Break</td>
<td>Reception Area</td>
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<tr>
<td>10:30-12:30</td>
<td>Paper Session: Modelling, Mapping, and Physiology</td>
<td>Chair: Michael C. Neale</td>
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<tr>
<td>11:06</td>
<td>Specific genetic determinants of two-way active avoidance learning in inbred mouse strains</td>
<td>John Hoffmann</td>
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<tr>
<td>11:18</td>
<td>Toddler temperament linked to MNS blood markers</td>
<td>P. Phillips &amp; AP Mutheury, Jr.</td>
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<tr>
<td>11:30</td>
<td>Mapping an epilepsy gene</td>
<td>VT Anderson, TC Bosco, GM Ronen, M Connolly, &amp; M Seppala</td>
</tr>
<tr>
<td>11:42</td>
<td>Genetic and environmental predictors of socioeconomic status</td>
<td>P. Lichterstein, NL Pelzisen, &amp; GE McKeen</td>
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<tr>
<td>11:54</td>
<td>A third source of individual differences</td>
<td>PCM Molenaar</td>
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<tr>
<td>12:06</td>
<td>Segregation analysis of psychophysiological traits</td>
<td>EB Ruttenberg</td>
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<tr>
<td>12:18</td>
<td>Population genetic study of EEG</td>
<td>PJ Donovick &amp; IG Burright</td>
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</table>

### Symposium: Neurobehavioral-Geneic Dissection of Two-Way Active Avoidance Learning in Mice and Rats
- Chair: Wim E. Crusio
- Canyon Room

- The shuttle-box as an anxiety task in rats | P. Driscoll
- Shuttle box avoidance learning: Behavioral, genetic and endocrine factors | IR Bush
- Multivariate quantitative-genetic analysis of two-way active avoidance learning, locomotor activity, and hippocampal mossy fibers in mice | WE Crusio

#### Authors & Affiliations
- MM van den Bos, JK Hewitt, M Monteleer, LJ Evers, & BM Schlehen
- DL Drury, NG Martin, NJ Espanich, & B Grossarth-Maticek

### Friday Afternoon, July 3

<table>
<thead>
<tr>
<th>Time</th>
<th>Session/Activity</th>
<th>Description</th>
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<tr>
<td>12:30-1:30</td>
<td>Lunch</td>
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<tr>
<td>1:30</td>
<td>Paper Session: Substance Abuse in Humans</td>
<td>Chair: C. Robert Cloninger</td>
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<tr>
<td>1:54</td>
<td>A twin study of the role of personality in the genetics of alcoholism</td>
<td>W. Stuik, S. Pickens, D. Siskis, &amp; M. Mclellan</td>
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#### Authors & Affiliations
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- E.A Adams, CJ Eaves, M. Mclellan, D. Veal, & S. Pickens
- E.A Adams, CJ Eaves, M. Mclellan, D. Veal, & S. Pickens

#### Symposium: Maternal Effects: Inhibition or Stimulation to Behavior Genetic Analysis
- Chair: Michele Carlier
- Canyon Room

- Introduction: Maternal effects dissociated from genotypic effects can be demonstrated on non-human species as well as on humans. | M. Carlier
- The separation of genetic from maternal effects: A focus on the mouse. | M. Carlier
- The maternal effect in rodent models of hyperactivity. | DA Blizard
- Elimination of maternal effect to demonstrate that embryo cryopreservation is not negligible and interfering with the genotype. R. Bouloukos, R. Moulou & B. Toyama
- Should knowledge about fetal sensory development influence thought in behavior-genetic analyses? | MC Bunkel
- Maternal and paternal effects on human behavior: Applications of ME twin designs. | D. Rose
- Dermatogenic and behavioral differences in monochromic and albino ME twins. | M. White
- Should knowledge about fetal sensory development influence thought in behavior-genetic analyses? | MC Bunkel

#### Authors & Affiliations
- E. Adams, C.J. Eaves, M. Mclellan, D. Veal, S. Pickens
- E. Adams, C.J. Eaves, M. Mclellan, D. Veal, S. Pickens
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- E. Adams, C.J. Eaves, M. Mclellan, D. Veal, S. Pickens

# Call Home !!!

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Friday Afternoon, July 3

3:30-5:30

Poster Session A over wine & cheese with authors present

Reception Area

1 Use genetic data and just say no to negative symptom schizophrenia. 
K Force & R Gottesman

2 Schizophrenia discordant twins as windows on psimorbid and postmorbid personality. 
DL DeLiso, R Gottesman, T Wazie, & EF Torrey

3 The relationship between conduct disorder, antisocial personality disorder, and antidepressant symptoms in the families of adolescent substance abusers. 
E Wear & G Corey

4 Genetic analyses of the etiology of personality disorder. 
KJ Jang, WJ Uresly, DR Jackson, & PA Yerson

5 A twin study of behavior problems in early adolescence. 
C Edelbrock, BD Bendes, B Romin, & LA Thompson

6 The heritability of inhibited behavior in twins. 
J Robinson, B Conley, & J Lagan

7 The heritability of divorce: New data and theoretical implications. 
T Turkheimer, G Lovett, CD Rabinette, & R Gottesman

8 A prospective high-risk twin study of alcohol and substance abuse. 
M McGue, J Flicker, WG Iacono, DF Lykken, & A Tellegen

9 Genetic effects on progression of the smoking habit: A growth curve analysis. 
KR Turell, JM Meyer, & JK Hewitt

10 Complex segregation analysis of speech and language disorders. 
BA Lewis & PJ Byard

11 Commingling and segregation analysis of complex psychological traits: Are extremes of normal variance etiologically distinct? 
JW Gilger, SF Pennington, I Borecki, & JC DiFries

12 Behavioral effects of ethanol and nicotine co-administration are influenced by genetic factors. 
W Ciao, L Wilcke, C Becker, & AC Collins

13 Influence of ethanol dose and mouse strain on the development and disappearance of rapid tolerance. 
S Cole-Harding & AWK Chan

Evidence for lack of association between 1 dilution cost color gene and ethanol intake in house-freed rodents. 
DL Overturf, AH Rezvani, & DS Janowsky

Behavioral and taste predictors of ethanol intake in genetically heterogeneous rats. 
DL Overturf, AH Rezvani, A Kampov-Polevoy, & B Murneke

Effects of the CS dopamine receptor agonist quinpirole on the locomotor activity in FAST and SLOW selected lines of mice. 
EJ Shen, JC Crobbe, & DJ Phillips

Purinergic sensitivity in LS and SS mice: Locomotor and physiological responses. 
Th Smolen, A Smolen, DD Comelison, & CA Ross

The use of F1 crosses between RI strain to replicate associations found in recombinant inbred (RI) quantitative trait loci (QTL). 
B Wondol, JN Naiditch, GE McKeown, & B Promis

Genetic analysis of nitrous oxide withdrawal severity in BXD recombinant inbred mice and in WSP, WSR selectively-bred mice. 
S Angel-Guiste, M Heins, & JK Selkoe

Automated measurement of multiple behavioral measures in BXD/RI recombinant inbred mice. 
AJ Julien, B Promis, BC Jones, & GE McKeown

A recombinant inbred strain analysis of responses to nicotine using the LS-SS-derived RI strains. 
MJ Marks, B Selvaggio, B Promis, & AC Collins

A pharmacogenetic study of the effects of amphetamine on immune aggression in mice. 
MM Westenberger, BE Ginsburg, & R Gutfman

Differential housing and strain affect cocaine self-selection in mice. 
AC Morse & BC Jones

Conditioned tolerance to the analgesic effects of morphine in inbred mice. 
GI Elmer, CB Mustum, CW Schindler, & SR Goldberg

Enzyme markers in mouse erythrocytes separated according to age on perfusion density gradients. 
A Smolen & JA Westrick
Friday Evening, July 3

<table>
<thead>
<tr>
<th>5:30-6:30</th>
<th>Perspectives</th>
<th>Conversazione</th>
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<tr>
<td>旗staff Room</td>
<td>Chair: Linda K. Dixon</td>
<td>主席: Linda K. Dixon</td>
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<td>演讲场: Canyon Room</td>
<td>演讲场: Flagstaff Room</td>
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<tr>
<td>5:30</td>
<td>Evolutionary adaptation and stress: Energy budgets and habitats selected.</td>
<td>演讲场: Conversazione Canyon Room</td>
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<tr>
<td></td>
<td>PA Parsons</td>
<td>Robert Plomin</td>
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<tr>
<td>6:00</td>
<td>Unsolved problems in behavior genetics.</td>
<td>演讲场: Conversazione Canyon Room</td>
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<td></td>
<td>JP Scott</td>
<td>John Hewitt, Carol Lynch, Norman Henderson</td>
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</tbody>
</table>

6:30-9:00 旗staff Room available for Informal Discussion Group

8:00-10:00 Remove Session A Posters

Saturday Morning, July 4

8:00-8:30 Poster Area open to place posters for Session B

Rception Area

8:30-10:30 Poster Session B over coffee with authors present

Rception Area

1. A multivariate analysis of cognitive measures of 14 months: The MacArthur Longitudinal Twin Study. KE Whitting, SS Cherry, DW Fulker, & JS Beazick

2. Genetic and environmental influences on offspring from 14 to 23 months. The MacArthur Longitudinal Twin Study. JM Braungart, RJ Plomin, BN Emde, J Campos, R Corley, DW Fulker, J Riggs, JS Beazick, J Robinson, C Zahn-Waxler, MC & JC Defries


5. Intelligence and environmental influences on social development: A national collaborative project. E Turkheimer

6. Genetic and environmental influences on social competence in middle childhood. JM Neeher, RJ Plomin, & H Coon

7. Genetic and environmental influences on social competence in middle childhood. JM Neiderhiser, RJ Plomin, & H Coon

8. Intelligence and environmental influences on social competence in middle childhood. JM Neiderhiser, RJ Plomin, & H Coon

9. Genetic perspectives on successful aging. P Mosson, P Lichtenstein, GE McClearn, & NL Pedersen

10. Origins of social status in aging. P Mosson, P Lichtenstein, GE McClearn, & NL Pedersen

11. Self-rated vs. "actual" personality similarity in MZ and DZ twins and non-twin siblings. PA Vernon & KL Jong
<table>
<thead>
<tr>
<th>Page 12</th>
<th>Behavior Genetics Association 1992</th>
</tr>
</thead>
</table>
| 12  | Genetic and behavioral studies on yellow Drosophila.  
A Prauzn-Hotchkiss, K Sato, & JF Thompson |
| 13  | The effects of physical activity on learning performance in CSF and DBA mice.  
DE Fordyce & JM Wehner |
| 14  | Behavioral effects of the quinol in mice.  
DJ Nash & K Eggelston |
| 15  | Spatial learning performance in BID recombinant inbred strains.  
M Upchurch & JM Wehner |
| 16  | Application of the use of recombinant congenic strains (RCS) in the estimation of the minimal number of genes implicated in mouse reactivity to p-CCM.  
B Martin, C Marchiolini, J Phillips, G Chepehuer, C Spach, & B Malta |
| 17  | Implication of a region of chromosome 4 in the reactivity to p-CCM in mice.  
B Martin, B Mauleur, Y Clermont, P Vanoult, J Phillips, & G Chepehuer |
| 18  | Mapping quantitative trait loci for life span and self-fertility.  
A Brooks & TE Johnson |
| 19  | Circadian rhythms of pineal melatonin and related indoles in RHA/Verh vs ILA/Verh rats.  
G Oerling, P Beuquinto, & P Drescoi |
| 20  | Age-dependent gene expression during the adult life span of Caenorhabditis elegans.  
TJ Fablin & T Johnson |
| 21  | A molecular genetic composition of brain protein kinase C genes in CS/Bl6 expression and DBA/2ag mice.  
BJ Bowers, CL Potham, & JM Wehner |
| 22  | Movement and postural deficits and cerebellar abnormalities in M625/Nh rats.  
SM Anderson & JM Petras |
| 23  | Strain differences in inhibition of handedness in the mouse.  
FG Biddle, JA Gerriftsen, & CM Cifaro |
| 24  | The effects of corticosterone and cholesterol treatment on spatial learning performance in mice.  
S Miller & JM Wehner |
### Saturday Afternoon, July 4

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>12:30-1:30</td>
<td><strong>Lunch</strong></td>
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<tr>
<td>1:30-3:30</td>
<td><strong>Paper Session: Childhood Health and Parenting</strong></td>
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<td></td>
<td>Chair: Lee Anne Thompson</td>
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<td>Room: Flagstaff Room</td>
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<tr>
<td>1:30</td>
<td>A preliminary analysis of neonatal cry characteristics in human twins</td>
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<td>ME Hahn, F Manginello, &amp; JK Hewitt</td>
</tr>
<tr>
<td>1:42</td>
<td>Genetic influence on change in activity during the first four years of life</td>
</tr>
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<td>JM Brumang &amp; BD Bande</td>
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<tr>
<td>1:54</td>
<td>Genetic and environmental influence on the etiology of problem behavior in early childhood</td>
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<td>S. Schmitt &amp; DW Kutcher</td>
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<td>2:06</td>
<td>A sibling adoption study of behavior problems in middle childhood</td>
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<td>R Rende &amp; R Plomin</td>
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<td>2:18</td>
<td>A study of the Child Behavior Checklist in international adoptees</td>
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<td>DI Boomsma, EOJ van den Dorst, &amp; JC Verhulst</td>
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<td>2:30</td>
<td>Genetic mediation of environment-outcome associations during adolescence: A study of twins, full siblings, and step siblings</td>
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<td>(T) S McGuire, D Dragon, EM Hetherington, &amp; R Rende</td>
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<td>2:42</td>
<td>Human parental behavior: Evidence for genetic influence and implication for gene-culture transmission</td>
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<td>D Penrose, MC Neale, AC Heath, &amp; U Evert</td>
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<td>2:54</td>
<td>The transmission of parenting behavior: Revising or genetics?</td>
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<td>BC Brown, S Collier, SG Harmon-Losoya, &amp; IJ Goldsmith</td>
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<td>3:06</td>
<td>Movement history and personality: A genetic analysis</td>
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<td>V Jockin, M McGuie, &amp; BJ Lykken</td>
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<td>3:18</td>
<td>Estimated familiality of cognitive abilities of offspring tested in adolescence and young adulthood</td>
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<td>CT Moghul &amp; JC Johnson</td>
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**Symposium: Innovative Techniques for Evaluation of Behavioral and Drug Responses**

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<th>Time</th>
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<tr>
<td>1:30</td>
<td>Selection for neurochemical differences.</td>
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<td>JK Selkoe</td>
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<td>1:42</td>
<td>Congenic mouse strains exhibiting differences in sensitivity to alcohol-stimulated activity.</td>
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<td>BC Dudzki</td>
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<td>1:54</td>
<td>Transgenic mice.</td>
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<td>MN Sikola</td>
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<td>2:18</td>
<td>Redeselation of cryopreserved embryos.</td>
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<td>JC Crabbe</td>
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<td>2:30</td>
<td>Selective breeding for IFUS.</td>
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<td>GE McCleary</td>
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<td>2:42</td>
<td>DISCUSSIONS:</td>
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<td>SM Anderson, P Driscoll, DA Bizard, RA Harris</td>
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</tbody>
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| 3:30-4:00 | Coffee Break Receptions Area                                                                 |
| 4:00-5:30 | Business Meeting Century Room                                                               |
| 5:30-6:00 | Remove Posters from Session B Reception Area                                                 |
| 6:00-7:00 | Reception Ballroom (front)                                                                  |

**Annual Banquet & Awards Ceremony**

**Presidential Address:**

*Modelling the Genetic and Environmental Mechanisms of Human Behavioral Development*

Lindon J. Eaves  
Medical College of Virginia
### Sunday Morning, July 5

<table>
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<th>Time</th>
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| 7:30- 8:30 | Executive Committee Meeting  
Executive Board Room |
| 8:30-10:00 | Paper Session: Animal Models of Behavior  
Chair: Jeanne M. Wehner  
Flagstaff Room |
| 8:30-10:00 | Paper Session: Personality Structure  
Chair: Lon R. Cardon  
Canyon Room |
| 8:30 | General activity level—The ubiquitous $G_x$ in animal behavior genetics.  
ND Henderson |
| 8:42 | Genetic influences on personality consistency:  
Paysar, J. Baskall, & JL Wehner |
| 8:54 | Stability and change in conservatism.  
KZ Truett |
| 9:06 | Stability and change in personality through the lifespan: A longitudinal analysis.  
EJ Vikan, EJ Rose, M. Eekeren, & J Espiri |
| 9:18 | Caucasian and biological and unrelated family members for an MMPI measure of aggression.  
EJ Vikan, EJ Rose, M. Eekeren, & J Espiri |
| 9:30 | Handwriting characters and personality traits. Male and female college students.  
EC Peeples & P. Boxall |
| 9:45-10:00 | Coffee Break  
Reception Area |
| 10:00-12:00 | Symposium: Sex Differences in Transmission and Expression  
Chair: J. Michael Bailey  
Canyon Room |
| 10:00-12:00 | A genetic study of female sexual orientation.  
JM Bailey  
Genes, gender, and culture.  
LA Baker  
Disentangling hormonal and social influences on sex-typed behavior.  
SA Beemboom  
Gender differences in regional brain structure and function.  
SM Benick  
DISCUSSION:  
DC Rowe |
SALLY M. ANDERSON and J.M. PETRAS. Movement and Postural Deficits and Cerebellar Abnormalities in M520/Nih Rats.  

We reported behavioral, genetic and neuroanatomical findings on a neurological single autosomal recessive mutation in a subset of rats derived from the genetically heterogeneous N/Nih rat line (S.M. Anderson and J.M. Petras, 1990, Behavior Genetics 20, 70; J.M. Petras and S.M. Anderson, 1990, The Anatomical Record 226, 79A-80A). The movement and postural deficits are characterized by tremors, trunkal ataxia, splayed feet and falling from the sitting position. The cerebellum is marked by loss or degeneration of Purkinje and granule cells, Purkinje cell ectopia, and foreshortened dendrites in some Purkinje cells. Observation of abnormal movement in descendents of N/Nih rats maintained in other animal colonies suggested that this mutation was neither new nor unique to our rats. After further investigation we became aware of a similar a normal movement disorder in a subset of the M520/Nih strain, one of the eight inbred strains crossed to develop the N/Nih line. Preliminary findings on cerebella from M520/Nih rats also indicate degenerated Purkinje and granule cells. These data suggest that the M520/Nih rat strain is the source of this new neurological mutation and that these rats are a model of cerebellar degenerative diseases.  

1. Department of Medical Neurosciences, Division of Neuropsychiatry, Walter Reed Army Institute of Research, Washington, D.C. 20307-5100.

V. ELVING ANDERSON, TEODORO O. ROSALES, GABRIEL M. RONEN, MARY CONNOLLY, and MARK LEPPERT. Mapping an Epilepsy Gene.  

Study of a large Newfoundland kindred (68 affected individuals over six generations) has confirmed the linkage of a gene for benign familial neonatal convulsions (BFNC) to the long arm of chromosome 20. BFNC shows interesting developmental, clinical, and EEG features. Seizures in this family started on days 2-4 of life in 76% and stopped at 4-6 weeks in 48%. Neonates had up to nine brief seizures of mixed type per day and between seizures they were essentially normal. An ictal EEG confirmed the seizures as epileptic. 16% developed later onset epilepsy. Later development was otherwise normal, although an increased frequency of learning disorders cannot be ruled out. Four-point linkage analysis (BFNC and three DNA markers) of this and other families yields a lod score of over 14. There is some evidence for linkage heterogeneity. Further studies using additional DNA markers and families are underway in an effort toward better localization and eventual positional cloning of this gene. Information about other recently mapped epilepsy genes will be reviewed briefly for comparison.  

1. Dight Laboratories, University of Minnesota, Minneapolis, Minnesota 55455.  
2. Janeway Child Health Centre and Memorial University of Medicine, St. John's, Newfoundland, Canada A1A 1R8.  
3. Department of Pediatrics, McMaster University, Hamilton, Ontario, Canada L8N 3Z3.  
4. Howard Hughes Medical Institute, University of Utah Health Sciences Center, Salt Lake City, Utah 84105.

SANDRA ANGELI-GADD, K.L. HELMS and J.K. BELEKAP. Genetic analysis of nitrous oxide withdrawal severity in BXD recombinant inbred mice and in WSP, WSR selectively-bred mice.  

Both nitrous oxide and ethanol produce handling-induced convulsions (HIC) as part of their withdrawal syndromes in mice. WSP and WSR mice, which were selectively-bred to show severe (WSP) or mild (WSR) HIC after ethanol withdrawal, also show similar differences in HIC after nitrous oxide withdrawal. This finding suggests a sizeable genetic correlation between these two drug withdrawal syndromes. The BXD series are presently being tested for nitrous oxide withdrawal, and data collection is now 80% complete. For 16 BXD strains tested to date, with at least 6 mice per strain, there is only a moderate genetic correlation (r=0.5) with ethanol withdrawal severity reported by Crabbe et al. (Neurotox. Toxicol. 5:181-187, 1983) in many of these same strains. Associations between nitrous oxide HIC severity and 410 marker loci in the BXD series were also examined for evidence of linkage. A strong (p<0.001, single test) association was seen with the Fen-7 region of Chromosome 2, suggesting the presence of a quantitative trait locus (QTL) affecting nitrous oxide withdrawal HIC in this chromosome region. Interestingly, loci in the same chromosome region (within 5 cm) appear to be associated with ethanol withdrawal HIC and tonic-clonic convulsions due to high pressure in BXD mice as reported in the literature. These results will be followed up in an F2 segregating population using Southern blots to assess the genotypes of individual mice for loci in this chromosome region.  

1. Department of Medical Psychology, Oregon Health Sciences University, and Research Service (151W), VA Medical Center, Portland, OR 97201.  

Individual differences both in rate and pattern of aging are generally acknowledged to be great. Understanding the origins of this variability is of fundamental importance for basic scientific understanding of aging processes. Although recent research has begun to explore the genetic and environmental bases of individual differences in aging, these studies are principally concerned with the "young-old." The OCTO-Twin Study is the first twin study ever conducted on a population-based sample of intact, like-sex, twin pairs 80 and above. The goal is to investigate more than 350 pairs with the aim of assessing the role of environmental and genetic factors influencing individual differences in various domains of aging, including physical and cognitive functioning, personality, interpersonal relations, personal control, life satisfaction, and mental health. The project is based on the Swedish Twin Registry at the Karolinska Institute in Stockholm. It is related to three other Swedish gerontological programs: the Gothenburg longitudinal study (H 70), the Swedish Adoption/Twin Study of Aging (SATSA), and the longitudinal study of the oldest old in Jönköping (OCTO). In February 1992, approximately 100 pairs had been examined. Preliminary analyses will start in Spring 1992.

1. Institute of Gerontology, University College of Health Sciences, Jönköping, Sweden.
2. Center for Developmental and Health Genetics, The Pennsylvania State University, University Park, PA 16802.
3. The Karolinska Institute, Stockholm, Sweden.
4. Supported by the National Institute on Aging grant AG08861.


HA/LA mice are replicate lines selected for differences in susceptibility to ethanol (EtOH) withdrawal seizures. Mice in the HA lines show high susceptibility to handling-induced seizures, LA lines show low susceptibility, and CA lines are randomly selected controls. Ninth generation mice tested after 11 days of consuming a mixture of EtOH and liquid diet (DYET #710266) showed the expected line differences. The seizure scores of the HA lines were higher than those of the LA lines and the characteristic hypothermic response was more pronounced for the high lines than for the low lines. Eight to 11 mice from each replicate high and low line were given the same treatment except that EtOH was mixed into their water and they had free access to food chow. The mean blood EtOH concentration of the mice at withdrawal did not differ significantly from that when EtOH was mixed into liquid food. But virtually no mice had seizures, even though the hypothermic responses of high and low lines were more pronounced than that of non-EtOH control mice, they were nearly identical to each other. The severity of the withdrawal symptoms and the differences between HA and LA lines seem to be due, at least in part, to the liquid food. We are further examining the interaction of EtOH withdrawal and the stress not directly caused by the EtOH (e.g., weight loss, unpalatability of the EtOH/food mixture) on these withdrawal symptoms.

1. Institute for Behavioral Genetics, University of Colorado, Boulder, Colorado 80309.
2. Supported by Grant AA-03527 from the National Institute of Alcohol Abuse and Alcoholism to the University of Colorado Alcohol Research Center.

F. G. BIDDLE, J. A. GERRITSEN, and G. N. COFFARO. Strain Differences in Lateralization of Handedness in the Mouse.

Handedness can be measured in the mouse by a left and right paw reaching task in an unbiased test chamber. Direction does not appear to be a genetically-determined variable, but the strength of lateralization is a genetic variable because a bidirectional selection study, beginning with a heterogenous constructed population, produced both HI (highly lateralized) and LO (weakly lateralized) strains within a relatively few generations (R. L. Collins, 1985, in Cerebral Lateralization in Nonhuman Species, S. D. Glick, ed.) Academic Press, pp. 41-71). We have begun an assessment of our research colony for lateralization of paw preference. In the first three strains, our C57BL/6 and the ancestral-related Wb/Re strains are phenotypically identical to both the previously reported highly lateralized C57BL/6 and HI strains and our SWV strain is phenotypically identical to the weakly lateralized LO strain. There are no sex differences within the strains in the degree of lateralization. We suggest the highly lateralized and weakly lateralized paw preference phenotypes of the HI and LO strains may represent genetically-determined alternate phenotypes among the inbred strains of the mouse and, as such, the difference may have a genetically simple cause.

1 Departments of Paediatrics and Medical Biochemistry, University of Calgary, Calgary, Alberta T2N 4N1.
2 Supported by Alberta Children's Hospital Foundation, Alberta Heritage Foundation for Medical Research, and Medical Research Council of Canada.


The contributions of genotype and common environment to problem behaviors were assessed in international adoptees living in the Netherlands aged 12-4 years, 10.2, mean age at placement 26.9 months, and a matched sample of biological children. The sample consists of biologically related siblings adopted together, unrelated subjects adopted together, and adopted children who grow up as only child. A new rat is especially useful in assessing the importance of sibling interaction effects. Parents rated behavioral problems in the children using the Child Behavior Checklist (T.M. Achenbach and C.S. Edelbrock, 1983, Manual for the Child Behavior Checklist and Revised Child Profile. Burlington: University of Vermont). Correlations for log transformed total scores, grouping factors internalizing and externalizing and subscales are as follows:

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<td>.57</td>
<td>.34</td>
<td>.52</td>
<td>.59</td>
<td>.64</td>
</tr>
<tr>
<td>Internalising</td>
<td>.44</td>
<td>.41</td>
<td>.28</td>
<td>.15</td>
<td>.16</td>
<td>.31</td>
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<tr>
<td>Externalising</td>
<td>.19</td>
<td>.37</td>
<td>.11</td>
<td>.46</td>
<td>.43</td>
<td>.52</td>
</tr>
<tr>
<td>Withdrawn</td>
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<td>.31</td>
<td>.13</td>
<td>.15</td>
<td>.14</td>
<td>.06</td>
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<tr>
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<td>.54</td>
<td>.08</td>
<td>.25</td>
<td>.26</td>
<td>-.01</td>
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<tr>
<td>Anxious/depressed</td>
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<td>.30</td>
<td>.23</td>
<td>.21</td>
<td>.08</td>
<td>.33</td>
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<td>.12</td>
<td>.14</td>
<td>.08</td>
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<td>.30</td>
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<td>.42</td>
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<td>Attention problems</td>
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<td>.13</td>
<td>.09</td>
<td>.17</td>
<td>.14</td>
<td>.44</td>
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1 Department of Child and Adolescent Psychiatry, Sophia Children's Hospital, Erasmus University, Rotterdam, The Netherlands.
2 Department of Psychometrics, Free University, Amsterdam, The Netherlands.
A Molecular Genetic Comparison of Brain Protein Kinase C genes in C57BL/6Jbg and DBA/2Jbg mice.

From at 14 and months emerged of the MacArthur Longitudinal Twin Study were assessed at 14 and 20 months of age in the laboratory and home. Longitudinal correlations from 14 to 20 months indicated that the second year of life was a period of change rather than continuity. Maximum-likelihood model-fitting analyses indicated that about two-thirds of the continuity between 14 and 20 months is mediated genetically. In addition, two types of genetic change were examined: changes in genetic and environmental contributions to change from 14 to 20 months. In general, heritability estimates were similar at 14 and 20 months. Evidence for significant genetic influence on change from 14 to 20 months emerged for several measures within the domain of temperament and emotion.

The purpose of the present study was to examine genetic change as well as continuity during the second year of life within the domains of genetic processes explained the genetic cardiovascular response to exercise. The first set of genes was expressed at rest and persisted with increased impact as the load increased. In contrast, the environmental effects were largely load-specific and showed relatively little persistence as loads were increased.

The genetic regulation of systolic and diastolic blood pressure and heart rate was investigated during rest and in stages of progressive dynamic exercise, on a bicycle ergometer. Subjects were 148 monozygotic and 111 dizygotic caucasian twin pairs, with a mean age of 11.1 years. A LIBREL model, including genetic and specific environmental effects, was fitted to the monozygotic and dizygotic same sex groups. Sex differences did not significantly influence the analyses. An increase in variance in cardiovascular response during exercise was found, which is a function of both genetic and environmental influences. Two distinct and independent genetic processes explained the genetic cardiovascular response to exercise. The first set of genes was expressed at rest and persisted with increased impact as the load increased. In contrast, the environmental effects were largely load-specific and showed relatively little persistence as loads were increased.

The purpose of the present study was to examine genetic influence on change in temperament during infancy and early childhood. Participants included 60 adoptive sibling and 72 nonadoptive sibling pairs who were part of the Colorado Adoption Project. Maternal reports of children's temperament as well as teacher ratings of children's behavior during a semistructured testing situation were used as measures of children's temperament at ages 1, 2, 3, and 4. Repeated measurements of the EAS traits on the OCTT (emotionality, activity, and sociability) and tester ratings (affect/extraversion, activity, and task orientation) were decomposed into orthogonal polynomial linear trends, which reflect linear change for each dimension. In addition, variance due to the means of each dimension across the four ages was partitioned out of the change scores so that the slopes represented a pure change. Intercorrelations and maximum-likelihood model-fitting analyses yield significant genetic influence on change for maternal ratings of activity and for tester ratings of activity and task orientation. In addition, phenotypic correlations indicate that an increase in activity during the first four years of life as rated by both mothers and teachers is associated with greater levels of externalizing behavior problems at age 7 as assessed by teachers.
Lafayette, Department of Biology and Department of Psychology, University of Colorado, Boulder, CO 80309.

P. ROBERT BRUSH. Shuttle-box Avoidance Learning: Behavioral, Genetic and Endocrine Factors.

Shuttle-box avoidance learning has been best modeled by two process theory, which places a heavy emphasis on the role of Pavlovian conditioned fear. Many behavioral characteristics of the Syracuse High and Low Avoidance (SHA/Brü and SLA/Brü) strains are consistent with that model if the observed behaviors are appropriately interpreted. In addition anatomical and physiological differences between the strains, which involve the limbic system and the hypothalamo-pituitary-adrenocortical axis, are consistent with that model. These findings are discussed in relation to other selectively bred strains, e.g., the Roman and Australian strains.

RICHARD G. BURRELL, D.A. BASILE, and P.J. DONOVICK. Cross Generation Effects of Low-Level Lead Exposure on Binghamton Heterogeneous Stock Mice.

Mice drank (ad lib) either water or a 0.52 aqueous lead acetate solution for none, one, two, or three successive generations. Various developmental measures, including behavioral activity were considered. Mice exposed to lead weighed less than mice drinking water, but did not differ in age of eye opening or latency to home nest return. Exposure to lead across two and three generations resulted in a marked and apparently cumulative increase in sterile matings, as well as dam and pup fatality rates. However, no such cumulative (or residual) effects were observed in the activity (assessed in open-field, running wheel, and swim tests) or surviving offspring at either 30 or 45 days of age. It appears that a selection effect for "lead tolerant" mice may have occurred; the implications of such a selection will be discussed.

KAZIMA B. BULAYEVA. Segregation analysis of psychophysiological traits.

As a result of the worked multi-level approach to the genetic study of small ethnic populations in the Caucasus great attention is given to the genetics of neuro- and psychophysiological traits. The evaluations of the reliability, variability and heritability as well as phenotypic and genetic analysis of their correlation in various human populations become are but necessary preliminary stages of genetic analysis which were carried out in our previous studies. The above stages of the genetic analysis determine the presence and degree of genetic determination of behavioral traits. The next stage for their genetic analysis is to define mechanisms of genetic determination of these traits by means of segregation and linkage analysis. Segregation analysis of some psychophysiological traits has been made by POINTER package on the basis of wide-scope population-and-family data which includes about 500 members from nuclear families. The data have been obtained in favour of the system on genetic determination of one out of the important indices that is critical flashing frequency (CFF) characterized by soviet psychophysiologies as the index of lability of the nervous system, mixed models which stipulate a major gene effect with a polygenic one. In 12 human populations stable phenotypical and genetic correlations of CFF with 6 types of RT(reaction time) and with SL and PI(speed and productivity of the solving logical nonverbal tasks from Cattel's test (Bulayeva et al., 1990, Biomedical Science, v.1) have been established.

W.I. Pavlov Institute of General Genetics, Russian Academy of Sciences, Gubkin St.3, Moscow 117809, Russia.

RICHARD G. BURRELL, D.A. BASILE, and P.J. DONOVICK. Cross Generation Effects of Low-Level Lead Exposure on Binghamton Heterogeneous Stock Mice.

Behavior Genetics Association 1992 - Page 25
MARIE CLAIRE BUSNEL¹, and A.J. DECASPÉR². Should Knowledge about Fetal Sensory Development Influence Thoughts in Behavior-Genetic Analysis?

The old controversy about nature and nurture and ideas about genetic programming might have to be modulated by what is now known of sensory stimulation's effect on the fetus. Not only does the fetus react to certain sensory stimuli in utero (M. C. Busnel and C. Granier-Defrere, 1983, in A. Olivero and M. Zapella, eds., The Behavior of Human Infants, Plenum Press) but even discriminates fine differences (like two syllables, or a male voice from a female one). He also becomes familiarized with the most usual stimuli and, after birth, prefers them to unknown ones (A. J. DeCasper and W. P. Fifer, 1980, Sciences, 208, 1174-1176). Even more intriguing since there is still a great deal to discover, is the behavioral plasticity of certain sensory organs when subjected to long duration stimuli, at times of high sensitivity. Does stimulation at critical periods imply a real transformation of that system's behavior in later life?


2. Department of Psychology, Spring Garden Street, University of North Carolina, Greensboro, NC 27412-5001, USA.

RITA M. CANTOR¹, M.A. SPENCE², G. HANNA³, V. VIELAND⁴, and H. NICOLIN⁵. Evidence for a Major Gene for Obsessive-Compulsive Disorder.

Obsessive-Compulsive Disorder (OCD) manifests itself in persistent ideas, thoughts, or impulses that are experienced as intrusive, senseless, and repetitive. There is a lifetime prevalence of 2-3%, an equal male to female ratio, and an increased risk to relatives. To elucidate the familiality, we have conducted a complex segregation analysis of 27 pedigrees ascertained through the UCLA Child Psychiatric Service. All first-degree relatives of the proband were either interviewed or, if not available, studied indirectly through informant relatives. Second-degree relatives were studied by the family history method. There were 314 relatives of probands in the study, 90 of whom were first degree. Complex segregation analysis with a normally distributed age correction was conducted using the REGTN subprogram of the Statistical Analysis for Genetic Epidemiology (SAGE) package. A dominant model, a recessive model, and a model with no major gene were each tested against a general model having 8 independent parameters by both likelihood ratio criterion and the Alikie information criterion. Results indicate substantial evidence for a major gene. We cannot, however, discriminate between the recessive and dominant models.

1. Neuropsychiatric Institute, UCLA School of Medicine, Los Angeles, California 90024.
2. Department of Psychiatry, University of Michigan, Ann Arbor, Michigan 48109.
4. Department of Psychiatry, University of Mexico, Mexico City, Mexico.

VU CAO¹, LINCOLN WILKINS¹, CAMERON BACKER¹, and ALLAN C. COLLINS². Behavioral Effects of Ethanol and Nicotine Co-administration Are Influenced by Genetic Factors.

Many studies have suggested that both alcoholism and tobacco use are regulated by genetic factors. Human alcoholics are almost invariably heavy smokers and the consumption of ethanol generally evokes increased tobacco use by alcoholics. However, very little is known about behavioral interactions between these two drugs. Consequently, the effects of ethanol, nicotine, and ethanol-nicotine combinations on two behavioral tests were determined. Behavioral tests included: a long-sleep (LS) test and short-sleep (SS) test. These tests used the long-sleep (LS) and short-sleep (SS) mice that were selectively bred for differences in duration of ethanol-induced anesthesia (sleep-time). The effects of drug injection were measured using two behavioral tests: the mirrored chamber test (a measure of anxiety) and the open field test (a measure of locomotor activity). Dose-response curves were constructed for the effects of ethanol and nicotine on both of these tests. Ethanol elicited a dose-dependent increase in the number of entries into the mirrored chamber, in the time spent in the chamber per entry, and in the total time per test spent in the chamber. Since diazepam treatment elicited similar effects we conclude that these changes reflect anxiety reducing effects of ethanol. The LS mice were more sensitive than were the SS mice to these potential anxiolytic effects. However, the SS mice were more sensitive than the LS to ethanol-induced increases in activity in the mirrored chamber. Nicotine treatment failed to evoke changes in mirrored chamber behaviors that resemble those evoked by diazepam, but changes in locomotor activity were evident. Nicotine treatment elicited dose-dependent decreases in activity in both mouse lines; the LS were more sensitive to this effect. The co-administration of ethanol and nicotine failed to alter the behavior of the LS mice, but SS behavior was changed dramatically. Nicotine-ethanol combinations resulted in marked increases in those mirrored chamber behaviors that are believed to reflect anxiolytic effects of drugs. The open field test also detected LS-SS differences. Ethanol treatment resulted in dose-dependent increases in open field activity in the SS mice whereas the LS mice exhibited only decreases in activity. Similar results were obtained with nicotine. The co-administration of low failed doses of ethanol and nicotine failed to evoke any marked changes in behavior whereas robust interactions were seen in the SS mice. Co-administration of subactivating doses of ethanol and nicotine resulted in profound increases in locomotor activity. These results further document LS-SS differences in sensitivity to both ethanol and nicotine and demonstrate that interactions between ethanol and nicotine are influenced by one or more of the genes that regulate sensitivity to the anesthetic actions of ethanol.

1. Institute for Behavioral Genetics, University of Colorado, Boulder, 80309.
2. Supported by NIAAA grant AA-06391 and NIDA grant DA-00116.
LON R. CARDON. A Longitudinal Hierarchical Model of Development with Application to Specific Cognitive Ability Data from the Colorado Adoption Project.

With genetically informative data such as twin or adoptee measures, hierarchical models of behavioral characters may be used to assess whether relationships among observed traits are due to common genetic influences or to trait-specific genetic factors. In this study, the genetic hierarchical model is extended to account for longitudinal assessments in order to explore issues relating to the stability of trait-specific versus common genetic effects over time, the impact and persistence of trait-specific and common genetic influences arising at specific occasions, the differentiation of common genetic influences into specific effects, and the effects of phenotypic assortative mating on inducing covariances among common and specific genetic factors. The longitudinal hierarchical model is applied to measures of specific cognitive ability obtained from adopted/nonadopted siblings and their parents in the Colorado Adoption Project. The sibling measures are collected at 3, 4, 7, and 9 years of age and are designed to assess verbal, spatial, perceptual speed, and memory abilities in an isomorphic fashion as possible. Results indicate both common and specific genetic influences at early occasions, with additional time-specific genetic effects on verbal and spatial abilities at later ages. Trait-specific genetic effects show substantial stability for all cognitive domains except memory abilities, whereas the stability of common, or general, genetic effects are less striking. The pattern of results suggests that the lack of stability for general genetic effects results from the differentiation of general into specific genetic influences over time. Assortative mating does not contribute greatly to the genetic factor covariances, but is nonetheless substantial.

1. Institute for Behavioral Genetics, University of Colorado, Boulder, CO 80309-0447.
2. Supported in part by NICHD grants HD-10333, HD-18426, and HD-07290. Analyses of these data were facilitated by BRSG Grant RR-07103-25 awarded to the University of Colorado by the Biomedical Research Support Grant Program, Division of Research Resources, National Institute of Health.

GREGORY CAREY. Pedigree analysis of antisocial symptoms, alcohol abuse symptoms, and drug abuse symptoms in adolescent substance abusers and their families.

A series of 35 severe substance abusing male adolescents and their first-degree relatives and a series of 35 control teenagers and their family members were administered a structured psychiatric interview that measured symptoms of antisocial personality, alcohol abuse/dependence and drug abuse/dependence. Within individuals and within families, the three types of symptoms were highly correlated, both among probands and their male and female relatives, suggesting a common familial etiology. A method for fitting multivariate models to selected and unselected samples is proposed and the results of the study discussed in terms of general versus specific familial contributions to substance abuse.

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2. Supported in part by grant DA-05131.

STACEY S. CHERNY and D. W. FULKER. Continuity and Change in General Intelligence from Ages 1 through 9 Years.

General intelligence was measured on 201 to 92 MZ twin pairs (the number depending on age) and 175 to 75 same-sex DZ twin pairs at 1, 2, 3, and 4 years of age drawn from the MacArthur Longitudinal Twin Study and 37 to 32 adopted and 103 to 43 nonadopted sib pairs and 342 to 278 siblings assessed at 1, 2, 3, 4, 7, and 9 years of age, drawn from the Colorado Adoption Project (CAP), with the decreasing numbers of twin and sib pairs arising from the ongoing nature of these studies. A total of 1481 children were assessed. The tests used were the Bayley MFM at ages 1 and 2, the Stanford-Binet at ages 3 and 4, the WISC-R at age 7, and a first principal component from the telephone administered CAP specific cognitive abilities battery at age 9. Genetic, shared environmental, and unique environmental influences on continuity and change during development were assessed employing a Cholesky decomposition. Due to the incomplete nature of these ongoing developmental studies, a Maximum-Likelihood pedigree approach was employed. The Cholesky decomposition indicated a distinct pattern of development for each of the three components. Genetic influences appear to drive the developmental process. There is strong genetic continuity in general intelligence from 1 through 9 years of age as well as evidence of new variation appearing at certain ages. The timing of this new variation is striking. New variation enters at ages 2 and 3, but not at 4. That is, general intelligence appears to have stabilized by age 4. However, at age 7, after the children have experienced schooling, new variation once more appears, but at age 6, there is again no new variation. Clearly some different genetic influences occur before and after entry to school, but with strong continuity throughout the entire period. The genetic component of variation and covariation was highly significant ($x^2 = 88.56, p < .001$). In contrast to the genetic component, that due to the shared environment indicated a single common factor with uniform loadings operating throughout the entire period ($x^2 = 4.29, p < .05$). At the specific environmental level, there is little continuity and mostly change. Simplex and common factor models were employed in a more searching analysis.

1. Institute for Behavioral Genetics, University of Colorado, Boulder, CO 80309-0447.
2. Supported in part by Grants HD-10333, HD-18426, and HD-18982 from NICHD, by BRSG Grant RR-07013-25 from NIH, and by a grant from the John D. and Catherine T. MacArthur Foundation. S. S. C. is supported in part by NSERC of Canada.

MICHELE CARLIER. The Separation of Genetic from Maternal Effects: Focus on the Mouse.

Maternal effect is said to occur when the phenotype of the progeny derives more from the characteristics of mother than of father. Adria Carlier, 1987, in T. Fujita and P. M. Nosten, eds Functional Teratogenesis, Teikyo Univ. Press, Tokyo, 27-38). Several components have been defined: cytoplasmic environmental, mitochondrial, uterine and post-natal (P. L. Roubertoux, M. Nosten-Bertrand and M. Carlier, 1991, Advances Study Behay., 19, 205-247). An overview of available methods used to disentangle these components is presented (classical mendel cross, quantitative genetic approach, adoption, embryo transfer and ovarian graft, nuclear manipulation). With examples, the technical advantages and disadvantages of each of these method as well as their limitations are discussed.

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S. COLE-HARDING1, and A.W.K. CHAN2. Influence of ethanol dose and mouse strain on the development and disappearance of rapid tolerance3

Rapid tolerance to the hypothermic effects of ethanol has been found frequently in mice after one dose of 3.5 g/kg (e.g., Crabbe et al., 1979, J. Pharmacol. Exp. Ther. 108, 128-133). In a series of preliminary studies, BALT6, C57BL/6 and DBA/2 mice were used to test the hypothesis that rapid tolerance also would develop after a lower dose of ethanol. Groups of animals were injected with a 2.5 g/kg (moderate) or 3.5 g/kg (higher) dose of ethanol, or saline on Day 1. On Day 2, mice that demonstrated tolerance to the hypothermic effect of ethanol were then tested at various intervals to determine if the tolerance disappeared. No tolerance was seen in the DBA groups after either treatment. However, the responses of the C57s and BALBs to treatment with 2.5 g/kg of ethanol appeared to be very different from the responses after the higher dose of ethanol. After the moderate dose, rapid tolerance was observed in both those strains. In BALBs the tolerance declined gradually between days 4 and 18. On the other hand, no tolerance was seen after the higher dose. In C57 mice, rapid tolerance after a 3.5 g/kg dose of ethanol disappeared after 1 day (Chan et al., 1985, Alcohol 2, 209-213). However, after one 2.5 g/kg dose, tolerance in the C57s had not attenuated after 30 days.

The persistence of rapid tolerance after a moderate dose of ethanol has been seen in ethanol-prefering (P) rats (Gatto et al., 1987, Pharm. Biochem. Behav. 28, 105-110) when measured by agility in an escape apparatus. Tolerance in the P rats persisted between 10 to 14 days after the last injection. The studies cited previously reported that rapid tolerance was not mediated by dispositional factors, regardless of dose. The results of our preliminary studies indicate that there may be different types of functional tolerance that develop after single injections of ethanol, possibly elicited by different patterns of physiological responses to moderate and high doses of ethanol.

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3. Supported in part by NIH PES # S07RR05938-05 and in part by PHS # AA06016.

ALLAN C. COLLINS1, YUEHONG LIO1, CAMERON BACER1, and MICHAEL J. MARKS1. A Recombinant Inbred Strain Analysis of Responses to Oxtremorine Using the LS-SS-Derived RI Strains2.

Numerous studies have suggested that ethanol exerts some of its behavioral actions by modifying the activities of brain cholinergic systems. These observations led us to test the sensitivities of the long-sleep (LS) and short-sleep (SS) strains, which were selectively bred for differences in duration of ethanol-induced anesthesia (sleep-time), to several of the actions of the muscarinic receptor agonist oxtremorine. Because the analyses of the effects of oxtremorine on Y-maze crossing and rearing activities and body temperature were performed following the injection of a 0.04 mg/kg oxtremorine dose, these effects were divided into two groups. For the LS mice, each group received a single dose of 2.5 g/kg ethanol. For the SS mice, the ethanol doses were 3.5 g/kg, and the ethanol dose was 2.5 g/kg / kg. The responses of the LS and SS mice to oxtremorine were compared to the responses of the LS-Ss-derived RI strains following the injection of a 0.04 mg/kg oxtremorine dose. This dose was chosen because both the LS and SS mice showed a response to this dose, and the LS-Ss differential was maximal.

A bimodal distribution of sensitivities was seen for each of the three responses. Approximately half of the 27 RI strains resembled the LS mice with respect to sensitivity to oxtremorine. The remaining strains were more sensitive than the SS mice, but were distinctly less sensitive than the LS mice. The bimodal distribution of the sensitivities of the RI strains suggests that a relatively simple genetic regulation of response to oxtremorine is involved. The responses to oxtremorine varied widely across the strains but were more highly correlated with one another, but they were not correlated with the sleep-time responses of the 27 RI strains to ethanol. The lack of correlation between oxtremorine response and the sleep-time response to ethanol argues that muscarinic, cholinergic systems are not a major system that regulates the sleep-time response to ethanol.

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2. Supported by NIAAA grant AA-06391 and NIDA grant DA-00116.

ROBIN CORLEY1 and HILARY COON2. Familial resemblance for the middle childhood interests of adopted and nonadopted children.

A previous report (R. Corley & H. Coon, Behavior Genetics, 21, 567, 1991) examined familial resemblance for television viewing and other interests in adopted and nonadopted children at age 7. In contrast to television viewing, other interests and activities in which children participate during the middle childhood years may be limited by formal age requirements (e.g., Little League baseball) or informal maturational requirements (e.g., the ability to read independently). These requirements limit the usefulness of a year-by-year developmental analysis of interests. We develop multi-year composite measures for middle childhood interests by combining parent and child reports of the child's interests and activities from age 7 through age 12, examining age of onset of interest, peak interest, number of allied interests, and sustained nature of interest. Interest domains examined include musical ability, dramatic arts, team sports, individual sports, and mechanical arts. We examine the degree of parent-offspring resemblance in adoptive and nonadoptive families, as well as sibling resemblance for the childhood composite interest measures for a partial sample of sibling pairs.

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Two-way active avoidance learning (TWAAL) in a shuttle-box correlates negatively with the size of the Timm-stained hippocampal intra- and infrapyramidal mossy fiber terminal field (IIP) in mice and rats (H. Schweger and H.-P. Lipp, 1981, Neurosci. Lett. 23, 25-30). Locomotor activity (LOCOM) in an open-field, TWAAL, and the size of the IIP were measured in 100 males from a 5x5 diallel cross and phenotypical, environmental, and genetic correlations (indicating functional relationships) between the different variables were estimated. Factor analyses showed that a correlation between the IIP and LOCOM was to a large extent responsible for the observed IIP-LOCOM correlation. Only in later stages of training did the IIP appear to play a role in processes directly related to learning.

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1 I gratefully acknowledge support from a NATO Science Fellowship, an Alexander-von-Humboldt stipend, the CNRS (URA 1294), and Dr. Herbert Schweger's valuable help with hippocampal morphometry.

By virtue of their genetic isomorphism and similar rearing environments, monozygotic (MZ) twins discordant for psychiatric disorder provide a unique vantage point for the study of the etiology and course of illness. For schizophrenia, MZ twins share the same genetic liability, yet concordance for schizophrenia among MZ pairs averages just under 50% (I.I. Gottesman, 1980, Schizophrenia Genesis: The Origins of Madness, W.H. Freeman & Co.). Study of discordant MZ twin pairs may provide clues about risk factors or protective factors associated with schizophrenia. In particular, by viewing the discordant co-twin as a control for the schizophrenia twin, analysis of personality data provides insight into pre-morbid personality patterns associated with schizophrenia and to the impact of schizophrenia on personality functioning. We present work in progress from a sample of MZ twins ascertained specifically to be discordant for schizophrenia. The twins were diagnosed via structured interviews and psychometric (MMPI) data. Normal personality traits were assessed via the Multidimensional Personality Questionnaire (MPQ), and comparisons were made between probands and unaffected co-twins as well as between the cotwins and estimates for the normal population.  

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P.DRISCOLL1, and A.FERNANDEZ-TERUEL2. The shuttle box as an anxiety test in rats.  

Studies with various drugs, including putative, endogenous ligands for benzodiazepine receptors, have indicated that deficiencies in two-way, active avoidance behavior in rats, particularly in the initial stages of acquisition, are likely due to an increase in anxiety. This contention is supported by other, non-behavioral genetic studies, data which have delineated the development of successful two-way avoidance acquisition as opposed to a tendency toward successful passive avoidance behavior and/or freezing behavior. These findings have been repeatedly borne out through the use of both non-selected rats with differing “anxiety baselines” and psycho-genetically selected stocks of rats, e.g. Roman and Syracuse high-avoiders and Maudsley nonreactive rats on the one side and, Roman and Syracuse low-avoiders and Maudsley reactive rats on the other. In addition, environmental influences which reduce fearfulness, such as postnatal handling, have also been shown to improve active avoidance acquisition. The behavior of rats in this test, therefore, as well as the effects of drugs on that behavior and the functional state of the benzodiazepine/GABA-Chloride channel complex (and other neurotransmitter systems), depends upon the emotional state of the subjects used.

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Grossarth-Maticek and Eysenck have recently (1990) described a revised questionnaire designed to identify six different personality types predisposing to different diseases, notably cancer and coronary heart disease. This inventory was completed by 127 pairs of German twins (61 monozygotic pairs - MZ; 66 dizygotic pairs - DZ). The MZ twins were significantly more concordant than the DZ twins for scores on four out of the six subscales, suggesting genetic determination of these traits. Heritabilities for these four scales (untransformed) were 80% for Type III (psychopathy), 65% for Type IV (healthy, normal), 75% for Type V (anomia) and Type VI (antisocial). Multivariate genetic analyses suggested both genetic and environmental correlations (negative and positive) between particular types such as Types I and IV.

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A Twin Study of Behavior Problems in Early Adolescence.1

This study provides a quantitative genetic analysis of behavior problems in adolescence using a twin design. Subjects included identical (n=99) and fraternal (n=82) twin pairs participating in the Western Reserve Twin Project. For each child, mother reports on the Child Behavior Checklist were collected via mail. Model-fitting analyses revealed significant genetic influence on all eight primary scales, as well as the second-order factors internalizing and externalizing. Two scales—anxious/depressed and delinquent behavior—also showed significant effects of shared environment. The results support an emerging literature on genetic influence on behavior problems in early adolescence.

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3. Supported by NICHD Grant HD-21947

1Elmer, G.I., 2Mathura, C.B., 3Schindler, C.W. and 4Goldberg, S.R. Conditioned tolerance to the analgesic effects of morphine in inbred mice.

The purpose of the current study was to investigate the genetic and environmental factors important in the development of tolerance by using three inbred strains of mice with varying opiate receptor concentration and acute behavioral response to opioids; C57/BL/6J, CB6K/B6J, and CXB/B6J mice. Each strain was divided into three groups, each group received two injections per day. Two groups of each strain were administered morphine specifically paired with the test room (Paired) or with the colony room (UnPaired); saline was administered in the opposite room. A third group was administered saline in both rooms (Control). Morphine and saline were administered in this manner for 8 days. On day 9, animals were tested for hot-plate nociceptive response following administration of morphine or saline. There was a significant effect of treatment condition but not genotype on morphine-induced analgesia. In all strains, only the Paired treatment condition produced tolerance. In the mice that received saline on test day, only the C57 mice showed a conditioned analgesic response. Thus, genotype did not affect the development of conditioned tolerance but, did affect the conditioned drug response.

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THOMAS J. FARLAN1,2 and T. JOHNSON2. Age-Dependent Gene Expression During the Adult Life Span of Caenorhabditis elegans.

We are exploring age-dependent changes in gene expression during the adult life span of the nematode Caenorhabditis elegans. In order to characterize changes in the abundance of transcripts with age, age-specific total RNAs were isolated from several synchronous C. elegans cultures. These age-specific RNAs are being analyzed, via Northern, dot blot and quantitative PCR analyses, to determine whether there are consistent age-dependent patterns of transcript abundance for a number of cloned genes. In addition, to directly isolate cDNAs for abundantly-expressed genes which exhibit altered levels of expression during the adult life span, we differentially screened a nematode cDNA library with cDNA probes from young adult and aged adult nematodes. Of the 23 distinct (as determined by cross-hybridization under stringent conditions) clones recovered from the screen, 13 gave a stronger signal with the young adult cDNA probe, and 10 yielded a stronger signal with the aged adult cDNA probe. Thus, if this pattern is altered, it strains with genetically-extracted life spans. We will begin sequencing and mapping clones showing reproducible patterns of expression.

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FARACE, E. and GOTTMAN, J. Use Genetic Data and Just Say No to Negative Symptom Schizophrenia.

Although schizophrenia is phenotypically heterogeneous in phenomenology and course, it is not known how much this reflects heterogeneity on an etiologic level. Previous attempts have been made to categorize varying symptoms of schizophrenias qualitatively by sorting patients' clinical presentation of positive and negative symptoms as indicators of different "types" of the disorder. A review of the literature reveals that quantitative and qualitative methods, such as dividing probands by subtype and then examining the frequency of schizophrenia in relatives regardless of subtype, may be the most reliable method of determining patterns, if any. This review showed that clinical heterogeneity in schizophrenia represents different points along a continuum of genetic and environmental liability for the disorder. That is, varying amounts of genetic loading and timing of stressors result in differing severities of the disorder. "Positive and negative symptom" schizophrenia represent mixtures of trait- and state-dependent aspects of a phenotype.

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DIANA E. FORDYE1 and JEANNE M. WEHNER2. The Effects of Physical Activity on Learning Performance in C57 and DBA Mice,1,3.

Previously, we have found that physical activity, in the form of moderate-pace treadmill running, increased performance on the place-learning-set spatial task and altered hippocampal pre- and post-synaptic cholinergic function, high affinity choline uptake and muscarinic receptor density, in F344 rats (D.E. Fordye and R.F. Ferrar, 1991, Behav. Brain Res., 46, 123-133). The protocol did not induce stress as determined by adrenal gland analysis.

The present study was designed to investigate whether moderate-pace physical activity would improve learning performance in two genetic strains of mice, C57BL/6Dbg and DBA/2Dbg, differing in initial performance levels. Relative to C57 mice, DBA mice perform poorly on the Morris water maze spatial learning task (J.M. Wehner, S. Sleight, M. Upchurch, 1987, Brain Res., 523, 181-187) and show an associated reduction in total particulate protein kinase C activity. The treatment of moderate-pace treadmill running altered performance, measured behaviorally and biochemically, in both C57 and DBA mice compared to sedentary controls. All mice were tested on two types of spatial learning tasks, the Morris water maze task and the more stringent place-learning-set task, and the hippocampal neurochemical parameters of high affinity choline uptake, muscarinic acetylcholine receptor density, and post-synaptic protein kinase C, cytosolic and particulate, activity were analyzed.

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2. Supported by NSF BNS-8820076 and Training Grant # HD-07289

Helen Forsberg' and Richard Olson'. Heritable deficits in phonological awareness, rapid-naming, and short-term memory skills are linked to disabled readers' heritable deficits in phonological decoding.

Disabled readers' group deficit in the oral reading of pronounceable nonwords (phonological decoding) is highly heritable (h2 = .76) and accounts for 80% of the heritable variance in disabled readers' performance in word recognition (R.K. Olson, J.J. Gillis, J.P. Rack, J.C. DeFries and D.W. Fulker, 1991, Reading and Writing, 3, 235-248). To assess possible pathways of genetic influence on phonological-decoding deficits in reading, we observed the genetic covariation between probands' deficits in several non-reading tasks and cotwins' deficits in phonological decoding. Different groups of MZ and DZ twin-probands were selected on each non-reading measure for performance that was at least 1.5 SD below the population mean. Genetic covariation for each measure was then assessed by comparing the regression of MZ and DZ cotwins' phonological decoding toward the population mean. Significant genetic covariation of phonological awareness skills with phonological-decoding deficits was found when probands were selected for deficits in phoneme segmentation (b = .73, SE = .19) and phoneme deletion (b = .63, SE = .24), but not for rhyme generation which yielded significant shared-environment covariation (b = .38, SE = .31; g2 = .62, SE = .25). Significant genetic covariation was also found with deficits in a rapid naming task (b = .71, SE = .30), deficits in WISC-R digit span (b = .88, SE = .26), and deficits in verbal tests on the WISC-R (b = .75, SE = .24).

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2. Supported in part by NICHD Grants HD 11681, HD 27802 and HD 22223.

J.W. Gilger, B.F. Pennington, I. Borecky, and J.C. DeFries. Co mingling and Segregation Analysis of Complex Psychological Traits: Are Extremes of Norel Variance Etiologically Distinct?

Though a variety of psychological traits appear heritable, it is unclear whether the genes responsible for abnormal or extreme values of the trait are the same as those contributing to normal trait variability. Using reading disability (RD) as an example of an extreme in normal variation in reading skills, we present results from a segregation study (SegMix) and a segregation (POINTER) analysis performed on a continuous reading phenotype in 133 RD and 125 nonRD families. It was hypothesized that if RD is due to a unique genetic mechanism, separate from normal variation, multiple distributions (co mingling) and clear genetic segregation patterns for the phenotype should be observed in the RD, but not the nonRD families. Preliminary results show significant co mingling only in the RD families, and distributed segregation patterns of genetic segregation in the RD and nonRD families for the reading phenotype. The method used here has gener al implications for addressing similar issues regarding the etiology of extremes for other complex psychological disorders.

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DAVID M. GILLIAM\(^1\) and KINDLER J. CHASE\(^2\). Ethanol teratogenesis in three inbred mouse strains. The C57BL\(\text{I}/6\) (B6) mouse is particularly susceptible to ethanol teratogenesis, which possibly results from a unique polyallelic combination. Such a genotype would likely never occur in other inbred strains predicting the B6 mouse is singular in its susceptibility. To determine whether other inbred strains show susceptibility, we examined ethanol teratogenesis in DBA/2Ibg (D2) and \(\text{A/Ibg}\) (A) mice. C57BL/6Ibg mice were included as a positive control. Dams were given either 5.5 g/kg ethanol (E) or an isocaloric amount of maltose-dextrin (MD) by oral gavage on day 14 of pregnancy. Fetuses were removed on day 18 of gestation weighed, and assessed for gross malformations. Results show similar weight deficits in B6-E and A-E litters compared to their controls; no weight deficits were seen in D2-E litters. Ethanol increased the percentage of litter malformations in B6 mice, while fetal mortality increased in A mice. Specific ethanol teratogenic endpoints appear to be genotype dependent. 1. Department of Psychology, University of Northern Colorado. Greeley, CO 80639.

JACQUELYN J. GILLIS\(^3\), J. C. DEFRIES\(^3\), B. F. PENNINGTON\(^3\), and J. W. GILGER\(^3\). Genetic etiology of comorbid reading disability and attention deficit hyperactivity disorder.\(^3\) Although reading and learning disabilities often co-occur with symptoms of Attention Deficit Hyperactivity Disorder (ADHD) (D. P. Cantwell and L. Baker, J. Learn. Disab., 24, 88–95, 1991), the genetic and environmental etiologies of the comorbidity between these disorders is unknown. Because significant genetic variation has been reported for both reading disability and ADHD (J. C. Defries, D. W. Fulker, & M. C. LaBuda, Nature, 329, 537–539, 1987; J. Stevenson, Behav. Genet., in press), their comorbidity may be due at least in part to the same heritable influences. The present study examined the genetic etiology of the comorbidity between ADHD and reading disability in a sample of twin pairs participating in the Colorado Reading Project. Subjects in the present study included 61 identical (MZ), 43 same-sex (fraternal, DZ), and 44 opposite-sex (DZ twin pairs for which complete reading and behavioral data were available. A composite measure of reading performance was computed using scores from the Peabody Individual Achievement Test (L. M. Dunn & F. C. Markwardt, American Guidance Service, Circle Pines, MN, 1970) Reading Recognition, Reading Comprehension, and Spelling subsets. ADHD symptoms were measured using the Attention Deficit Disorder Diagnostic Interview for Children and Adolescents – Parental Interview form (B. Herjani, J. Campbell, & W. Reich, J. Abnorm. Child Psychol., 10, 307–324, 1982). The data were fitted to a bivariate extension of the basic multiple regression model for the analysis of selected twin data (J. C. Defries, D. W. Fulker, Behav. Genet., 15, 467–473, 1985) in which cotwins’ ADHD scores were predicted from reading-disabled probands’ reading scores and the coefficient of relationship (1.0 for MZ and 0.5 for DZ twin pairs). Although the phenotypic correlation between reading performance and ADHD scores is only 0.35 in this sample, the estimate of "bivariate h\(^2\)" (0.28 ± 0.13, \(p = 0.003\)) suggests that about 80% of their covariance is due to genetic factors. Thus, the comorbidity between reading disability and ADHD is due at least in part to heritable influences. 1. Institute for Behavioral Genetics, University of Colorado, Boulder, Colorado 80309. 2. University of Denver, Denver, Colorado, 80208. 3. Supported in part by NICHD grants HD-11681 and HD-27802 and by NIMH grant MH-16880.

I.S. GLEICHauf, P. DRISCOLL, and K. BAETTIG. Effects of drinking ethanol before and after giving birth, with or without pre- and postnatal injection stress, on the maternal behavior of Roman high- and low-avoidance (PHA/Verh and RLA/Verh) rats. Several facets of maternal behavior were observed 4X daily (D) and 6X nightly (N) in 54 PHA/Verh and RLA/Verh litters, using a time-sampling method. The mothers were either controls (HC, LC) or ethanol during gestation and for 2 wk after birth (HE, LE), had been injected 2X daily with physiological saline for 2 wk before and for 2 wk after birth (HS, LS) or had been subjected to the latter two conditions (HES, LES). Ethanol effects were mostly observed in N rats. As in earlier studies, LC had a higher active-passive (A/P) position ratio (DAN), slept less often within the nest (DAN), changed nest location more often (D) and had more teratogenic endpoints (D & N). All except A/P were altered significantly in HE (DAN), eliminating the rat line differences. Compared to D, N increased sleeping outside the nest in both H and L, while reducing both sleep and contact with the pups. Ethanol increased sleep at night in both HE and LE. Unlike earlier studies, the stressor had little effect on most behaviors in either line, and HES and HES rats generally behaved as if they had only had ethanol. It was concluded that the earlier regimen used (3-4X nightly injections) was probably more effective as a stressor than that used (2X daily) in the present study. 1. Behavioral Biology Laboratory, ETHZ, 8092-Zurich, Switzerland.

QUASTAVINO, J.-M. Murine cerebellar mutation and learning in a water escape device. Effects of the mutation and of the strain. The behavior of two cerebellar mutants, "hot-foot" and "staggerer", has been tested in a water tank and compared to 'normals' of the same strains: C57BL both for the staggerer and the hot-foot and DBA2 for hot-foot. The locomotor deficit is in an aquatic device not so markedly altered slightly the escape behavior in the C57BL strain, impairing it strongly in the DBA2 strain. These mutants showed very poor improvement during the 5 day period of trials. 1. Department of Psychology, University of Colorado, Boulder, Colorado 80309. 2. University of Denver, Denver, Colorado, 80208. 3. Supported in part by NICHD grants HD-11681 and HD-27802 and by NIMH grant MH-16880.
MARTIN E. HAHN, FRANK MANGINELLO and JOHN K. HEWITT. A Preliminary Analysis of Neonatal Cry Characteristics in Human Twins.

The cries of newborn infants have been studied for more than 30 years. As a result, the sources of individual differences in cries are being catalogued and include such variables as birth weight, gestational age, status of the CNS and nutritional state. The importance of genotype as a source of individual differences has not been studied with the exception of one study of 16 pairs of twins. That study found no evidence to support a genetic source of variance on the aspects of cries measured but in only 7 of the pairs was specificity determined by blood groups (P.F. Ostwald, D.G. Freedman and J.H. Kurtz, 1962, Folia Phoniat. 14:37-50). We have begun a study of the cries of twins at birth and in two painful situations (one injection and one "heel stick"). At this point we have recorded 36 sets of MZ and DZ twins (verified by blood groups). Analysis to date reveals significant correlations for the fundamental frequencies of cries in MZ twins of about .80 and non-significant correlations of about .40 for DZ twins. Melody types (changes in pitch over time) of cries in some of the MZ pairs are strikingly similar.

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ANDREW C. HEATH and NICHOLAS G. MARTIN. Genetic structure of personality: different constructs, same dimensions of genetic variability?

The recent proliferation of personality assessments in behavioral genetic research has not clarified the extent to which different personality assessments, designed to measure different personality constructs, are in fact assessing the same underlying dimensions of heritable variation. We explore the use of multivariate genetic twin regression models, instead of genetic factor models, to address this question. Self-report data on short-form versions of the Eysenck Personality Questionnaire (Revised) and the Tridimensional Personality Questionnaire of Cloninger have been obtained from 2680 adult twin pairs in the 1989 survey of the Australian Twin Register. Univariate genetic analysis confirmed significant genetic contributions to variation in scores on Cloninger's Harm Avoidance, Novelty Seeking and Reward Dependence dimensions, accounting for between 50-65% of the stable variation in these traits. By fitting multivariate genetic triangular decomposition models, we were able to show that Harm Avoidance is assessing the same dimensions of genetic variability as the Eysenckian constructs of Extraversion and Neuroticism, corresponding closely with Gray's construct of Anxiety, but that for Novelty Seeking and Reward Dependence, substantial residual genetic variance, not explained by genetic factors assessed by the EPO-R, was found.

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3. Supported by ADAMHA grants AA03539, AA07535, AA07728, DA05588, MH1302 and MH40828, and a grant from the Australian National Health Medical Research Council.

DEBRA HELLER, GERALD E. MCCLEARN and FRANK AHERN. An Application of Canonical Correlations to Personality in Twins.

The concept of finding a linear composite of variables which maximizes the intraclass correlation of monozygotic twins has been applied to ridge count (C.A.B. Smith, Ann. Eugen., 17: 286-292; S. B. Holt, Ann. Eugen. 17: 293-301, J. Rostron, Ann. Hum. Genet. 41: 199-203) and psychological tests (M. B. Jones, Psychol. Bull. 75: 92-96). Canonical correlations, which maximize the correlation between linear composites of two variable sets, present a powerful multivariate technique to maximize the correlation between co-twins. A canonical maximizing the correlation of monozygotic twins reared apart would in theory identify a maximally heritable combination of variables.

This approach has been applied to personality scales from the Swedish Adoption Twin Study of Aging (SATSA). The personality scales, as measured by questionnaire, include neuroticism, extraversion, emotionality, activity, sociability, fear, impulsivity, monetary avoidance, and anger. Canonical variates were designed first to maximize co-twin resemblance for monozygotic twins reared apart (MZ). Composite personality scores were then computed for all twins using the canonical coefficients obtained from the MZA canonical correlational analyses. The intraclass correlations of the canonical composites were then modeled for the four groups of twins (MZ, DZ, MZA, DZT) in order to estimate the genetic and environmental contributions to variance. The utility of multivariate canoni cals in identifying combinations of variables most susceptible to environmental effects will be discussed.

1. Program in Biobehavioral Health, Penn State University.
2. Supported by NIA Grant AG-04563 and the MacArthur Foundation Research Network on Successful Aging.

NORMAN D. HENDERSON. General Activity Level -- The Ubiquitous G DNA in Animal Behavior Genetics.

Additive genetic correlations among various locomotor activity measures in house mice tend to be high, even when significant differences exist in the underlying genetic architectures of the individual behaviors (N.D. Henderson, 1986, Behav. Genet. 16: 201-220). The current report extends the argument to show that the genetic variation observed in behaviors not normally thought of as reflecting general activity level may in fact have a high genetic loading on G DNA in a study involving ten inbred strains of house mice (Mus domesticus, N = 693, 5 JAX strains and 5 Connor strains) the additive genetic correlation between locomotor activity in an arena and behavior related to nest building (cotton nesting material pulled into home cages) was .76, suggesting that both behaviors are highly loaded on a common G DNA. The effects were consistent within both groups of strains and the average within-strain environmental correlation was close to zero. The reasons for, and the implications of, a ubiquitous genetic influence on a wide variety of apparently different behaviors (e.g., sexual, maternal, aggressive, thermoregulatory, hoarding, learning) will be addressed.

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The variance of an individual's item responses to a personality scale may be used as a measure of personality consistency. Genetic analysis may be applied both to the level of a trait (the total score on a personality scale) and the consistency of the trait (the standard deviation of item responses). A number of personality scales from the Swedish Adoption-Twin Study of Aging (SATS4) were analyzed with respect to trait consistency, with the following results: (1) moderate stability in trait consistency existed across three years; (2) a moderate correlation existed between trait consistency and level; and (3) an average heritability of 42% was discovered for trait consistency across 20 personality scales; and (4) the correlations between genetic influence on trait consistency and trait level for most of the personality scales was non-significant, suggesting that trait consistency provided an alternative view of personality.

References:
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Strains DBA/2 (high) and C57BL/6 and DBA/1 (low) show clearly separated distributions of avoidance scores. As high scores are dominant in both F1 generation, carriers of DBA/2-derived alleles can be reliably separated in segregating generations. We transferred these alleles to the recessive C57BL/6 and DBA/1 backgrounds by repeated backcrossing for over more than 10 generations. Congenic strains for this behavioral trait are now being established. Analysis of response latencies in the shuttle box suggests that the poor avoidance performances of C57BL/6 and DBA/1 may be due to different mechanisms. Performance differences between high- and low-avoiding backcross animals in other tests (open field, T-maze) disappeared in the course of backcrossing. Hippocampal mossy fiber distributions were almost identical, too. While in DBA/2 high avoidance performance coincides with high intertrial activity, this was not so in high avoiding backcross animals. Results suggest that backcross animals do not differ in emotionality or locomotor activity.


The genetic contribution to personality disorder has received little detailed attention in the psychiatric research literature. Subjects, 52 monozygotic and 63 dizygotic twin pairs, completed the Dimensional Assessment of Personality Pathology Questionnaire - a self-report questionnaire that measures 18 factor analytically based dimensions of personality disorder in clinical and general population subjects (W. J. Livesley, D. N. Jackson, & M. L. Schroder, 1989, A Study of the Factorial Structure of Personality Disorder. Journal of Personality, 3, 292-306). General population subjects were used because their responses to questions of psychopathology have consistently been shown to be similar to those obtained from clinical samples. An additive genetic model (A,C,E) was fitted to age and sex adjusted data. Moderate heritabilities were found for many dimensions of personality disorder although the magnitude was not consistent across all dimensions (range .085 to .731). The heritabilities of related dimensions were, however, consistent. Furthermore, environmental coefficients show that nonshared events are significant in the etiology of personality disorder.

References:
1. Institute of Neurobiology, D-0-3010 Magdeburg, Germany.
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3. Supported by BMFT grant 031944A.


Two closely related inbred strains, AB/Halle (aggressive) and ABG (non-aggressive), differ markedly in spontaneous (SA) as well as isolation-induced aggression (IIA). A Mendelian-cross analysis suggested the involvement of only few genetic factors. By repeated backcrossing with concurrent selection, the AB/Halle alleles could be introduced into the genetic background of the low aggressive ABG strain. From the 10th backcross generation we established congenic strains with almost identical genome but differing for the locus (or loci) correlated with variation in aggressive behavior. The first behavioral analyses suggest that both SA as well as IIA depend on the same or adjacent genes.

The variance of an individual's item responses to a personality scale may be used as a measure of personality consistency. Genetic analysis may be applied both to the level of a trait (the total score on a personality scale) and the consistency of the trait (the standard deviation of item responses). A number of personality scales from the Swedish Adoption-Twin Study of Aging (SATS4) were analyzed with respect to trait consistency, with the following results: (1) moderate stability in trait consistency existed across three years; (2) a moderate correlation existed between trait consistency and level; and (3) an average heritability of 42% was discovered for trait consistency across 20 personality scales; and (4) the correlations between genetic influence on trait consistency and trait level for most of the personality scales was non-significant, suggesting that trait consistency provided an alternative view of personality.

References:
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2. Genetic, Neurogenétique et Comportement, URA 1294 au CNRS, 45 rue Saints-Pères, 75270 Paris Cedex 06, France.
3. Supported by BMFT grant 031944A.
Using data from the Minnesota Twin Registry, McGue and Lykken (in press) found that genetic factors contributed substantially to risk of divorce. The present study seeks to investigate the relationship between marital history and personality. The MPQ (A. Tellegen, Unpublished manuscript, 1982) and a marital history questionnaire were completed by 763 MZ and 993 DZ twin pairs. The relative contributions of genetic and environmental factors to various aspects of marital history were assessed, and cross-correlational analysis was used to determine the extent to which covariation between aspects of marital history and subscales of the MPQ was genetically and environmentally mediated.

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Ronald C. Johnson1, Abraham J. Weatherspoon1, and George P. Danko1
Chinese-American and Korean-American alcoholism in Hawaii

Persons of Chinese ancestry, whether assessed in Asia, Hawaii, or in the U.S. mainland are very low in alcohol use. Homeland Koreans are very high in alcohol use and have a far higher rate of problem drinking than North American (nearly all Caucasian) samples. Korean-Americans and Chinese-Americans residing in Hawaii do not differ significantly from one another in reported alcohol use or in beliefs concerning the nature of normal or of problem alcohol use. As in prior research, individual differences in beliefs concerning the nature of normal alcohol use are powerful predictors of reported consumption. The extremely large differences in alcohol consumption between Taiwanese Chinese and homeland Koreans, as compared with the almost non-existent differences between Chinese-American and Korean-American residents of Hawaii suggest a social explanation for group differences in alcohol use.

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THOMAS E. JOHNSON1,2, J. C. DEFRIES1,2, A. K. JENSEN1, and P. D. MARKEL1,2
Mapping Quantitative Trait Loci for Behavioral Traits In The Mouse3

After more than 30 years of studying various behavioral traits in the mouse, it is clear that most are heritable and are specified by complexes of genes or quantitative trait loci (QTLs). In order to attain a more complete understanding of the genetic causes of individual differences in behavior, the mechanisms of action of these QTLs must be elucidated. The most straightforward approach to determining the mechanism of action of a particular QTL is to identify and molecularly clone the gene; this can be done by positional cloning which depends on precise knowledge of genetic map position. As the genetic data base for the mouse genome continues to develop, such strategies will become increasingly easy to perform. Here we suggest a multistage strategy for QTL mapping using recombinant-inbred strains of mice: (1) characterize genomic DNA from parental strains originally used to generate the RI strains; (2) characterize the RI strains for DNA markers that differ in the parental strains; (3) assess the quantitative character in F2 mice derived from crosses between the parental strains, and then determine genotype of selected F2 mice for markers that account for at least 5% of the additive genetic variance. We illustrate the approach with examples from our mapping QTLs specifying neural sensitivity to the anesthetic effects of ethanol.

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AMY J. JULIAN1, ROBERT PLOMIN1, JULIA M. BRAUNGART1, D. W. FULKER2, & J. C. DEFRIES3
Genetic Influence on Communication Development: A Sibling Adoption Study of Two- and Three-year-olds4

The present study examined genetic influence on communication development during toddlerhood using the sibling adoption design. The Sequenced Model of Communication Development, consisting of expressive, receptive, and total scales, was administered to the full sample of sibling pairs (73 adoptive, 83 nonadoptive) from the Colorado Adoption Project when each child was two to three years of age. Nonadoptive sibling correlations were greater in magnitude than adoptive sibling correlations on both scales, indicating genetic influence on expressive and receptive communication development. Additionally, cross-sibling longitudinal correlations from two to three years were greater for nonadoptive than adoptive pairs, indicating genetic influence on continuity in language development from two to three years of age. Finally, results of bivariate analyses suggested substantial genetic covariation between expressive and receptive scales at age two, but less genetic covariation at age three. Maximum-likelihood model-fitting analyses confirmed these results.

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3. Supported in part by NICHD (HD-10333 and HD-18426) and NSF (BNS-8806589).

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The present study presents preliminary results of genetic influence on multiple behavioral variables in Recombinant Inbred (RI) mice measured using the Omnitech apparatus. The Omnitech device continuously assesses a standard battery of behavioral measures, including various dimensions of activity and stereotypy, and records responses directly into a computer. Fifteen of the BXD/Ty RI strains (n=10 per strain) were measured on 21 behavioral variables at six 5-minute intervals. Heritability was estimated to range from 0% to 57% for 21 variables. Genetic correlations between strain means and quantitative trait loci analyses were presented.

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3. Supported in part by NIAAA (AA08125) and a gift from John Hanley.

WENDY J. KEIR1 and A.L. MORROW1. Are GABA_A Receptor Subunit mRNAs in Mammalian Brain Differentially Polyadenylated?2

Our laboratory has been investigating the possibility that genetic differences in behavioral traits are mediated by alterations in receptor gene regulation. Currently, we are studying the regulation of the GABA/benzodiazepine (BZ) receptor complex. GABA/BZ receptors are characterized by the presence of multiple distinct recognition sites and multiple distinct subunit compositions which form functionally distinct ionoreceptors. Sixteen subunits of this receptor have been cloned from the mammalian brain including several distinct classes of subunits designated α, β, γ, δ, and ρ. The exact composition of native GABA_A receptors in mammalian brain and their corresponding stoichiometry is unknown. In order to study the regulation of GABA_A receptor expression, we have used specific cRNA probes. Using Northern blot analysis, we have recently observed differential polyadenylation among GABA_A receptor mRNA transcripts. Specifically, the α1 and β2 transcripts appear to be polyadenylated while the β1 and β2 receptor subunit mRNAs are detected in greater abundance in total RNA preparations than in poly A+ RNA preparations. This finding suggests that all GABA_A receptor subunit mRNAs may not be polyadenylated. Therefore, studies of GABA_A receptor expression should be conducted in both poly A+ and total RNA preparations.

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CARLETTA KING1, A.K. WATSON2 and J.R. WILSON2. Differences in Dietary Consumption Between Smokers and Non-Smokers.

We are examining differences in the dietary intake of smokers and non-smokers as part of a larger Behavioral Genetic Analysis of Cigarette Withdrawal study. Friedman, King, Klatsky & Huiley (1981), reported that, on average smokers tend to weigh less than non-smokers. Additionally, Subar, Harris & Mantson (1990), reported that non-smokers appear to consume more foods that are high in vitamins, minerals and dietary fiber, while Fisher and Gordon (1985) have shown that smokers tend to consume more fatty foods. Subjects for this study were chosen when the ages of 18 and 55, and smoked between 10 and 40 cigarettes per day. Subjects were mailed a three-day food diary one week prior to entering the lab for a testing session. This diary included instructions and diagrams that asked the subjects to record all food and drink ingested during the three-days prior to their scheduled test. These data were then entered into the computer via the Nutritionist III software package from N-Squared Computing Software, Salem, OR. This program obtains averages from the three-day food diary, and separates the averages into 56 individual nutrient values. These data were then analyzed using a 2-way ANOVA, smokers vs. non-smokers and gender. For weight, there were no significant differences between smokers and non-smokers. This finding could be due to our subjects being recruited from the health conscious Boulder area. However, it was found that smokers consumed significantly more fats, and high cholesterol food items than non-smokers. Moreover smokers and non-smokers differed significantly on several other variables including alcoholic and caffeinated beverage consumption, and vitamin intake. These findings, for the most part, lend a measure of support to previous research in this area, with the exception of the lack of significant differences between the groups in weight.

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2. The partial support of NIDA Center Grant DA-05131 is gratefully acknowledged.

ELIZABETH A. LAFFAN2 and JAMES R. WILSON2. Predicting Craving During Short Term Cigarette Withdrawal.

Smoking cessation is a difficult process and many smokers fail to quit or relapse within the first year. The various symptoms of withdrawal are often cited as the cause of relapse or failure to quit. Cravings or urges for cigarettes have been widely reported as one of the most common and rapid withdrawal symptoms to appear. There is wide individual variation for the onset, frequency, and severity of cravings. The factors which contribute to these individual differences are somewhat elusive. As part of a larger genetic study on the symptoms of cigarette withdrawal, data are being collected on craving both prior to and during a short (5 hour) withdrawal period. Craving is measured as part of a questionnaire on smokers complaints (Shiffman & Jarvis, 1976, Psychopharmacology 50:35-39). As predicted, the smokers self-reported craving for cigarettes generally increases as the length of withdrawal increases. However, large individual differences do exist. Anxiety is also measured over the withdrawal period using the State Trait Anxiety Inventory (STAI) (Spielberger, et al., 1970, Manual for the State Trait Anxiety Inventory, Con. Psych. Press, Palo Alto, CA). The subtest that obtains the Eysenck Personality Questionnaire (EPQ), (Eysenck; et al., 1985, Persorn. Individ. Diff. 6:21-29), smoking history questions, and a motivation for smoking scale (Russell, et al., 1974, J.R. Statist. Soc. A. 137:313-333). To explore the factors contributing to the individual variation in craving, a multiple regression analysis was performed. For this analysis craving was scored as the residualized difference between the craving reported prior to withdrawal and at maximum withdrawal to correct for any baseline differences. Four predictor variables explained 30% of the variance in craving scores. The predictor variables were: the extraversion score from the EPQ (2%), the number of years smoking (7%), the score on the STAI at maximal withdrawal (10%), and the automatic smoking score from the motivation scale (13%). With further research it may be possible to predict the level of craving and possibly other withdrawal symptoms. This information could be useful in implementing appropriate cessation strategies.

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The mode of inheritance for speech and language disorders was investigated in a sample of 276 nuclear families ascertained through 45 probands with a documented history of preschool speech and/or language delay. Affected status of first, second, and third degree relatives was determined through interview of the probands or their parents, using strictly defined criteria. Hypotheses concerning mode of inheritance were tested using the computer program POINTER, which compares single major gene, multifactorial, and mixed models of transmission, as well as testing for Medelian transmission probabilities for the major gene (J.M. Lalouel, D.C. Rao, N.E. Morton, and E. Elston, 1983, Amer. J. Hum. Genet., 35: 816-826). Results are consistent with a multifactorial mode of inheritance with estimates for heritability of 40-70%. Weak evidence is also found for a major recessive gene, but transmission of this component appears to follow non-Mendelian transmission probabilities.

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PAUL LICHTENSTEIN1,2, NANCY L. PEDERSEN1,2, and GERALD, R. McCLEARN3, Genetic and Environmental Predictors of Socioeconomic Status4.

An earlier report from the Swedish Adoption/Twin Study of Aging (SATS) has shown both genetic and shared environmental influences on socioeconomic status (SES), as measured by occupational status and educational achievement (Lichtenstein and Acta Sociologica, in press). In this study we investigate the importance of genetic and environmental effects on SES after controlling for effects on IQ and attitude towards education (ATE) in the rearing home, in 83 pairs of male twins in the SATS study.

Both IQ and ATE were substantially correlated with SES. Genetic effects significantly mediated the correlation between SES and both IQ and ATE. However, about 50% of the genetic effects were unique to SES. Non-shared environmental effects were primarily unique to SES, while much of the shared environmental effects were in common between SES and ATE.

Thus, genetic effects on SES are not solely due to effects in common with IQ, and shared environmental influences for SES are not only due to the attitudes towards education in the rearing home. Non-shared environmental was the most important component of variance unique to SES, and thus not contributing to the correlation with IQ and ATE.

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We are using three distinct genetic approaches (classical, quantitative, and molecular) to identify genetic functions involved in the specification of longevity and senescence (classical aging). We have identified one gene, age-1, the mutant form of which lengthens life span up to 70%. We are attempting to clone this gene using a novel multipoint mapping strategy. age-1 has been mapped to the center of chromosome II and the four-fold reduction in hermaphrodite self-fertility (fru) previously associated with this mutation map to another site on II. We have also obtained long-lived strains by generating recombinant inbred strains between two wild type strains and comparing life span of the joint action of many genes and these genes are being localized using a strategy employing a multiplex Tci-based PCR approach. We are also identifying genes that are differentially expressed over the life span of the nematode by screening a cDNA library with cDNA made from "young" vs "old" nematodes.

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4. Supported by research grants AG-08322, AG10248, and AA-0527 and a RO1, K04-AG369, to J.R.


As part of a larger study on behavioral genetic analysis of cigarette withdrawal symptomology, the present study examines cigarette withdrawal symptomology in order to identify changes in the mood components of anxiety, indirect aggression, and stress. Further analyses of the mood data of MZ and DZ pairs were performed in order to partition the variance into genetic and environmental components. The mood data of smokers and non-smokers, including MZ pairs, DZ pairs, and control subjects, were obtained using a battery of mood tests that were administered several times during a 10-hour testing day (two times during cigarette withdrawal, three times after smoking, and once again after resumption of smoking). The results indicated that smokers become more anxious, aggressive, stressed, and complain more during a short period of withdrawal from cigarettes. These results are consistent with previous studies that have found increased levels of anxiety, aggression, and other withdrawal symptoms during cigarette withdrawal (e.g., Hughes et al, Psychopharmacology, 83, 82-87, 1984). The genetic analyses of the mood data yielded no significant results. These insignificant results may be due to the small sample sizes available to date, or may be accurately indicating that the genetic contribution to these cigarette withdrawal symptoms is low.

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This abstract reports preliminary data from the Harvard Twin Study of Drug Abuse. Twins from the Vietnam Era Twin Registry were interviewed by telephone (942 MZ pairs and 648 DZ pairs). The Registry comprises twins who served in the military during 1964–72. Subjects from pairs in which both members indicated they had used marijuana more than five times (149 MZ pairs and 98 DZ pairs) were asked if they had ever experienced each of a number of subjective reactions. The frequency of individual reported reactions was quite variable (e.g., 93% felt “high” after one use, 50% felt “paranoid”, and 5% felt irritable). The contribution of genetic and environmental influences varied by specific reaction. For example, additive genetic factors significantly influenced feeling "paranoid" while common environment did not. By contrast, feeling creative, additive genetic factors were not significant while common environment was a significant influence. Some subjective reactions to marijuana are probably primarily physiological and significantly heritable, while other reactions primarily reflect cultural conditioning and learned expectations.

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Seasonal changes in mood and behavior (seasonality) have been reported to occur in the general population. Seasonal Affective Disorder (SAD), a clinically diagnosed syndrome, is believed to model the morbid extreme of a spectrum of seasonality. Using items from the Seasonal Pattern Assessment Questionnaire (SPAQ), we collected self report data from a total of 2093 Australian twin pairs to test the following hypotheses: (1) the same genetic and environmental risk factors that determine risk of SAD also determine differences in seasonality within the norm range; (2) genetic vulnerability to seasonality is manifested by seasonal change in a broad spectrum of behaviors including sleep pattern, social activity, mood, weight, appetite and energy level; and (3) there is a sex difference in the magnitude of the genetic contribution to risk of SAD. We found a tendency for seasonality to run in families with 26–30% of the variance determined by additive genetic effects. We also found: (1) two or more paths of inheritance for seasonality; (2) that there is not one generalized genetic vulnerability to seasonality, but instead distinct genetic factors that predispose certain individuals to (1) weight and appetite changes; and (2) mood and energy change; and (3) males and females respond differently to the SPAQ with genetic vulnerability greater in women. Seasonality is hypothesized to be a component that contributes to the wide variability in illness of patients with seasonal affective disorder and efforts to determine the role of seasonality in the development of depressive disorder.

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5. Supported in part by AMADA grant AA07335, a grant from the Australian NH & MRC, and funds from the Clinical Psychology Branch of the NIMH.

PAMELA A. ADDISON, A.C. HEATH, N.E. ROSENTHAL, and N.G. MARTIN. Seasonal Change in Mood and Behavior: A Twin Study.
BENOIT MARTIN, C. MARCHALAND, J. PHILLIPS, G.
CHAPOUTHIER, C. SPACH, and R. MOTTIA. Application of the use of Recombinant Congenic Strains (RCS) in the estimation of the minimal number of genes implicated in mouse reactivity to B-CCM

Recombinant Congenic Strains (RCS) are related strains. Each carries a small fraction of the genome of one strain ("donor strain") on the genetic background of another strain ("background strain"). The variable reactivity of the RCS for a trait is thus the result of a few minor-gene effects originating from the donor strain, since the probability that major genes are present in any one RCS is low. Unlike Recombinant Inbred Strains in which minor-effect genes are often masked by major genes, RCS enable the effects of minor genes to be shown. With this method, an estimate can be made both of the gene "strength distribution" of the minimal number of genes involved having a certain strength for a given trait. This method has been applied here, from RCS B10.D2 and DBA/2, to the reactivity of the benzodiazepine receptor inverse agonist methyl β-carboline-3-carboxylate (B-CCM). This was measured by the potency of a 5 mg/kg i.p. administration of the drug to induce myoclonic seizures: the minimal number of genes involved was estimated to be 13.
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BENOIT MARTIN, R. MOUTTIER, Y. CLEMENT, P. VENAULT, J. PHILLIPS, G. CHAPOUTHIER. Implication of a region of chromosome 4 in the reactivity to B-CCM in mice.

The linkage-testing strain JE/Le has been tested for its susceptibility to three different convulsant agents: a) methyl β-carboline-3-carboxylate (B-CCM), an inverse agonist of the benzodiazepine receptor (5 mg/kg i.p.); b) pentylenetetrazol, an antagonist of the GABA receptor not acting at the benzodiazepine site (50 mg/kg i.p.); and c) strychnine, which inhibits the transfer of glycine transmission (1 mg/kg i.p.) as controls. The JE/Le strain is homozygous except for the gene je on the 4th chromosome, one of the four markers backcrossed in this strain, and the small fraction containing this gene. We have compared the action of the three convulsant agents on the je/je and je/+ mice. The results did not show any differences between these genotypes for pentylenetetrazol and strychnine, whereas, in contrast, we found that je/je mice convulsed significantly faster than je/+ mice for B-CCM. These results suggest that one gene at least, in the je region of chromosome 4, influences specifically the reactivity to B-CCM administration. Although the data might be interpreted as indicating that this gene is identical with je, known to affect the cochlear neuronal system, this seems improbable because the possibility of a pleiotropic effect of je would, therefore, also be observed in the action of strychnine and pentylenetetrazol, which is not the case.
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PAMELA MAXSON, PAUL LICHTENSTEIN, G. E. MCCLEARN, AND NANCY L. PEDERSEN. Genetic Perspectives on Successful Aging.

The concept of "successful" aging is attracting increasing theoretical attention in gerontology. We presume that "success" in aging is the product of complex multivariate systems and that the distribution of success will be multidimensional. No single measure can characterize such a system and no composite is likely to be exhaustive. This study examines one potentially useful index derived from the domains of physiological and cognitive functioning, mental health, life satisfaction, locus of control (internal/external control over the direction of one's life), and social support. Data were obtained from the Swedish Adoption/Twin Study of Aging (SATSA). Age differences were examined for each domain and for the composite using moving intervals. The genetic and environmental contributions to the variance of the individual domains vary both across age intervals and domains. The genetic and environmental contributions to the composite also change across age groups.
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The Minnesota Twin Family Study is a prospective high risk study of the development of substance abuse and related psychopathological disorders. The target sample consists of 635 male twin pairs in two cohorts (11 year olds and 17 year olds), their mothers and their fathers. Approximately 30% of the twins are at relatively high-risk for developing substance abuse by virtue of having one or both biological parents meeting DSM-III-R criteria for Alcohol or Substance Dependence. Preliminary results from the first 400 families are reported. Results indicate: (1) that high- and low-risk youth differ along two broad dimensions of personality, behavioral undercontrol and negative emotionality, (2) that individual differences in these personality dimensions are, in part, inherited, and (3) that risk status and genetic factors are associated with exposure to environmental liabilities including negative peer models and family conflict. These results are interpreted within a general developmental model that posits the existence of inherited temperamental factors which increase both the likelihood of exposure to experimental risks (genotype-environment correlation) as well as vulnerability to environmental provocation (genotype-environment interaction).
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2. Supported by NIDA grant DA05147.

Recent twin and adoption studies have revealed that many environmental measures show substantial genetic influence. The social importance of this finding and the possibility that genetic factors contribute to associations between environmental measures and outcomes is a bivariate model is applied to a diverse set of environmental and outcome measures to investigate the extent to which environment-outcome associations are mediated genetically. Participants were from the Nonshared Environment and Adolescent Development Project, a nationally representative sample of 720 families. The study examined sibling resemblance across six groups: MZ, DZ, full, half, and unrelated siblings. Although phenotypic correlations between family environment measures and adolescent outcomes were low, model-fitting results showed significant genetic mediation on several environment-outcome associations.

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4. The project is supported by the National Institute of Mental Health (#1R01MH43373) and the William T. Grant Foundation.

S.L. MILLER and J.M. WEHNER. The effects of corticosterone and cholesterol treatment on spatial learning performance in mice.

C57Bl/6Jpg mice are significantly more adept than DBA/2Jbg mice at performing a spatial learning form of the Morris water task (M. Upchurch and J.M. Wehner, 1988, Behav. Genet. 18: 55-68). Studies in rats have shown that persistent elevations of the stress hormone, corticosterone, may alter learning performance. To examine whether such elevations of corticosterone will alter performance in C57 and DBA mice, we performed chronic treatment experiments. Pellets containing 40% corticosterone, 10% peanut oil, and 50% cholesterol, or pellets of 50% cholesterol, 10% peanut oil were implanted subcutaneously into C57 and DBA mice. Beginning on the 7th day after surgery, animals were trained for 3 days on the Morris water task to locate the position of a hidden platform. Immediately following training on day 7, the platform was removed and each animal was given a probe trial. Animals were scored for site crossings, latency to cross the platform sites, and search time in each of 4 possible quadrants. Corticosterone treatment did not modify performance in C57 or DBA mice. Interestingly, DBA mice with cholesterol pellets exhibited significantly enhanced performance in the biochemical mechanism for this unexpected effect of cholesterol is currently under investigation. Our results suggest that short-term chronic treatment with corticosterone has no effect on spatial learning performance. However, the steroid hormone precursor, cholesterol, in high concentrations may alter performance in some genotypes.

S.A. MINNICK and J.M. WEHNER. The Effects of Acute Stress on Ethanol Absorption Rates.

The release of cortisol in humans and corticosterone (CCS) in rodents is a natural response to stress. Much evidence exists that supports a role for ethanol in the reduction of stress in humans and animals. Previously we demonstrated that naive Long Sleep (LS) mice absorb ethanol faster than Short Sleep (SS) mice when administered 6.0 g/kg ethanol i.g. and that the removal of the adrenal glands results in decreased absorption in both lines (Alcoholism: Clin. Exp. Res., in press). To determine whether release of CCS in response to stress, regulates ethanol absorption, animals were exposed to an elevated plus-maze for 45 minutes, given ethanol i.g. immediately after removal from the maze and their blood ethanol content measured at various times and compared to nonstressed controls. The results support a role for CCS in regulation of ethanol absorption. Stressed LS and SS mice absorb ethanol faster than unstressed controls. If CCS release regulates ethanol absorption, then removal of its source, the adrenals, and exposing the animal to stress should produce no difference in absorption between control and stressed adrenalectomized (ADX) animals. At 7 days after surgery, ADX SS control and stressed animals do not absorb ethanol differently, but ADX control and stressed LS animals differ significantly in their rates of absorption. These findings indicate that a mild stressor can alter ethanol absorption rates in rodents and may have implications for ethanol's actions on stress reduction in humans.

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PETER C. M. MOLENAAR. A third source of individual differences.

Already in the first path diagram drawn by Sewall Wright there is a type of latent factor called D which pertains to variability caused by developmental processes. It turned out in Wright's analysis that the effect of D was quite large. Also in the textbook by Mather & Jones mention is made of the vagaries of development causing substantial intra-individual differences. In this talk more recent material will be presented, showing that variability due to developmental processes may constitute an important third source of individual differences alongside genetic and environmental influences. A theoretical model is proposed which may explain the "how" and "why" of this third source. It will be indicated that in many behavior genetic analyses the effects due to the third source are disguised as specific environmental influences.

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EDWARD MONAHAN and STEPHEN C. MAXSON. Effects of the Y Chromosome on Open Field Behaviors of Mice.

Open field behaviors were measured for two congeneric strains (DBA/1Bg and DBA.C57BL/10-Ybg) differing in the origins of the non-pseudautosomal (non-recombining) region of the Y chromosome. The open field was a 20x20x30cm digiscan activity monitor (Omnitech Electronics). Five dependent variables were automatically recorded in the 15-minute test. These were: horizontal activity, vertical activity, movement time, rest time, and total distance travelled. There were significant differences between the congeneric strains for movement time and total distance travelled, but not for the other dependent variables. Mice with the DBA Y chromosome travelled a greater total distance and were active more of the time than mice with the C57BL10 Y chromosome.

Thus, on the DBA/1Bg background, the DBA and C57BL10 Y chromosomes differ in effect on not only urine marking and aggression as previously reported, but also on activity. The difference in activity and aggression may be due, at least in part, to effects of the Y chromosome on serum levels of testosterone.

Andrew C. Morse and Byron C. Jones. Differential Housing and Strain Affect Cocaine Self-Selection in Mice.

Previous studies have shown the behavioral effects of cocaine to covary with genetic makeup in mice (B.C. Jones, A. D. Campbell, R. A. Radcliffe and V. G. Erwin, 1991 Pharmacol. Biochem. Behav. 40, 941-948). We recently conducted an experiment to investigate the possible co-operation between genetic makeup and differential housing on cocaine self-administration. Male and female C57BL/6J and DBA/2J mice were assigned to one of two housing conditions, isolate or grouped. Animals in the former condition were placed into individual cages at weaning (21-22 days of age) and grouped housed animals were maintained in unisex groups of 2-4 littermates until testing at 63-113 days of age.

Cocaine self-selection was measured in a two-choice test with one choice being cocaine-HCl solution of 40mg% in tap water and the other choice being plain tap water. Both liquids were delivered in graduated cylinders fitted with ball-stop sipper tubes. Volumes consumed from each cylinder were measured at the same time each day for four consecutive days. Cocaine solutions were prepared fresh each day and the positions (L v R) of the cylinders were alternated daily. The results of this study revealed a strain difference in cocaine self-selection with C57 mice evincing greater consumption than DBAs. Interestingly, we noticed that isolate-housed DBA females consumed less cocaine than group housed DBA females on days 2-4 of testing. These results suggest that both genetic makeup and social milieu may affect avicity for cocaine in mice.

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Water buffalo (Bubalus bubalis) and Zebu cattle (Bos indicus) probably originated in tropical regions of southern Asia. Animals of the two species were being raised together under free-ranging conditions on a ranch in the Brazilian Pantanal, the massive floodplain of the upper Paraguay River basin. Scan sampling was employed in observing calf-care and common daylight activities such as grazing, nursing, resting, walking, and bathing. Correlational analyses were used for identifying relationships between and among species, ages, activities, behavioral cyclicity, ambient temperatures, sun angles, and shadow lengths.

Contrary to our expectations, activity cycles tended to be independent of environmental factors. The cattle and buffalo maintained interspecific socio-spatial segregation without overt agonistic encounters while occupying the same pastures and sharing resources. There were important species differences in behavioral adaptations to the same environmental challenges.

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GRAIG T. MACOSSON and RONALD C. JOHNSON. Estimated Familialities of Cognitive Abilities of Offspring Tested in Adolescence and Young Adulthood.

As part of a follow-up study of now-adult offspring who originally participated in the Hawaii Family Study of Cognition (HFSC) from 1972-1976, 49 females and 46 males from 73 families of Caucasian ancestry and 63 females and 55 males from 103 families of Japanese ancestry were retested on the battery of cognitive abilities tests they took as adolescents. Age-corrected scale scores for verbal ability, spatial ability, perceptual speed, and visual memory were calculated for the offspring’s fathers and mothers, for their original HFSC testing, and for the retesting. Model-fitting procedures for a univariate model of familial transmission indicated significant differences in the parameters between the two racial/ethnic groups for all four cognitive ability scales. These procedures also demonstrated no significant differences in familialities for offspring abilities in adolescence vs. young adulthood across all four ability scales and both racial/ethnic groups.

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3. Supported by NICHD Grant HD-023307. The original HFSC was supported by NSF Grant CB-34720 and NICHD Grant HD-06669.
DONALD J. NASH¹ and KATIE EGGLESTON¹. Behavioral Effects of the Quinky Gene in Mice.

Behavioral studies were carried out in a congenic strain of mice segregating for the quinky tail mutation. The quinky gene is a semi-dominant gene which is lethal in the homozygous state. Heterozygous mice are viable and are born with a neural tube defect restricted to the tail. Previous studies have reported that quinky mice also exhibit circling and choreic behavior. The present study examines some behavioral differences between quinky mice and their normal siblings. The behavioral tests included neuro-ontological developmental tests, exploratory behavior, learning behavior, and nest building. Results from the neuro-ontological tests indicated that quinky mice weigh less than normal and develop some adult sensory and motor responses later than their normal sibs. The quinky gene also had effects on locomotion, maze learning ability, and nest building activity. The diverse effects of the quinky gene indicate that it is affecting the central nervous system in addition to its relatively minor effects on the skeleton.

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M. C. NEALE¹ Modelling multivariate genetically informative data with Mx

Multivariate analysis of genetically informative data is one of the most challenging aspects of human behavior genetics. Part of the challenge stems from the overhead required to write software for different models and the difficulty encountered when trying to change the number of variables in the analysis or the type of data summary used. It is shown how most of the currently popular models have a succinct matrix algebra formulation which can be programmed directly in Mx. Examples include the cholesky factors model, the common pathways or psychometric factors model, and the independent pathways or biometric factors model. These methods are illustrated using both regular and partially missing data from twins. Extensions to other family structures such as spouses, parents and offspring are discussed.

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JENAE M. NEIDERHISER¹, ROBERT PLOMIN¹, PAUL LICHTERSTEIN¹,², NANCY L. PEDERSSON³,⁴, and U. P. MCLEAN⁵. The influence of life events on depressive symptoms over time.

The purpose of this study is to investigate whether associations between life experiences and depressive symptoms are mediated by genetic factors. Life events and depressive symptoms were assessed using self-report measures. The sample is part of the Swedish Adoption/Twin Study of Aging, which consists of monozygotic and dizygotic twin pairs reared together (MZ n=92; DZ n=116) or reared apart (MA n=44; DA n=109) with an average age of 56 at time 1. Life events at time 1, and depressive symptoms at time 1 and at time points 3 and 6 years later were used for this analysis. Longitudinal model-fitting techniques were applied to assess the amount of genetic and environmental influences in common for life events and depressive symptoms at the three points in time. The results indicate that a substantial amount of the association between life experiences and depressive symptoms can be explained by genetic factors.

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JENAE M. NEIDERHISER¹, RICHARD RENDE¹, and ROBERT PLOMIN¹. Genetic and environmental influences on social competence in middle childhood.

Very little is known about the genetic and environmental components of social competence, particularly in middle childhood. The present study explores genetic and environmental influences on the social competence of seven-year-old children. Social competence is measured using mother and teacher ratings of leadership ability, popularity, self-confidence, and problem behavior. The sample consists of nonadoptive (n=63) and adoptive (n=52) sibling pairs participating in the Colorado Adoption Project. Sibling correlations for both mother and teacher ratings of social competence suggest genetic influence. Maximum-likelihood model-fitting analyses confirm that genetic influences are important components of social competence (average $h^2 = 53$%), and further indicate that shared environment is not important (average $s^2 = 42$%).

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Richard Olson1 and Helen Forsberg2. Genetic and shared-environment influences on deficits in word recognition and component coding skills.1

Catwin regression to the population means for the oral reading of isolated words (REC), the phonological decoding of pronounceable nonwords (PHON), and the orthographic recognition of words (ORTH) in word-pseudohomophone pairs (e.g., train-rain) were compared for RE and PHON pairs whose probands' performance was at least 1.5 SD below the respective population means. The group deficit in REC was both heritable (h2 = .41, SE = .10) and due to shared environment (c2 = .16, SE = .10). A similar pattern was found for PHON, with 20% of the variance in PHON (c2 = .42, SE = .17). However, PHON was highly heritable (h2 = .76, SE = .14) with no significant influence of shared environment (c2 = .12, SE = .13). Moreover, both h2 and c2 were significantly different between REC and PHON (p < .05). A second set of analyses assessed the genetic and shared-environment covariance between probands' deficits in REC and cotwins' deficits in PHON (h2 = .63, SE = .16; c2 = .29, SE = .13), and between probands' deficits in REC and cotwins' deficits in ORTH (h2 = .09, SE = .22; c2 = .57, SE = .18). The above pattern of results indicates that the group deficit in PHON is highly heritable and is related to most of the heritable variance in REC, while ORTH is the least heritable component skill and is related to most of the shared-environment influence on group deficit in REC. Other analyses have linked the heritable deficits in PHON to heritable deficits in several language skills, while individual differences in print exposure were linked to shared-environment influences on REC and ORTH.

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2. Supported in part by NICHD Grants HD 11681, HD 27802 and HD 22223.

David H. Overstreet1, Amir H. Rezvani1, and David S. Janowsky3. Evidence for Lack of Association between Riddle Coat Color Gene and Ethanol Intake in Fawn-Hooded Rats.

The r dilution gene is a recessive gene which confers tan coat color, red eyes and prolonged pineal melatonin loss to Fawn-Hooded (FH) rats. More than 30 years ago, K.M. Meyers, 1984, J. Hered. 75, 349-352). Because FH rats also voluntarily drink ethanol (A.H. Rezvani, D.H. Overstreet, and D.S. Janowsky, 1990, Alcohol & Alcoholism 25, 573-575), we undertook a series of cross-breeding studies between FH and the alcohol nonpreferring Flinders rats. A preliminary report of this study, communicated at last year's meeting, indicated that alcohol preference was a dominance gene affected condition. The FH progeny from a cross between FH rats and the Flinders Sensitive Line (FSL) rats were either fawn-hooded (25%), black-hooded (50%) or albino (25%). Each coat color group contained both drinkers (>5 g/kg alcohol per day) and nondrinkers (<1 g/kg alcohol per day). In particular, at least 5 out of 14 of the fawn-hooded FH progeny, which must have all alleles of the r dilution gene, were nondrinkers. If FH albino which preferred alcohol had one all-albino how, F2 group (hindered by albimism), then only of the FH would result in some fawn-hooded progeny. However, all progeny of such mating were black-hooded, suggesting that r dilution gene was not related to the high ethanol intake in this subgroup of albino F2s. Finally, when F2 progeny were separated into high or low sensitivity to buspirone, a serotonin agonist, there were no differences in alcohol intake. These findings indicate that the presence of the r dilution gene in FH rat does not appear to be responsible for their high alcohol preference.

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DAVID H. OVERSTREET1, AMIR H. REZVANI1, ALEXEY KAMPOV-POLEVY2 and LENN MURREN1. Behavioral and Taste Predictors of Ethanol Intake in Genetically Heterogeneous Rats.

Recent studies of alcohol preferring strains of rats and their controls have revealed differences in the acceptance of solutions with different taste qualities (J.D. Sinclair, A. Kampo-Polevoy, R. Stewart, T.K. Li, Physiol. Behav. in press) and in certain behavioral measures (D.H. Overstreet, A. Kampo-Polevoy, A.H. Rezvani, D.S. Janowsky, and A.S. Halikas, presented at Research Society on Alcoholism meeting, June, 1992). The present study examined the same behaviors and tastes in a new line of a genetically heterogeneous rat population, F2 FH independent of ethanol preference. Target ethanol was given to Fawn-Hooded (FH) rats with the alcohol nonpreferring Flinders Resistant line (FRL) rats. Multiple regression analysis of the data revealed that ethanol intake was highly correlated positively (r = .63) with saccharine intake, while stepwise regression analysis indicated that 41% of the variance (p = .05) of ethanol intake could be accounted for by the variance in saccharine intake. Of the behavioral measures (open field activity, performance in the elevated plus maze, and immobility in a standard or modified swim test) recorded, only immobility in the standard swim test explained a significant (p < .05) amount of the variance (18%) of ethanol intake. However, unlike findings with outbred rats, which were most immobile in the swim test drank the least amount of ethanol. These findings have confirmed the close association between saccharine and ethanol intake previously observed in alcohol preferring and nonpreferring strains of rats.1

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G. OXENKROG1, P. REQUINTINA1, and P. DROZD1. Circadian rhythms of pineal melatonin and related indoles in RHA/Verh vs RLA/Verh rats.

Pineal contents of melatonin and related indoles, i.e. serotonin (5-HT), N-acetylserotonin (NAS) and 5-hydroxyindoleacetic acid (5-HIAA) have been reported to be higher, at the middle of both night and day, in RHA/Verh than in RLA/Verh rats (A. Seidel et al. 1990, J. Neuro. Transm. 91, 1-10) and in certain behavioral measures (Bertolino et al. 1991, Behav. Neurosci. in press). As (HPLC) analyses were performed at only one timepoint for both day and night, however, it was not clear whether higher pineal levels in RHA/Verh rats reflected a true increase in amplitude or merely the circadian rhythm of melatonin biosynthesis between the two lines. In the present study, the rats used were also maintained on a 12:12 light:dark schedule, but 5 females (81-86d old) were decapitated every 2 hours. Pineal melatonin, 5-HT, NAS and 5-HIAA showed clear circadian rhythms in both lines, without showing any phase shifts in either. The levels were significantly higher in the RHA/Verh line throughout most of the day and at all points during the night, indicating that the previously described higher levels of these substances in RHA/Verh males reflected a true increase in the rate of pinealin biosynthesis in that line, as compared to the RLA/Verh line.2

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PETER A. PARSONS. Evolutionary Adaptation and Stress: Energy Budgets and Habitats Selected.

Stress is the norm in natural populations, so that evolutionary processes should be reassessed under this assumption. Furthermore, stress forms an evolutionary probe for increasing genetic variability whereby associations among life-history traits become more evident than under benign conditions. In particular, an underlying association of life-history traits (including behavioral activity) with metabolic rate becomes clear (A.A. Hoffmann and P.A. Parsons, 1991, Evolutionary Genetics and Environmental Stress. Oxford Press, Oxford) which is easily demonstrated with stress-sensitive behavioral mutants (P.A. Parsons, 1991, Functional Ecology S,713-5). 

Metabolic cost arguments suggest that optimal conditions for development should occur in minimum energy expenditure environments, so that habitats preferred should tend towards these conditions. Limited Drosophila field data are consistent indicating adaptation by behavioral means. Laboratory-based habitat selection experiments for resources tend to show low variability but they are normally carried out under non-stressful conditions. Under more stressful natural conditions energy budgets need to be considered especially where there is habitat selection involving a major resource.  

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TATIANA A. PAVLOVA. Population-Genetic Study of EEG.

In accordance with methodology of multi-level population-genetic study of human behavioral traits (Bulye et al., 1976-1991) specificity of phenotypical and genotypical variability and correlations of main EEG characteristics have been studied. Two populations (isolation and outbred urbanic) which had been studied before were examined same subjects as well as their genetic relatives, EEG was registered with 8-channel encephalograph "ERA" (Biomedica, Italy) in cases when the subject's eyes were closed and then opened, and during functional load solving intellectual tasks from Cattell's test. It is determined that EEG parameters under study are characterized by wide-scale interindividual variability. The distribution of this variability for a greater part of indices is shown by a normal distributions, and incidently influenced by age and sex in the groups of 16 to 50 years of age under study. Values of the genetic component (Ga) varies in EEG different ranges and shows from 40 percent to 80 percent of phenotypical dispersion of values. The effect of genetic factor is strongly pronounced in the range of 14 to 16 cycles per second. In order to determine and watch centres of electric activity on and inside the brain of the examined subjects and their genetic relatives we use the package of computer programme "BRAIN-LOG" for mapping of the electric brain activity. Such mapping allows us to evaluate the distribution of electric activity of brain and see the dynamics both in the state of calmness functional load. N.I.Vavilov Institute of General Genetics, Russian Academy of Sciences, Gubkin St.3, Moscow 117809, Russia.

R. PAYLOR1, L. BASKALL1, and J.M. WERNER1. C57 and DBA mice perform differently on hippocampal-dependent learning and memory tasks. 

Performance of C57BL/6J and DBA/2J mice differs in the Morris water task. The hippocampal formation is known to be critical for place-learning. Several measures suggest that the DBA's hippocampus may be compromised compared to C57's. If DBA mice are impaired on the place-learning task due to attenuated hippocampal function, then performance of DBA mice should be impaired on other tasks thought to depend on the integrity of the hippocampus. Similarly, they should be impaired on tasks that do not require proper hippocampal functioning. The purpose of this study was to understand better the nature of the DBA impairment by testing DBA and C57 mice on tasks thought to either depend on the hippocampus or to be independent of the hippocampus. 

Visual discrimination learning is thought to be independent of the hippocampus. DBA and C57 mice performed equally well on two different visual-discrimination tasks. Tasks that require conditional-learning processes, however, appear to require the hippocampus. C57 mice learned to solve a conditional-spatial-discrimination (csd) task. DBA mice, however, never solved the csd task. These results support the hypothesis that the impairment of DBA mice on some tasks may be due to a hippocampal dysfunction. 

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NANCY L. PEDERSEN1, 2, PAUL LICHTENSTEIN3, G.E. MCCLEARN1 and ROBERT PLOMIN. The Association Between Cognition and Attitudes Toward Education: Shared Genes or Shared Environments?

Cognitive variables are among the few for which shared environmental effects are significant. Although results from the Swedish Adoption/Twin Study of Aging (SATSA) show no shared rearing effects, early cognitive ability, rearing effects are significant for Information, Synonyms, Block Design and Card Rotations (N. L. Pedersen, R. Plomin, J.R. Nesselroade, and G.E. McClearn, submitted). What is striking about this finding is that it suggests that early rearing and the environment can cast a long shadow - the effect is observed nearly a half century after these individuals have left the families in which they were reared. In an attempt to identify factors responsible for this effect of shared rearing environment, we examined Attitudes Towards Education in the rearing home (ATE). 

The association between ATE and measures of cognition were examined for 146 pairs of twins reared apart and 156 reared together pairs participating in the in-person testing phase of SATSA. The association between ATE and the cognitive variables were small (less than .20), and of approximately equal magnitude for crystallized and fluid measures. The association between ATE and approximately equal magnitude for crystallized and fluid measures. The association between ATE and approximately equal magnitude for crystallized and fluid measures. The association between ATE and approximately equal magnitude for crystallized and fluid measures. The association between ATE and approximately equal magnitude for crystallized and fluid measures.

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Data gathered on the rearing style of 1,117 pairs of parent twins from the Virginia 30,000 study indicate that human parental behavior is under significant genetic influence. Findings further suggest that this influence is sex limited, with a higher heritability in mothers than in fathers, and may partly result from the expression of dominant genes. A 14-item version of the Parental Bonding Instrument was used to assess self-reported rearing practices of parent twins. The two factors of Care and Overprotection, commonly found in other studies, were recovered from this analysis of the PBI's parent form. For both factors and both parents, the best fitting models invariably assumed sex-limited genetic effects and unique environmental influences only. Broad heritability ranged from 18% (father overprotection) to 39% (mother care). These results are interpreted in the light of gene-culture theory: they appear consistent with a model of genetically-mediated cultural transmission, with genes exerting their influence by adaptively biasing the teaching, as opposed to the learning, of human cultural norms and behaviors.

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4. Supported by NIH Grant AG04954, and ADAMHA Grants AA08672, MH45268, AA07535, AA07728, DA05588, and MH40828.

E. Edward Peeples* and Paul Retzlaff. Handwriting Characters and Personality Traits: Male and Female College Students.

Few consistent findings have emerged linking handwriting and personality. Fifteen highly reliable handwriting characters (height of letter "h", width of crossing of letter "h", angle of letter "i", and area of lower loop of letter "g", etc.) were measured in handwritings of 250 college students. The Personality Research Form (PRF) measuring 22 normal personality traits was administered to each student. Stepwise regression by gender showed different patterns of handwriting characters and personality traits in each sex. All 15 of the handwriting characters were involved with personality traits. Both sexes had high handwriting prediction of personality on Cognitive Structure, Impulsivity, Play, and Social Desirability. Females were more predicted on Nurturance, Social Recognition, and Succorance. Male's personality was predicted on Abasement, Achievement, Affiliation, Aggression, Autonomy, Change, Defencence, Dominance, Endurance, Exhibition, Harassment, Order, Sentience, and Understanding. Prior research, was probably flawed by collapsing across sex.

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STEPHEN A. PETRILL1, L. A. THOMPSON1, and D. K. DETTERMAN1. The Effects of Age and Gender upon Heritability of Measures of Cognitive Ability and School Achievement.

Previous twin studies have employed various multiple regression methods to examine the genetic and environmental variance underlying membership in "affected" or clinical groups. These methods may be extended to estimate differential effects of group parameters that occur in normal populations. The current study employed the extended regression model (M. C. Labuda, J. C. DeFries, and D. W. Fulker, 1986, Genetic Epidemiology, 3, 425-433) to examine the effects of age and gender upon measures of cognition and school achievement in a sample of 138 MZ and 125 DZ twin pairs who participated in the Western Reserve Twin Project. The twins, ranging in age from 6 to 12 years, were administered the Wechsler Intelligence Scale for Children--Revised (WISC-R), the Colorado Battery of Specific Cognitive Abilities (SCA)--a measure yielding psychometric Verbal, Spatial, Perceptual Speed, and Memory scales, the Cognitive Abilities Test (CAT)--a set of tests measuring elementary cognitive abilities, the Metropolitan Achievement Test (MAT), and the Wide Range Achievement Test (WRAT). Heritability tended to decrease and c² increase with age across school achievement measures. Age had a greater effect when entered as a discontinuous versus a continuous variable. The effects of gender were explored through various multiple regression methods. Elementary cognitive abilities had c² effects of being more affected by gender than psychometric cognitive tasks. The potential sources and implications of these findings are discussed.

1. Dept. of Psychology, Case Western Reserve University, Cleveland, OH 44106.
2. Supported by NICHD Grant HD21394 awarded to D.K. Detterman and L.A. Thompson and NICHD Training Grant HD07176.

KAY PHILLIPS and ADAM P. MATHENY, JR. Toddler temperament linked to MNS blood markers.

We report significant linkages between toddler temperaments in several domains (task orientation, affectivity, activity) at ages 18, 24, 30, and 36 months of age with MNS blood markers, using estimates of identical-by-descent status for non-identical sibling pairs (J. K. Haseman and R. O. Elston, Behavior Genetic Analysis, 5, 3-19) with the DeFries & Fulker regression approach to linkage (D. W. Fulker, L. R. Cardon, J. C. DeFries, W. J. Kimberling, B. F. Pennington, and S. D. Smith, 1991, Reading and Writing: An Interdisciplinary Journal, 4, 107-121). Twenty-five of 112 tested partial regression coefficients showed significance at a nominal significance level (.05, one-tailed), 13 for MZ and 12 for SS. Linkage was not indicated between toddler temperament and Rhesus; neither did IQ and MNS blood markers show linkage to MNS.

1. The Louisville Twin Study, Child Development Unit, Department of Psychology, University of Louisville School of Medicine, Louisville, KY 40292. Supported by grants HD22637, MH49772, and HD21395.
MICHAEL F. POUGUE-GRILLE, A.H. GARETT, J.J. BRUNKE, J.K. HALL, J.
CROWN, and N. HUXLEY. Susceptibilities to Schizophrenia: Neupropsychological Studies.

Twin-family studies suggest that genetic susceptibilities to schizophrenia are not always expressed at a diagnostic level. In order to understand more fully the range of manifestations of these susceptibilities, 40 stable, schizophrenic outpatients, 40 of their non-schizophrenic siblings, 40 matched, (age, sex, race, and education) screened, well, control probands, and 40 of their unscreened siblings were assessed for both neuropsychological impairment (61 standard tests) and psychopathology (SADS, SSP, and SIDP). First, the post-acute schizophrenic outpatients showed significantly greater impairments than controls on all six neuropsychological tests. Second, the total group of patient siblings showed significantly greater impairments than matched controls on the tests that are most sensitive to diffuse and/or frontal lobe CNS abnormalities: Symbol Digit Matching Test, Trails Making Test B, Wisconsin Card Sorting Test (sec), and the Verbal Fluency Test. Third, even diagnosis-free patient siblings performed significantly more poorly than controls on these tests. These findings demonstrate the potential usefulness of neuropsychological assessments as indicators of susceptibilities to schizophrenia over and above that provided by current spectrum diagnoses.

Note: Department of Psychology and Department of Psychiatry, University of Pittsburgh, Pittsburgh, PA 15260. Supported by NIMH grant MH43666.

Carol A. Prescot1, John K. Hewl1, Kim R. Truett1, Andrew C. Heath2, Michael C. Neale1, and Linden J. Evans.1 Alcohol Use and Abuse In a Community Sample of Older Twins

We studied patterns of alcohol use and abuse in a community-based U.S. volunteer sample of 3049 female and 3070 male twins aged 50 to 96. Significant gender and age effects were found for self-reported measures of current and lifetime alcohol use and abuse, with greater intake and higher prevalence of drinking problems among males, and lifetime abstinance more frequent and alcohol problems less frequent with increasing age. Significant associations were found between severity of alcohol use (based on Feighner criteria) and age of drinking onset, parental history of alcohol problems, and, among males, lower educational attainment. Biometric modeling based on 795 identical and 614 fraternal twin pairs assigned over 80% of the variance in alcohol use and abuse to genetic and shared environmental factors, with each contributing about 40%. Results of multiple threshold models for severity of alcohol abuse indicated about 30% of the variance was due to shared environmental factors, with genetic sources accounting for another 40%. The results did not suggest sex-related differences in genetic structure or magnitude of genetic effects, but may have been affected by power limitations. Contributions of personality differences to heterogeneity in alcohol use and abuse also will be addressed.

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Supported by NIH Grants AA08672, HD-26746, AA-07728 and AA07553 and gifts from the Philip Morris and R.J.R. Nabisco corporations. We gratefully acknowledge the participation of the volunteer twins who made this research possible.

R. ARLEN PRICE1. Increases in Prevalence and Extent of Obesity in Post-World War II Birth Cohorts: Implications for Genetic Analyses

During the past half century there have been large increases in the prevalence of obesity in developed countries. Such short term changes in prevalence must be environmentally determined, but genes appear to mediate response to environmental change, e.g., through variable gene penetrance and expression. Obesity increases of varying degrees have been observed in White and Black American women and children of both sexes, in native Americans of both sexes and all ages, and in several other groups from around the world. Based on studies of 2500 individuals, we have reported particularly large increases in level and prevalence of obesity in the Pima Indian population, especially among individuals born after World War II (R.A. Price and W.C. Knowler, paper under review). These large changes parallel smaller increases in other parts of the world and suggest a world-wide epidemic of obesity that may be partially responsible for parallel increases in obesity related diseases such as diabetes, heart disease and hypertension. The increases across birth cohorts complicate the interpretation of phenotypic comparisons between and within generations for all these complex disorders.

2. Supported in Part by NIH Grant R01-DA40793.

ANITA PRIZAN-HOTCHKISS1, KEIKO SATO1, and JOAN P. THOMPSON. Genetic and Behavioral Studies on Yellow Drosophila.

Two experiments were conducted using a yellow-bodied mutant of the Arrowhead (AB) strain of Drosophila pseudobscura. In Experiment I, the genetic background of the mutant fly was explored. Previous research had determined that the gene responsible for the yellow mutation is located on the X-chromosome. The vermilion fly, another X-chromosome mutant, exhibits a bright red eye color. The two mutants were crossed, and the offspring displaying both mutations were counted and used to determine the exact locus of the gene. Results indicated that the gene responsible for the yellow mutation is located at the 58.5 locus.

In Experiment II, behavioral studies were conducted. Previous behavioral studies revealed a severe mating disadvantage for the mutant yellow-bodied males when placed in competition for mates with normal, wild-type males. The source of this disadvantage appears to be complicated, involving such factors as latency to courtship, less frequent wing vibrations, and body size. Pilot studies indicated that large mutant males are more successful than their smaller counterparts when in competition with wild-type males for mates. We are investigating the heritability of size and the concurrent changes in mating attractiveness.

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2. Partially supported by New England Telephone Student Research Grant.

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TERRY REED. Dermatoglyphic and Behavioral Differences in Monochorionic and Dichorionic MZ Twins.

Approximately 30% of identical (MZ) and all fraternal twins have two chorions (DC). The remainder of MZ twins have monochorionic membranes (MC) as a result of later splitting of the twins. Our studies of dermatoglyphics (finger, palm, and footprint) in MC and DC identical twins initially focused on identifying traits which may be used to retrospectively assess placenta. Using dermatoglyphics to classify MZ twins of unknown placenta type, we found (T. Reed, D. Carmelli, R.H. Rosenman, 1991, Behav. Genet. 21:9-19) that some measures of type A behavior had significantly disparate intraclass correlations in MZ versus DC pairs. A second focus has been using palmar a-b ridge count asymmetry as a marker of reduced buffering capacity. We reported (R.J. Rose, T. Reed, A. Bogle, 1987, Behav. Genet. 17:125-140) increased intrapair differences in 20 MMPI scales in MZ twin-pairs asymmetric for a-b ridge count. A completely independent sample replicated these results for 15 scales related to bodily complaints, anxiety, depression, and psychotic behavior (A.C. Bogle, Ph.D. Thesis, Indiana University, 1989). In the latter study a number of pairs were of known placental type and a significant effect of placenta on a-b asymmetry was found. MC pairs had greater variability in a-b asymmetry than DC pairs, and in DC twins there was greater variability within pairs with fused versus separate placentas. Increased a-b asymmetry was associated with increased intrapair differences in MMPI scale scores only in MZ-DC twins.

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RICHARD RENDE & ROBERT FLOMIN. A Sibling Adoption Study of Behavior Problems in Middle Childhood.

This study provides a quantitative genetic analysis of behavior problems in middle childhood using a sibling adoption design. Subjects included nonadopted (n=42) and adoptive (n=52) sibling pairs participating in the Colorado adoption Project. For each child, mother and teacher reports of the Child Behavior Checklist were collected after the completion of first grade. Model-fitting analyses revealed significant genetic influence on maternal reports of thought problems and aggressiveness; a number of subscales showed significant effects of common environment. Genetic influence was found for teacher reports of somatic complaints and attention problems; there was no evidence for shared environmental influence on any subscales of teacher reports. Discrepancies between results for mother and teacher reports are discussed.

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2. Supported by NSF Grant BNS-8643938 and NICHD grants HD-10133 and HD-18426.

ROLLIN C. RICHMOND and SUE BRANDON. The behavior genetics of cocaine and amphetamine in Drosophila melanogaster.

The mode of action of psychoactive drugs is poorly understood, but it is clear that these agents often interfere with neural systems which are likely to be central to brain function. Drosophila is a species on which the full power of genetic, biochemical and molecular techniques can be focused in order to understand the biological basis of drug action. We have completed a series of experiments designed to determine if cocaine and amphetamine have effects on the locomotor behavior of Drosophila. We chose to study locomotor behavior because it is easily measured, has been extensively studied in Drosophila, is routinely used to assess the effects of psychoactive drugs in vertebrates, and has been previously used as the basis for selective mutant screens in Drosophila. We show that cocaine and amphetamine have pronounced effects on Drosophila behavior which may allow the development of mutant screens designed to identify genotypes that have altered responsiveness to psychoactive drugs. Further our results implicate the dopaminergic neuron systems in Drosophila as the site of action of cocaine thus linking cocaine's effects in Drosophila to those observed in mammals.

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Temperamental styles are hypothesized to be organized patterns of behavior which appear early in life, persist into childhood, and have a partial biological basis. One style, the tendency to respond to the unfamiliar with wariness or avoidance has come to be known as "behavioral inhibition." Previous developmental research has shown it to be fairly stable through age five - about one-half preserve the phenotype (Kagan, J., Reznick, J.S., & Snidman, N., 1988, Science, 240, 167-171). The goal of this study is to assess the heritable nature of these two categories. The longitudinal sample consisted of 177 same-sex twin pairs seen at 14 months and 162 pairs seen at 20 months. An aggregate inhibition index was constructed by averaging standard scores for seven observed behaviors indicative of wariness. The index had relatively high internal consistency at both ages and was moderately stable (r = .35). Estimates of heritability (h^2) were significant at both ages. Multiple regression analysis of data from selected twin pairs suggests that extremely inhibited and uninhibited behaviors are heritable. Results of longitudinal genetic correlation analyses provide evidence for substantial genetic continuity from 14 and 20 months.

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3. Supported by a grant from the John D. and Catherine T. MacArthur Foundation.

We thank the families who participated and the research assistants at IBC, Harvard and Yale who assisted with data collection and coding.
LAWRENCE A. RODRIGUEZ, and J.R. WILSON. A Developmental Assessment of Alcohol Consumption: Transmission Effects Versus a Common-Factor Mechanism.

Using data provided by adult male and female MZ (N=62) and DZ (N=41) twin pairs from the Colorado Alcohol Research on Twins and Adoptees (CARTA) project, a model of common-factors genetic and environmental effects was tested against a model of environmental and genetic occasion-to-occasion transmission to determine which best explained changes in individual alcohol use over a 4 year period. Developmental models, in the general form described by Eaves et al. (1986, Behav. Genet. 16,143-162), were fitted to an 8x8 covariance matrix of variables that indicate the amount of alcohol (in g/kg/month) consumed by an individual during the 1-year period prior to their initial CARTA test session, and for 3 years thereafter. A full model containing common-factor and occasion-to-occasion transmission effects provides a good fit to the data ($\chi^2_8=46.74$, $p=.284$). When common-factor shared environmental effects were dropped, there was no significant decrease in the fit of the model ($\chi^2_8=46.74$, $p=.442$; diff- $\chi^2_1=0.0$, $p>.05$). Neither was there a significant decrease in the fit of the model when common-factor genetic effects were dropped ($\chi^2_8=51.09$, $p=.281$; diff- $\chi^2_1=4.35$, $p<.05$). However, dropping common-factor unique environmental effects resulted in a significantly worse fit ($\chi^2_8=60.26$, $p<.001$; diff- $\chi^2_1=13.52$, $p>.05$). We conclude that earlier patterns of alcohol consumption influence later alcohol consumption, and that these patterns are more strongly mediated by genetic and shared environmental effects specific to each year, rather than by pleiotropic and shared environmental effects that affect consumption every year. Common-factor unique environmental effects also account for variance in yearly alcohol consumption, but these effects are not transmitted to later occasions.

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Within the behavior genetics literature on alcoholism a predominant number of studies have been based on samples of treated alcoholics. A pertinent issue is the degree to which research based on treated alcoholics can be generalized to all individuals with the disorder. Preliminary findings from the Minnesota Twin Family Study show that only 20 percent of the males with a DSM III-R diagnosis of definite alcohol dependence have received treatment. This provides an opportunity for an important question to be addressed—what do alcoholics who seek and receive treatment differ from those who do not. Data from the Minnesota Twin Family Study will be analyzed to assess the following domains in treated and non-treated adult male alcoholics: 1) demographic factors such as age, SES, and marital status; 2) co-morbidity for DSM III-R antisocial personality disorder and a history of major depression; 3) biological family history of alcoholism; and 4) self-reported symptoms such as physical sequelae and drinking history.

1. Department of Psychology, University of Minnesota, Minneapolis, Minnesota 55455.
2. Supported by NIDA grant DA-05147.

PIERRE L. ROUBERTOUX, M. CARLIER, S. MORTAUD, S. TORDIMAN, and H. DEGREILLE. Neurobiobehavioral correlation of the substitution of the specific region of the Y chromosome SR-Y.

The Y chromosome of the NZB and CBA/H strains of laboratory mice differ by DNA variants in spite of a common origin of this chromosome. Congenic strains of N and H for the SR-Y (N-Y SR-YH and H-Y SR-YH respectively) are developed for more than 25 generations in the URA 1294. Breeding and the control technics are discussed. The effect of the permutation of the SR-Y N, SR Y H are presented for weight, litter size, sensitivity to steroids, neuroendocrine measures (SHT, GABA) and behavioral responses including initiation of attack behavior. The possibility to distinguish between the SR-Y substitution effect and differential genomic imprinting by classical crosses will be considered here.


PIERRE L. ROUBERTOUX, R. MOUTIER, and K. TOYAMA. Elimination of Maternal Effect to Demonstrate that Embryo Cryopreservation is not Negligable and Interacts with the Genotype.

It is necessary to keep the maternal environment constant when the consequence of a treatment is expected to be minor or when the range of inter-individual variation is reduced. The effect of cryopreservation was analyzed in two strains of laboratory mice. The two cell embryos analyzed in two strains of laboratory mice. The two cell embryos from C3H/Orl x DBA/Jico (C3D2F1) and C57Bl/6Jico x CBA/Jico (B6.CAF1) were collected and either directly transferred or cryopreserved when transferred in pseudopregnant NMR1 females. These females are not inbred, however differences due to their residual genetic variation was randomly distributed among the four groups. Consequently it can be assumed that the maternal environmental differences linked to this genetic variation was also randomly distributed among the groups. The sensory motor development was systematically delayed in the cryopreserved C3D2F1 and not in the other hybrid group, compared to their respective non-cryopreserved controls. This statistical interaction suggest a higher sensitivity either due to the genotype or to the cytoplasmic factors to the cryopreservation in the C3D2F1 hybrids. The hypothesis of mutagenic effects of this treatment will be discussed.

Behavioral phenotypes include parenting behavior as well as more traditional personality traits. When parenting behavior is regarded as a parental trait, its transmission can be regarded as due to rearing in the family of origin or as due to genetics. To address this issue, we report data from adult MZ twins, adult DZ twins, and adult unrelated children reared together, who now have their own families with children nine years old or under. Two measures of parenting were factor analyzed into two broad parenting dimensions: positive support and negative control. Combining data from the three groups, genetic variation influenced both parenting dimensions but rearing experiences (in the family of origin) influenced neither. Both parenting dimensions also shared considerable variation in common with the 'big-five' dimensions of personality.

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3. Support for this project was provided by NIDA DA06287

STEPHANIE SCHMITZ and DAVID W. FULKER. Genetic and environmental influence on the etiology of problem behavior in early childhood.

The new Child Behavior Checklist CBCL/2-3 assesses problem behaviors in 2- and 3-year-olds. In the present study this instrument was administered to 239 twins in this age group (74 MZ, 67 DZ-SS, 98 DZ-DS). Preliminary factor analysis indicated the 6 scales identified by Achenbach et al. (social withdrawal, depression, somatization, sleep problems, aggressiveness, and destructiveness) and scores on each of these scales were computed for all subjects. Genetic (h²), shared environmental (e²), and specific environmental variation (e²) were estimated using a maximum likelihood procedure. For all the scales there was relatively little evidence of e² which ranged from 0.5 to 0.20. Significant h² was found for 4 out of the 6 scales and ranged from 0.31 to 0.65. A maximum likelihood pedigree analysis which allowed for several patterns of missing data and fitted a full-rank Cholesky decomposition confirmed the univariate findings. However, both genetic and shared environmental components appeared to be statistically significant. The full-rank genetic component was highly significant (Chi²=48.70, df=21, p<.001). The shared environmental component, which only estimated 11 non-zero loadings, was also significant (Chi²=25.46, df=11, p<.01), if judged by these 11 degrees of freedom. The shared environmental component was essentially of rank 1. That is a single environmental influence appeared to operate across all scales. The genetic component revealed a second-order factor structure described by Achenbach et al. That is the factor structure observed at the phenotypic level appears to be largely genetically determined.

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2. Supported by a small grant from the John D. and Catherine T. MacArthur Foundation: Transition from Infancy to Childhood Network. S.S. is supported in part by NICHD grant HD07289-07. Analyses of the data were facilitated by BSRG Grant RR-07013-25 awarded to the University of Colorado by the Biomedical Research Support Grant Program, Division of Research Resources, National Institutes of Health.

DAVID C. ROWE, SUZANNE CALLOUR, SANDRA G. HARMON-LOSoya, AND N. H. GOLDNSMITH. The Transmission of Parenting Behavior: Rearing or Genetics?

There are numerous unsolved problems in behavior genetics, beginning with Tryon's result of an F₁ whose range overlapped both selected parent strains in his maze running rats. Among the most current important problems is that of the effects of the inheritance of gene combinations affecting a particular behavioral trait such as schizophrenia. Some possible theoretical solutions will be presented.

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ELAINE H. SHEN, J.C. CRABBE, AND T.J. PHILLIPS. Effects of the D2 Dopamine Receptor Agonist Quinpirole on the Locomotor Activity in FAST and SLOW Selected Lines of Mice.

Selectively bred FAST mice are highly activated by a 2.0 g/kg dose of ethanol (EtOH), while oppositely selected SLOW mice are significantly less activated, and often depressed by this same dose. In previous studies, we demonstrated that pharmacologic manipulation of the dopamine system altered ethanol-induced activity in these lines (E.H. Shen, J.C. Crabbe, and T.J. Phillips, 1991, Society Neurosci, Abst, 17, 1421). Specifically, ethanol-stimulated activity in FAST mice was significantly decreased by a mixed antagonist and a D₁ agonist, but not a D₂ antagonist, while SLOW mice were unaffected by these same drugs. However, ethanol-induced locomotor depression in SLOW mice was reversed by pretreatment with the D₁ agonist, SKF-38393. In the current study, we tested several doses of the D₂ agonist, quinpirole, on locomotor activity. Both lines were significantly depressed by all doses of quinpirole, beginning at 5 minutes and continuing through 60 minutes post-injection. There was no significant response difference between the lines. To determine whether the lines would differ in response to quinpirole when EtOH was present, a second experiment was performed, in which quinpirole was injected 2 minutes prior to EtOH administration. Quinpirole significantly and equally decreased saline and EtOH activity in both lines. We have provided evidence that ethanol-mediated activity in the FAST and SLOW lines may be differentially sensitive to D₁ stimulation or concomitant D₁ and D₂ stimulation, but not to D₂ stimulation alone.

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2. Department of Veterans Affairs Medical Center, Portland, Oregon 97201.
3. Supported by a grant from the V.A. and NIAAA grants AA06498 and AA08621.
FRANS SLUIJTER and G.A. VAN OORTMERSSEN. Effect of the Y-chromosome on Coping Strategies of Wild House Mice

A clear difference in aggressive behavior is found when the reciprocal F1 males of different selection lines for attack latency are compared (G.A. van Oortmerssen, R.F. Benus and F. Sluijter, 1992, Aggress. Behav. 18, in press). The more aggressive males have the Y-chromosome of the more aggressive parent.

In some instances, aggressive behavior can be seen as an expression of the way in which individuals cope with changes in their environment (R.F. Benus et al., 1991, Experimenta 47, 1008-1019). The selection lines mentioned differ in coping style as measured by routine formation and adaptation to an inversion of the light-dark cycle. The more aggressive males show a more routine-like behavior and lack an immediate response to a change in the LD cycle. The aim of this study is to evaluate the effect of the Y chromosome on these parameters of coping.

This Y chromosomal effect only partly affects its effect on aggression. A difference in adaptation to a change in the LD cycle is found in the reciprocal F1 males. The more aggressive males, having the Y-chromosome of the more aggressive parent, show more resistance to a change. However, no difference in routine formation is found.

These findings suggest that the Y-chromosome is only partly responsible for a difference in coping strategies between two selection lines for attack latency.


Wendy Slutske, R. Pickens, D. Svikis, and M. McGuire.

A Twin Study of the Role of Personality in the Genetics of Alcoholism.

Several recent theories stress the role of personality dimensions as mediators of genetic influences on the development of alcoholism. In this study, Defries and Fulker's (1985, Behav. Genet. 15, 467-473) hierarchical multiple regression analyses of twin data were extended to test models of mediation and moderation. Mediation of the genetic influences on alcoholism by personality occurs when genes exert their effect on alcoholism through personality traits, i.e. personality traits account for the phenotypic correlation between genes and alcoholism. Moderation of the genetic influences on alcoholism occurs when the relation between genes and alcoholism depends upon the level of the personality trait. Diagnostic and typology information, as well as Multidimensional Personality Questionnaire (MPQ; A. Tellegen, 1982, unpublished) scores were obtained on 305 adult male and female Michigan DZ twins. Analyses were performed to test several hypotheses which included: 1) mediation of genetic influences on alcoholism by behavioral undercontrol in male twins, and 2) moderated effects of genetic influences on alcoholism by neuroticism in female twins. Advantages and disadvantages of this methodological approach are also discussed.

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3. Addiction Research Center, National Institute on Drug Abuse, National Institutes of Health, Baltimore, Maryland, 21224.
4. Department of Psychiatry and Behavioral Sciences, The Johns Hopkins University, Baltimore, Maryland, 21224.
5. Supported in part by the Hazelden Foundation; U.S. Public Health Service Grants AA06500, DA05147, and AG06886.
The purine nucleoside adenosine is an important neuromodulator of central nervous system (CNS) excitability. Several studies have suggested that the sedative actions of a number of drugs, could be explained by enhancement of adenosine-mediated systems. There is good evidence that adenosine systems are involved in the effects of ethanol following both acute and chronic administration. We are investigating potential adenosine-ethanol interactions in Long Sleep (LS) and Short Sleep (SS) mice selectively bred for differences in sensitivity to ethanol's hypnotic effects. We examined the differential response of LS and SS mice to the adenosine agonists cyclohexyladenosine (CHA), L-phenylisopropyladenosine (PIA), 2-chloroadenosine (CAD), and N-ethylcarboxamidoadenosine (NEC) and the adenosine antagonists, caffeine (CAF) and theophylline (THE). The mice were injected with one of 2-4 doses of drug or saline and tested for one of the following: T-maze activity, rotated activity, heart rate, or body temperature. The results showed that LS and SS mice were more resistant to the behavioral and physiological effects of the agonists (CHA, PIA, CAD, NEC). We observed little-to-no stimulation by antagonists except at the highest doses. The adenosine agonists exerted potent depressant effects on these measures in both lines of mice. The LS mice, however, were more affected by these compounds than were SS mice. These findings support the proposed link between ethanol sensitivity and adenosine receptor-mediated processes.

1. Institute for Behavioral Genetics, University of Colorado, Boulder, CO.
2. Supported by NIAAA Grant AA07127.


Self-reported depressive symptoms were examined in a sample of 286 three-generation families consisting of 1188 individuals. The data consisted of CES-D total scores and three subscale scores: negative mood, lack of well-being, and psychomotor retardation. Pedigree analysis using maximum-likelihood estimation procedures were employed to examine family resemblance. Results indicated that family factors (both heredity and shared environment) accounted for approximately 22% of the observed variance in total CES-D scores. Results for the individual subscales were similar with family factors accounting for 17%, 13%, and 24% of the variability in the respective subscales. Spouse resemblance was also highly significant (r's ranged from .20 to .40), suggesting either some form of assortative mating or cohabitation effects. Moreover, although familial factors had similar effect sizes in males and females, our results suggested the possibility of different factors operating in the transmission of depressive symptoms in the two sexes.

1. University of Southern California

DEL THIESSEN1, CARLOS ZALAQUETT1 and MEHDI MOINI2. The Biology of Alarm Odors in Mice.

Mice produce an alarm chemoattractant when stressed by footshock or forced swimming. The signal has several effects on conspecifics, including behavioral avoidance, preference for higher ambient temperatures, suppression and stimulating effects on the immune system and modification of swimming. These results are presented along with preliminary information on the chemical identity of the signal and strain differences in the behavioral reactions.

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LEE A. THOMPSON1, STEPHEN A. PETRILL1, AND DOUGLAS K. DETERMAN1. Differences in Heritability Across Groups Differing in Ability, Revisited.

Previous results from a subsample of twins (54 DZ, 86 MZ) tested as part of the Western Reserve Twin Project (WRTP) suggested that heritability decreased as ability increased (D. K. Detterman, L. A. Thompson, & R. Plomin, 1990, Behav. Genet., 20, 369-384). The study used a modification of a regression technique developed by DeFries and Fulker (1985, Behav. Genet., 15, 467-473) especially for use in selected twin sample. Bailey and Revelle (1991, Behav. Genet., 21, 397-404) discussed these findings in relation to their contradictory findings of higher heritability in the upper range of IQ in two larger twin samples using intrapair differences as a function of ability and zygosity. Both methodological approaches have strengths and weaknesses; unfortunately, neither study reported results based on both approaches. The current study revisits the basic question of, "Does heritability change as a function of ability level?" in the completed WRTP (32 DZ, 146 MZ) using a variety of approaches. The results suggest that heritability appears to increase with ability level and that common family environment is more influential at lower ability levels. The study also examines changes in h² and c² as a result of the covariation between specific cognitive abilities, elementary cognitive tasks, and scholastic achievement with IQ level. Interestingly, h² and c² in different domains appear to be differentially affected by changes in IQ level. Potential explanations of these effects will be discussed.

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2. Supported by NICHD Grant HD11247 and NICHD Training Grant HD07176.
Theresa Tritt1, B.C. Dudek2. BEHAVIORAL DIMENSIONS OF ETHANOL’S DIFFERENTIAL EFFECT IN C57BL/6Agg AND DBA/2Agg MICE2.

One of the most compelling findings in alcohol pharmacogenetics has been the differential ethanol activation of locomotor activity in C57BL/6Agg and other inbred strains of mice such as the DBA/2 strain. Unlike other inbred strains, C57BL/6 show no activation. While this dichotomy is suggestive of a major gene effect, characterization of this behavioral response has rarely gone beyond measures of forward locomotion. In order to more broadly define the genetic effect, we examined procedural parameters that have previously been found to have an effect on this ethanol activation. We used an apparatus that provided more information than just simple photocell beam interruptions, and included total distance traveled, total rest time, vertical and horizontal activity and a speed measure.

The results showed clear differences between the two inbred strains with the C57BL/6Agg showing characteristic sedation and the DBA/2Agg showing activation. In addition to the DBA/2 increment in distance traveled, and the C57BL/6 decrement, indices of speed of movement and movement time showed correlated patterns across the genotypes. Their F1’s generally showed intermediate inheritance, with no reciprocal differences. The genotypic patterns were found to be only slightly influenced by procedural manipulations such as (1) order of testing in a repeated testing procedure, (2) repeated vs. between-group designs, and, (3) lighting condition. When testing was done in the light, the B6/D2 difference was smaller than when testing was done in the dark.

2. Supported by NIAAA grant 1R01 AA09039-01.

K.R. Truett.2 Age Differences in Conservatism2

Nearly 30,000 twins and their family members from across the United States returned a mailed survey which included a version of the Wilson-Patterson conservatism scale. Principal component factor analysis of the 28 social attitude topics (i.e., abortion, socialism, the draft) revealed an underlying conservatism factor, as found in previous studies. When parent-offspring and spousal correlations were calculated for this conservatism factor, extensive heterogeneity was noted and the correlations could not be pooled. Because it has been previously noted that conservatism increases with age, age was examined as a potential cause of this heterogeneity. Conservatism by age plots uncovered a remarkably consistent age pattern. Regardless of ascertainment method, gender, initial level of conservatism, education or geographical location, conservatism scores escalate rapidly during the fifth decade of life. This is especially interesting since the period of rapid change is one of transition in the reproductive and social life of the individual, and is marked by corresponding changes in a variety of physiological and behavioral indexes.

1. Medical College of Virginia, Box 3, MCP Station, Richmond VA 23298, U.S.A.
2. Supported by NIH grants GM30250, AG04954, ADAMHA grants AA06781, AA07728, and MH40828 and a gift from RJR Nabisco.


To gain a comprehensive understanding of genetic and environmental contributions to the progression of the smoking habit, we have analyzed the following variables in a sample of 4,118 twin pairs from the Virginia and AARP registries: age at first cigarette, age at which quantity smoked reached 1 per day, age at which quantity smoked reached 10 per day, and average quantity smoked when the habit was fully developed. A logistic growth curve model, which allows for heterogeneity in parameters reflecting age at initiation, rate of consumption increase, point of maximum consumption velocity, and quantity smoked as a regular habit, was fit to the data. The information from twins permits a multivariate genetic analysis of these four growth curve parameters. Preliminary analyses suggest that all aspects of the smoking habit are genetically influenced, and that age at initiation correlates negatively, and rate of progression positively, with the amount consumed when the smoking habit is fully developed.

1. Medical College of Virginia, Box 3, MCP Station, Richmond VA 23298, U.S.A.
2. Supported by gifts from Philip Morris and RJR Nabisco, and PBS grant AA08672 and AG04954.


Twins from the Vietnam Era Twin Registry were interviewed by telephone as part of the Harvard Twin Study of Drug Abuse (942 MZ pairs and 684 DZ pairs). The Registry comprises males who served in the military during 1966-75. Twins were asked about their opportunity to use marijuana, stimulants, sedatives, cocaine, opiates, and psychedelics. The drug that the largest percentage of subjects had the opportunity to use was marijuana (80.5%), the least available were opiates (16.4%). Significant heritability was found for exposure to each drug. Subjects were also asked if they had ever used each drug and if they had, whether they had used it more than five times. A varied pattern was observed for genetic and environmental influences. For example, additive genetic factors did not influence "ever use" for marijuana but did influence whether it was used more than five times. Conversely, additive genetic factors did influence whether stimulants were ever used but not whether they were used more than five times. For some drugs but not others the common environment influenced whether the drug was ever used.

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3. St. Louis V.A.M.C., St. Louis, MO 63106.
4. Hines V.A. Cooperative Studies Coordinating Center, Hines, IL 60141.
5. Supported by NIDA Grant DA04604.
ERIC TURKHEIMER1, G. LOVETT1, C. D. ROBINETTE2, and I. I. GOTTESMAN1.
The heritability of divorce: New data and theoretical implications.

We discuss marital status data from twin pairs in the National Academy of Sciences-National Research Council (NAS-NRC) registry of twin veterans of WWII. An early wave of data collection included 6,082 pairs; a later wave included 2,753 pairs. Analysis of MZ and DZ concordance rates suggests modest heritabilities for marital status in general, and divorce in particular. Most heritabilities were below .2 and were not significantly different from zero. This result is discussed in light of a recent report of more substantial heritabilities in another sample (M. McGue & D. T. Lykken, in press). The prevalence of divorce was unusually low in the NAS-NRC, possibly contributing to the lower heritability figures. Finally, we consider the implications of moderate heritabilities for the understanding of dichotomous status variables such as divorce.

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2Institute of Medicine, National Academy of Sciences, 2101 Constitution Avenue, Washington, D.C. 20418.

ERIC TURKHEIMER1. Intelligence of adopted and fostered children in the National Collaborative Perinatal Project.

The cognitive development of 747 adopted and fostered children in the National Collaborative Perinatal Project (NCPP) is analyzed. Available data describe the educational level and socioeconomic status of the biological and adoptive mothers and some of the fathers, a comprehensive perinatal medical history, a record of childhood diseases, and a sequence of psychometric measures of childhood intelligence, including the Bayley Mental and Motor scales at 8 months, the Stanford Binet Intelligence Scale at 4 years, and the Wechsler Intelligence Scale for Children and the Wide Range Achievement Test at 7 years. Results are analyzed separately for white and non-white children because different factor models of socioeconomic status were required in the two groups. Adopted and fostered children showed dramatically different outcomes: adopted children showed gains in IQ scores resulting from their adoptive placement, whereas fostered children showed substantial decrements. The role of selection for adoption and fostering is also analyzed. Individual differences in the children's intelligence are related to the educational levels of both biological and adoptive parents. The most powerful predictor of individual differences in intelligence, however, is a summary variable describing the number of diseases incurred during childhood. This variable also interacts with biological parent status, such that the intelligence of children with a large number of medical conditions shows weaker relationships with the status of their biological parents.

1University of Virginia, Department of Psychology, Gilmer Hall, Charlottesville, VA 22903.

Kelly A. Underwood1, T. Tritto1, B.C. Dudek1. CONGENIC STRAIN ANALYSIS OF ALCOHOL'S BEHAVIORALLY ACTIVATING EFFECT IN MICE2

Most genotypes of mice show locomotor-activating effects of ethanol (ETOH). In contrast, the C57BL/6Abg (B6) strain shows a dose profile lacking any activation. Therefore, there are two qualitatively different low dose effects of ETOH on locomotor activity: activation or sedation. Using a within-subject testing procedure, we have begun development of a congenic B6 strain which shows the activating phenotype. This has involved repeated backcrossing of activated mice to the inbred partner B6 strain. The donor stock was originally an 8-way cross.

Using a two day testing procedure (saline day - 1.5 g/kg ETOH day), we indexed the activation phenotype with a change score. Through five generations of repeated backcrossing, the activation phenotype is being successfully transferred to the B6 background. We are concurrently backcrossing a B6-like sedative phenotype to the B6 background. However, caution about the use of change scores (Nagoshi, C.T., Wilson, J.R., Plomin, R. Alcoholism, Clin Exp Res, 10:343-349, 1986) lead to questions about the nature of the phenotype being transferred. We now report a study using a more traditional between groups design, where mice of both the activational and sedative congenic stocks were treated with either saline or 1.5 g/kg ETOH and then tested for locomotor activity. A clear distinction was observed between the two congenics in measures of total distance traveled, rest time, and several other indices. The repeated testing procedures succeeded in maintaining a phenotype which is closely related to that indexed in a between groups design. We compare these data to the results of analogous studies of B6 and DBA/2Abg inbred strains, and the selectively bred Long- and Short-Sleep lines, stocks where differing response to low ETOH doses have also been observed.

2. Supported by NIAAA grant 1 R01 AA09038-01.
PHILIP A. VERNOY, and KERRY L. JANO. Self-rated vs. "actual" personality similarity in MZ and DZ twins and non-twin siblings.

Adult MZ twins (53 pairs), same-sex DZ twins (35 pairs) and same-sex non-twin siblings (40 pairs) completed the Personality Research Form-E (PRF-E; Jackson, 1987, Port Huron, Mich.: Research Psychologists Press) and the Sibling Evaluation of Personality Characteristics (SEPC). The PRF-E yields scores and profiles on 20 personality traits. The SEPC presents subjects with brief descriptions of the same 20 traits and asks them to rate how well they think each description fits themselves and fits their sibling (on a 3-point scale; fits perfectly, fits a bit, doesn't fit at all). Results show: 1. On average, MZs are more alike than DZs and sibs on the PRF (average twin/sib correlations of .49, .29, and .14, respectively); 2. On average, MZs rate themselves more similarly than do DZs or sibs on the SEPC (average twin/sib correlations of .26, .10, and .05, respectively); 3. MZs, DZs, and sibs all rate themselves on the SEPC as being more similar to one another than the PRF indicates they actually are; however, the discrepancies between rated (SEPC) and actual (PRF) degrees of similarity for MZs (r = .33) than for DZs (r = .15) or sibs (r = .24). Thus, MZs appear to be better judges than either DZs or sibs of how similar/dissimilar they are across the 20 personality traits assessed by the PRF.

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Sylvia Vignetti1, Paul Lichtenstein1, Lars Bjorkman2, and Gerald R. MclLearna. Genetic and environmental influences on dental status in aging.

Quantitative genetic analyses were performed on standard epidemiological measures of dental status, such as, number of missing teeth and number of missing and filled surfaces.

The sample consists of 97 monzygotic twin pairs (36 reared apart and 61 reared together) and 166 dizygotic twin pairs (93 reared apart and 73 reared together) over 50 years of age participating in the in-person testing phase of the Swedish Adoption/Twin Study of Aging (SATSA).

The analyses showed genetic effects explaining around 50% of the variance for the measures as well as evidence of both shared and non-shared environmental effects. Even though genetic effects are substantial, the shared environmental influences indicate childhood environment is important for dental status even in the last half of the life span.

4. Supported in part by NIA Grant AG-04363 and the Hackthor Foundation Research Network on Successful Aging.

R.J. VIKEN, R.J. ROSE, M. KOSKENVUO, AND J. KAPRINO. Stability and Change in Personality through the Lifespan: A Longitudinal Analysis.

We investigated the longitudinal stability of Extraversion and Neuroticism in 58,000 twin pairs from the Finnish Twin Cohort. The twins completed an abbreviated version of the Eysenck Personality Inventory in 1975 and again in 1981. Age range at the 1975 baseline was 18-60. We divided the sample by gender into a series of sequential age cohorts, and modeled the longitudinal genetic and environmental influences throughout the lifespan. Shared and unshared environmental influences on stability were more variable across age, gender, and cohort.

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3. Department of Public Health, University of Helsinki, Helsinki, Finland SF-20520

GEORGE P. VOGLER. Partitioning Genetic Variation of Quantitative Traits using Marker Loci in Twins.

A method for partitioning human quantitative genetic variation into effects due to specific chromosomal regions has recently been developed (D. E. Goldgar, 1990, Am. J. Hum. Genet. 47:957-967). This approach estimates from sibling pair data the proportion of a chromosomal region shared identical by descent (IBD) using flanking marker loci. The method is readily extended to the analysis of twin pair data since dizygotic (DZ) twin pairs have the same information as sib pairs regarding identity by descent for a chromosomal region. Whereas there is no variability in monozygotic (MZ) twin data for the proportion of a chromosomal region shared IBD, the incorporation of MZ twin phenotypic data into the model permits partitioning of the total twin pair covariance into genetic and shared environmental components under the assumptions of the classical twin model. By exploiting the information in both MZ and DZ twin data, a model is developed to partition variation for a quantitative trait into additive genetic variance due to loci within a particular chromosomal region, additive genetic variance due to loci located in the remainder of the genome, environmental variance shared by twins, and environmental variance unique to the individual.

1. Division of Biostatistics, Washington University School of Medicine, Box 8067, 660 S. Euclid Ave., St. Louis, Missouri 63110.
2. Partially supported by NIH and NIMH grants GM28719 and MH31302.
Reading Performance and Verbal Short-Term Memory: A Twin Study of Reciprocal Caution.3

Although reading performance and verbal short-term memory (VSTM) are correlated (about 0.40), the etiology of this relationship has only recently been investigated. Some researchers have suggested that reading problems may be the result of deficits in VSTM, but longitudinal studies have provided little support for this hypothesis. B. F. Pennington, G. Van Orden, D. Kiron & M. Haith, in S. Brady & D. Shankweiler (eds) Phonological Processing in Literacy, 1991). Alternatively, poor VSTM may be a consequence of reading problems (K. Stanovich, Ann. Dyslexia, 38, 154-177, 1988), or the causal relationship may be reciprocal. In a previous analysis (S. J. Wadsworth & J. C. DeFries, Behav. Genet., 21, 594, 1991), we explored the genetic and environmental causes of the phenotypic association between reading and VSTM. Results of bivariate and multivariate genetic analyses indicated that both reading ability and VSTM are highlyheritable, and that approximately 80% of their phenotypic relationship is due to common genetic influences. Heath and Martin (Alc. Clin. Exp. Res., 15, 122-128, 1991) have recently suggested that cross-sectional twin data can resolve hypotheses about direction of causation if inheritance patterns differ for the two traits. In the present study, we explored direction of causation between reading and VSTM employing their approach. Data from 149 pairs of MZ twins and 114 pairs of DZ twins in which at least one member of the pair has evidenced reading problems, as well as 106 pairs of MZ twins and 74 pairs of DZ twins in which neither member has reading problems, were subjected to reciprocal causation analyses. Results of these analyses suggest that differences in reading performance (or reading component processes) may influence performance on VSTM tasks, but that differences in VSTM are not an important cause of variation in reading performance. However, the possibility of a common cause of both reading performance and VSTM is not precluded.

1. Institute for Behavioral Genetics, University of Colorado, Boulder, Colorado 80309.
2. Department of Psychology, University of Denver, Denver, Colorado 80208.
3. Supported in part by NICHD grants HD-11681 and HD-27802, and by NIMH grant MH-16880.

IRWIN D. WALDMAN1, RICHARD A. WEINBERG2, and SANDRA SCARR3. Correlations among Biologically-Related and -Unrelated Family Members for an MMPI Measure of Aggression.

Historically, multiple theoretical perspectives on the causes and development of aggression have been advanced within psychology. Some of these views have emphasized genetic and biologically-related factors, while others have emphasized environmental and non-shared environmental factors. Behavioral genetic methods have the advantage of uniquely estimating the causal roles of genetic influences and of shared and non-shared environmental influences on aggression. We examined correlations among biologically-related and -unrelated family members for an MMPI measure of aggression in the Minnesota Transracial Adoption Study. Specifically, 101 mid- to late-adolescent Black or White and Infraracial adoptees and their adoptive parents and adoptive siblings were administered a variety of measures, including the MMPI. We used the sum of T-scores for scales F, 4 (Pd), and 9 (Ma) as an index of aggression. Preliminary analyses suggested higher mean scores on this index for transracial adoptees than for the biological children of adoptive parents. Positive assortative mating was suggested for adoptive mothers and fathers based on their correlation (r = .24) on the MMPI measure of aggression. Little evidence for direct vertical genetic or environmental transmission existed, based on the correlations of adoptive parents with their biological and adoptive children. A particular form of non-shared environmental influence, sibling conflict, was suggested by correlations among adoptive siblings (r = -.22) and among biological siblings (r = -.29). Gender and age differences in these sibling correlations will also be explored. These preliminary findings suggest that, at least within the families of adolescent transracial adoptees, environmental influences are operating to create differences in aggression among both biological and adoptive siblings.

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2 Institute of Child Development, University of Minnesota, Minneapolis, Minnesota 55455.
3 Department of Psychology, University of Virginia, Charlottesville, Virginia 22901.
KEITH E. WHITFIELD,1 S. S. CHERNY,1 D. W. FULKER,3 and J. S. RENNICK2 A Multivari-
ate Analysis of Cognitive Measures at 14 Months: The MacArthur Longitudinal Twin Study.9

Cognitive ability was assessed using a measure of general intelligence, Bayley's Mental Develop-
mental Index (MDI), and three measures of specific cognitive ability: a word comprehension test
(WCT), a sorting task (ST), and a memory for location task (MLT), at 16 months of age in
the MacArthur Longitudinal Twin Study. Currently, the sample consists of 100 MZ and 100
same-sex DZ twin pairs. In order to explore the relationship between general intelligence and
these three measures, general factors common to all four measures and factors common to all mea-
sures except the MDI, together with specific variances on those three measures, were estimated at
the general ordered environmental, and unique environmental levels using a Maximum-Likelihood
pedigree approach which uses all available data. Regarding the relationship between general in-
telligence and these three other measures, there was no significant genetic variance common
to these four measures ($\chi^2 = 4.50, p > .50$), but there was significant genetic variance in the MDI
($\chi^2 = 3.3, \chi^2 = 4.74, p < .05$). WCT was slightly more heritable than MDI ($\chi^2 = .36$), although
not statistically significant ($\chi^2 = 2.84, p < .10$) due to a much smaller sample with data on this task.
There was also no significant unique environmental variance common to these four measures
($\chi^2 = 1.34 , p > .95$). Overall, while neither genetic nor shared environmental variance was statisti-
cally significant ($\chi^2 = 12.63, p > .20$ and 5.70, $p > .80$, respectively), there was significant familial
resemblance, as is evidenced by a significant overall test of genetic effects against a model without
shared environmental effects ($\chi^2 = 15.19, p < .0001$). Ratings on 50 pairs of additional twins
will be available shortly.

1. Institute for Behavioral Genetics, University of Colorado, Boulder, CO 80309-0447.
2. Department of Psychology, Yale University, New Haven, CT 06510.
3. Supported in part by Grants HD-19802, HD-18426, and supplemental Grant HD-18426-08S1
from NICHD, by BRSR Grant RR-07013-26 from NIH, and by a grant from the John D. and
Catherine T. MacArthur Foundation. S. S. C. is supported in part by NSERC of Canada.

KUNIO YAMAZAKI1, GARY K. BEAUCHAMP1, JUDITH BARD2, LEWIS THOMAS3 and EDWARD A. BOYSE4. Development of MHC-
Determined Odorotypes in the Mouse.4

The major histocompatibility complex (MHC) of genes is the prime but not exclusive determinant of genetically specified body odors, termed "odorotypes", represented strongly in the
olfactory system of the mouse. Perception of MHC-determined odorotypes causes preferential mating and also affects the maintenance of early pregnancy, thereby favoring the propagation of particular MHC
genotypes in the mouse. Several studies have shown that a mother can discriminate her own pups from alien pups by odor but no specific genetic basis for this has heretofore been identified.
So far, all of our studies of MHC-determined odorotypes have involved odors of adult mice. The age of onset of MHC-
determined odorotype was thus examined. We tested the ability of
trained mice to discriminate odors of pups differing only at the MHC in a Y-maze. The results clearly demonstrated that urine of pups as young as one day of age expresses odorotypes.
The preliminary study suggests that mother and other infants respond differently to infant mice depending on their MHC type.

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2. University of Arizona, Tucson, AZ 85724.
3. Cornell University Medical College, NY, 10021.
4. Supported by NIH grant M01RR00042 and Richard Lounsbery Foundation.

FRANK F. YEN1, J.H. HERDS1, and W. WEISSKOFF1. Detection of Fragile X
Chromosomes in Leukocyte Cultures.

During the past 5 years, 8 months, a total of 254 male and 83 female patients suspected of having fragile X syndrome or with a family history of mental retardation were referred to the cytogenetics laboratory for fragile X studies. Blood cells were grown under two different conditions: low thymidine (1xg fetal horse serum) and low thymidine, low folate growth media (Medium 199) at pH 7.4 for 72 hours; and in
low thymidine, low folate growth media for 96 hours. 5-fluorodeoxyuridine (FUDR) was
added to the latter media 24 hours before harvest. Fragile chromosomes were studied by the
G-TO staining technique. A range of 60 to 250 metaphases per patient were analyzed
under the microscope for chromosome number, structure and presence of fragile X.
Of the 337 patients undergoing chromosome studies, 9 (2.7%) were found to have
fragile X chromosomes. Among 6 male and 3 female positive fragile X patients, the fragile X chromosomes of these 3 males and all 3 females were detected only in the low thymidine, low folate and FUDR culture condition. The frequencies of
fragile X chromosomes in males and females were 1.5%, 1.7%, 15.8%, 17.6% and 21% for the
males and all 3 females were detected only in the low thymidine, low folate and FUDR culture condition. The frequencies of
fragile X chromosomes in males and females were 1.5%, 1.7%, 15.8%, 17.6% and 21% for the
males. In the remaining 3 males, the fragile X chromosomes were found under both
culture conditions (20%:278, 23%:404 and 16.4%:508, respectively).

The preliminary study suggests that low thymidine, low folate and FUDR culture is a
superior indicator for fragile X than low thymidine and low folate culture. The latter
culture may be replaced by FUDR and excess thymidine culture (F.P. Howard-Peaches.
routine cytogenetic detection of the fragile X chromosome.

1. Child Evaluation Center, Department of Pediatrics, University of Louisville
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The California Psychological Inventory (CPI) was administered to a sample of 60 pairs of monozygotic and 42 pairs of dizygotic twins reared apart (MZT, DZT twins, largely adults) and 113 pairs of monozygotic and 111 pairs of dizygotic twins reared together (MZT, DZT, all adult males). The twin reared apart data was age and sex corrected. The twin reared together data represented one sex and a narrow age range and was simply standardized. We scored the CPI for the 18 standard primary scales. We also scored the instrument for 11 factor scales and 11 theoretical scales (not necessarily measuring the same constructs) developed by Hase & Goldberg (1967) to avoid item overlap, to sample the same (CPI) item pool and to reflect different scale construction strategies. The two groups of 11 scales were considered independent samples of non-overlapping scales that might be derived from the CPI item pool. The average correlation across the 22 scales for the MZA and the MZT twins were .43 and .42, the DZA and DZT correlations were .12 and .12. Comparable figures for the 18 primary scales were .44, .44 and .20, .17. We also correlated the MZA correlations for the 18 primary scales, considered as estimates of broad heritability, with the heritability estimates for the same scales published by Loehlin (1985) based on 17 subgroups which included the adult twins reared together discussed above (Mean of .44). The correlation was .778. We plan to fit biometric models to these four group data, but it appears that the average heritability of substantive scales created from the CPI item pool will be about .44 no matter how they were created.

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2. Department of Psychology, University of Texas, Austin TX 78712
# Overview of Schedule

## 22nd Annual BGA Meeting, July 1992

### Genetics and Alcoholism Symposium

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<th>Location</th>
<th>Event</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>Wednesday, July 1st</td>
<td>1-5pm</td>
<td>Sunshine</td>
<td>IBG Registration</td>
<td>IBG Event</td>
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<tr>
<td></td>
<td>6pm</td>
<td>Clarion Gardens</td>
<td>Reception (no host bar)</td>
<td>IBG Event</td>
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<tr>
<td></td>
<td>7-10pm</td>
<td>Grand Ballroom</td>
<td>Symposium Dinner</td>
<td>IBG Event</td>
</tr>
<tr>
<td>Thursday, July 2nd</td>
<td>8-4:15pm</td>
<td>Flagstaff B,D</td>
<td>Alcohol Plenary Sessions</td>
<td>IBG Event</td>
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### Behavior Genetics Association Annual Meeting

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<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Location</th>
<th>Event</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Thursday, July 2nd</td>
<td>8-7pm</td>
<td>Sunshine</td>
<td>BGA Registration</td>
<td>Animal models of ethanol use and abuse</td>
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<tr>
<td></td>
<td>4:15-6:15pm</td>
<td>Executive Board</td>
<td>ExComm Meeting</td>
<td>Psychopathology</td>
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<td></td>
<td>4:15-5pm</td>
<td>Canyon Room</td>
<td>Associate Members Meeting</td>
<td>Modelling, mapping, and physiology</td>
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<td></td>
<td>5pm</td>
<td>IBG</td>
<td>Reception &amp; Open House</td>
<td>Neurobehavioral-genetic dissection of two-way active avoidance learning in mice &amp; rats</td>
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<tr>
<td>Friday, July 3rd</td>
<td>8-5pm</td>
<td>Sunshine</td>
<td>Parallel Paper Session</td>
<td>Substance abuse in humans</td>
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<td></td>
<td>8-10am</td>
<td>Flagstaff Canyon</td>
<td>Parallel Paper &amp;</td>
<td>Maternal effects: inhibition or stimulation to behavior genetic analysis</td>
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<tr>
<td></td>
<td>10:30-12:30pm</td>
<td>Flagstaff Canyon</td>
<td>Symposium Session</td>
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<tr>
<td></td>
<td>1:30-3:30pm</td>
<td>Flagstaff Canyon</td>
<td>Parallel Paper &amp;</td>
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<td></td>
<td>3:30-5:30pm</td>
<td>Reception Area</td>
<td>Symposium Session</td>
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<td></td>
<td>5:30-6:30pm</td>
<td>Flagstaff Canyon</td>
<td>Perspective</td>
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<td></td>
<td>6:30-9pm</td>
<td>Flagstaff Canyon</td>
<td>Conversazione</td>
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<tr>
<td>Saturday, July 4th</td>
<td>8-5pm</td>
<td>Sunshine</td>
<td>BGA Registration</td>
<td>Evolutionary adaptation &amp; stress</td>
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<td>8:30-10:30am</td>
<td>Reception Area</td>
<td>Poster Session B</td>
<td>Unsolved problems in behavior genetics</td>
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<td>10:30-12:30pm</td>
<td>Flagstaff Canyon</td>
<td>Parallel Paper Session</td>
<td>Opportunities and pitfalls in funding behavior genetic research</td>
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<td></td>
<td>1:30-3:30pm</td>
<td>Flagstaff Canyon</td>
<td>Parallel Paper Session</td>
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<td></td>
<td>4:5-5:30pm</td>
<td>Century Front Ballroom</td>
<td>Business Meeting</td>
<td>Aging, Y chromosome, and olfaction</td>
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<td>6-7pm</td>
<td>Front Ballroom</td>
<td>Reception</td>
<td>Cognition</td>
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<td>7-10pm</td>
<td>Grand Ballroom</td>
<td>Annual Banquet</td>
<td>Childhood health &amp; parenting</td>
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<td>Award Presentations</td>
<td>Innovative techniques for evaluation of behavioral and drug responses</td>
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<td>Presidential Address</td>
<td>Dobzhansky, Shields &amp; Thompson Awards</td>
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<td>Lindon Eaves</td>
<td>Modelling the genetic &amp; environmental mechanisms of human behavioral development</td>
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<tr>
<td>Sunday, July 5th</td>
<td>7:30-8:30am</td>
<td>Executive Board</td>
<td>ExComm Meeting</td>
<td>Animal models of behavior</td>
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<td>8:30-10am</td>
<td>Flagstaff Canyon</td>
<td>Parallel Paper Session</td>
<td>Personality structure</td>
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<td></td>
<td>10-12pm</td>
<td>Flagstaff Canyon</td>
<td>Symposium</td>
<td>Sex differences in transmission &amp; expression</td>
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