

A COMPUTER PROGRAMME FOR RECORDING MALE SEX BEHAVIOUR IN RATS

H. N. MALLICK*, P. TILAKARATNA, S. K. MANCHANDA
AND V. MOHAN KUMAR

*Department of Physiology ,
All India Institute of Medical Sciences,
New Delhi - 110 029*

(Received on December 15, 1992)

Abstract : An accurate method of recording the frequencies of copulatory events, the latencies of initiation to copulation and the time spent in different behavioural categories is described. A microcomputer (IBM-PC) based data collection system for acquisition and analysis of male rodent sex behaviour has been developed. This software features ease of data entry and operation, using single key presses by assigning a preset code to each. Internal clock of the computer is made to function as a timer for accurate recording of latencies and intervals. A print out of the frequency or duration of data can be obtained either concurrently or after the completion of the experiment, as required. The least count of the technique is about 10^{-4} min and this precludes its use for extremely rapidly changing behaviour.

Key words : rat sex behaviour computer programme pupulatory parameters

INTRODUCTION

Several computer programmes have been described for the acquisition and partial analysis of the copulatory behaviour of male rats (1, 2, 3). Some of these programmes had restrictions that made them incompatible with widely used IBM and compatible computer hardware. Moreover use of calibrated software loop in these studies reduces the accuracy of measurement of time. We present here a method of quantifying sex behaviour using an IBM compatible PC. The method measures frequencies, latencies and duration of different copulatory parameters. The least count for recording time by this system is 10^{-4} minute which uses the internal clock of the computer.

Two important parameters in behavioural scoring are the frequency and duration of certain behaviour. Thus in scoring the sexual behaviour of male rats, one may only want to know how often mounting, intromission or ejaculation takes places within a certain time period (4). In this type of scoring, stress is laid

on the frequencies of individual behavioural events, without taking into consideration the durations or latencies (1). However, other scoring systems also take into account the amount of time spent by the animal in various behavioural categories. The behavioural categories are assigned weightage according to the intensity of behaviour that they represent and the final score is calculated during the total time period. Thus the entire behaviour of the animal during certain period can be reduced to a single number which represents the intensity of the type of behaviour studied. As this procedure is very convenient, it has been used to give an ordinal measure of drive intensity in sexual behaviour (5).

Our behavioural scoring programme can deal with the above four types of scoring ; the frequency, duration, latencies and weighted scores of the type discussed above. It is more convenient to use than a kymograph or a polygraph as multiple channel event recorder. Also the commercial programme available elsewhere in the world are expensive and poses

*Corresponding Author :

operational difficulties as those are designed to meet individual requirements. We have specially designed this programme for use in our country with available IBM-PC. The software can be availed from us free of cost or one can use by reloading it from the complete list given.

Requirements for running sex behaviour programme : This programme was developed to study the different components of male sex behaviour of rats. The latencies to pursuit, mount, intromission, ejaculation and the post ejaculatory interval (PEI) can be tallied in real time by pressing appropriate keys on the computer key board. The computer does timing operations, using its internal clock. The frequencies of events (pursuit, mount, intromission and ejaculation) can be registered on pressing assigned keys. The timed parameters and sex drive score are processed through equations to a give a print out of the result. The minimum system requirements to run the programme are :

1. IBM PC or clone with 256 K of memory.
2. CGA display card
3. I Floppy drive (360 K)
4. 80 column dot matrix printer
5. Disk operating system (above version 2) by Microsoft Corporation.
6. Quick basic language disk (Microsoft Corporation)
7. The programme disk

The operation of the programme is fairly simple. To start up, the programme asks for information regarding the particular experimental session. (e.g. Rat identification, any treatment condition of the rat). When the experiment begins with the introduction of female to test cage, the user presses key 'O'. This starts the computer clock. When certain rat behaviour is observed, the corresponding key is pressed (e.g. key No. 1 for 'pursuit'). The computer records the latency of each of the categories (Pursuit, mount, intromission and ejaculation) and the PEI i.e. records the time interval from the start of the test till the key for any of these categories is pressed for the first time. In addition, it records the number of times each of the keys are pressed, for the frequency of events. Screen display confirms by showing a tally of all 'key presses'. Three

other functions are assigned, which include the time spent by rats in resting, grooming or self-oriented activity. When the experiment is over key No. 9 is pressed. The computer puts the acquired data through pre-programmed equations to give the sex drive score and mean interintromission interval. The results can be obtained either on the screen or on a line printer. The programme is set to end experiment with first intromission after first ejaculation or after 60 minute which ever is earlier. The flow chart and list of the programme is given in Fig. 1 and Fig. 2 respectively. A print out of the result of an experimental session is given in Fig. 3.

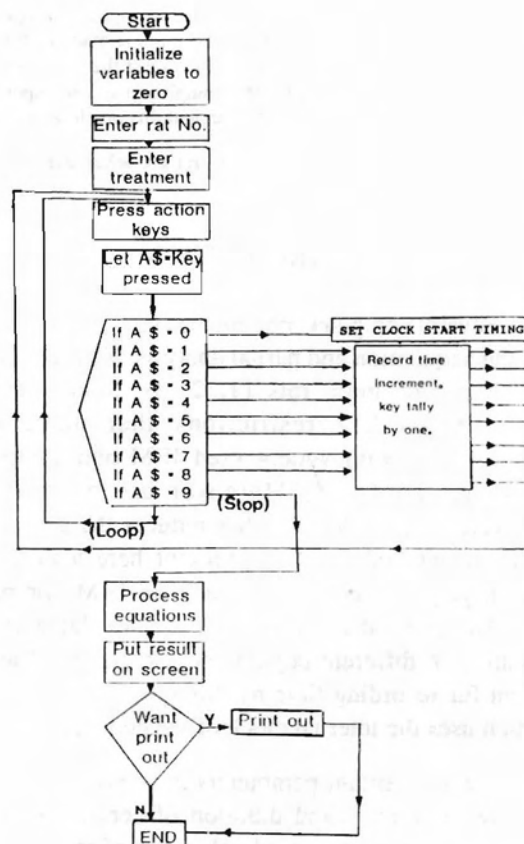


Fig. 1 : Flow chart of the programme used for recording male sex behaviour.

The accuracy of this system is 10^{-4} minute and can be further reduced if required.

```

10 REM no loop adjustments to be made
20 REM MODIFIED AGAIN : 4/SEP/90 : 1 OCTOBER 1990
30 REM MODIFIED PRASANNA 28 JAN 1989
40 LET FLAG = 0
50 LET INCREMENT = 0
60 GOSUB 1060
70 C = 0: D = 0: E = 0: F = 0: I = 0: J = 0: K = 0: L = 0:
M = 0: N = 0: O = 0: R = 0: X = 0: Y = 0: Z = 0
80 LET DS$ = DATE$
90 LOCATE 8, 47: INPUT RS$
100 GOTO 110
110 LOCATE 8, 69: INPUT TR$
120 INITIALTIME = 0
125 CZ = 0
130 AS$ = INKEY$
150 IF AS$ = "0" THEN INITIALTIME = TIMER: LET CZ = 1: LOCATE 10, 40:
LET TS$ = TIME$: PRINT "STARTED "; TIME$
160 IF AS$ = "1" THEN 270
170 IF AS$ = "2" THEN 300
180 IF AS$ = "3" THEN 330
190 IF AS$ = "4" THEN 360
200 IF AS$ = "5" THEN 390
210 IF AS$ = "6" THEN 410
220 IF AS$ = "7" THEN 430
230 IF AS$ = "8" THEN 450
240 IF AS$ = "9" THEN 700
250 IF CZ = 1 THEN LOCATE 20, 52: PRINT (TIMER - INITIALTIME) / 60
260 GOTO 130
270 IF C > 0 THEN 290
280 P = TIMER - INITIALTIME
290 C = C + 1: LOCATE 12, 52: PRINT C: GOTO 170
300 IF D > 0 THEN 320
310 N = TIMER - INITIALTIME
320 D = D + 1: LOCATE 14, 52: PRINT D: GOTO 180
330 IF E > 0 THEN 350
340 O = TIMER - INITIALTIME
350 E = E + 1: LOCATE 16, 52: PRINT E: GOTO 190
360 LET FLAG = 1: LOCATE 18, 52: PRINT 1: IF F > 0 THEN 380
370 S = TIMER - INITIALTIME
380 F = F + 1
390 T = TIMER - INITIALTIME
400 GOTO 210
410 IF I = 0 THEN 470
420 IF I = 1 THEN 500
430 IF J = 0 THEN 540
440 IF J = 1 THEN 570
450 IF K = 0 THEN 610
460 IF K = 1 THEN 640
470 I = I + 1
480 X = X + (TIMER - INITIALTIME)
490 BEEP: GOTO 220
500 I = I - 1
510 R = R + (TIMER - INITIALTIME) - X
520 X = 0
530 BEEP: GOTO 220
540 J = J + 1
550 Y = Y + (TIMER - INITIALTIME)
560 BEEP: GOTO 230
570 J = J - 1
580 M = M + (TIMER - INITIALTIME) - Y
590 Y = 0
600 BEEP: GOTO 230
610 K = K + 1
620 Z = Z + (TIMER - INITIALTIME)
630 BEEP: GOTO 240
640 K = K - 1
650 L = L + (TIMER - INITIALTIME) - Z
660 Z = 0: BEEP: GOTO 240
665 GOTO 700
670 GOSUB 1500: GOSUB 1280
680 LOCATE 13, 42: INPUT YN$
690 IF YN$ = "Y" OR YN$ = "y" THEN GOSUB 1530
695 RETURN
700 CLS : PRINT "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
710 PRINT "*"
720 PRINT "*"
730 PRINT "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

```

R E S U L T S E C T I O N

```

740 PRINT "
750 PRINT "DATE : "; D$; "                TIME : "; T$
760 PRINT "RAT #: "; R$
770 PRINT "TREATMENT :"; TR$
780 PL = P / 60
790 IF PL <> 0 THEN PRINT "PURSUIT LATENCY      =:"; PL; " Min. "
800 PF = INT(C + .5)
810 PRINT "PURSUIT FREQUENCY =:"; PF
820 IF N <> 0 THEN PRINT "MOUNT LATENCY =:"; (N / 60); "Min."
830 PRINT "MOUNT FREQUENCY =:"; INT(D + .5)
840 il = (O / 60)
850 IF il <> 0 THEN PRINT "INTROMISSION LATENCY =:"; il; "Min."
860 PRINT "INTROMISSION FREQUENCY =:"; INT(E + .5)
870 el = (S - O) / 60; IF O > S THEN el = 0
880 IF el <> 0 THEN PRINT "EJACULATION LATENCY =:"; el; "Min."
890 PRINT "EJACULATION FREQUENCY =:"; INT(F + .5)
900 IF FLAG <> 0 THEN PRINT "PEI = :"; (XX - S) / 60; "Min."
910 PRINT "R=:"; R / 60; "Min."
920 PRINT "G=:"; (M / 60); "Min."
930 PRINT "EOA=:"; (L / 60); "Min."
940 IF FLAG = 0 THEN LET RDA = 0:           ELSE LET RDA = 4
950 MARK = (INT(C + .5) * 1 + INT(D + .5) * 2 + INT(E + .5) * 3 + RDA
960 LET tdura = (FINNISH / 60): REM TDURA =IL+EL
965 IF FLAG = 1 THEN tdura = il + el

970 SDS = MARK / (tdura)
972 IF FLAG = 0 THEN LET LOVI$ = "TOTAL DURATION OF EXPERIMENT = "
973 IF FLAG = 1 THEN LET LOVI$ = " FIRST EJACULATORY SERIES DURATION
980 PRINT LOVI$; tdura; " Min"
990 IF E = 0 THEN PRINT "MIII IS INFINITY": GOTO 1020
1000 IF el > 0 THEN PRINT "MIII = :"; (el / E)
1010 IF el = 0 THEN PRINT "MIII = :"; ((tdura / 60) / E)
1020 REM
1030 PRINT "SDS = "; INT((SDS * 100) + .5) / 100
1040 INPUT " PRESS < -ENTER - > TO CONTINUE..... "; Z$
1045 GOSUB 670
1050 RUN
1060 CLS
1065 PRINT
1070 PRINT "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX"
1080 PRINT "*                MALE        RAT        S        E        X        B        E        H."
1090 PRINT "....."
1100 PRINT "*"
1110 PRINT "*                DEPTT. OF PHYSIOLOGY,AIIMS,NEW DELHI,INDIA
1120 PRINT "*"
1130 PRINT "*                RAT :        TREATMENT :
1140 PRINT "*"
1150 PRINT "*                ACTIONS.....
1160 PRINT "*"
1170 PRINT "                PURSUIT .....                TIMES
1180 PRINT "*"
1190 PRINT "                MOUNT.....                TIMES
1200 PRINT "*"
1210 PRINT "                INTROMISSION.....                TIMES
1220 PRINT "*"
1230 PRINT "                EJACULATION.....                TIMES
1240 PRINT "*"
1250 PRINT " XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX[
1260 PRINT "-----"
1270 RETURN
1280 CLS
1290 PRINT "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX"
1300 PRINT "*"
1310 PRINT "*                MALE        RAT        SEX        BEHAVIOUR        PROGRAM
1320 PRINT "*"
1330 PRINT "*"
1340 PRINT "*"
1350 PRINT "*                DEPTT. OF PHYSIOLOGY,AIIMS,NEW DELHI,INDIA
1360 PRINT "*"
1370 PRINT "*"
1380 PRINT "*"
1390 PRINT "*"
1400 PRINT "*"
1410 PRINT "*                DO YOU WANT PRINT OUT (Y/N)
1420 PRINT "*"
1430 PRINT "*"
1440 PRINT "*"

```

```

1450 PRINT "*"
1460 PRINT "*"
1470 PRINT "*"
1480 PRINT "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX["
1490 RETURN
1500 REM
1510 LET XX = TIMER - INITIALTIME: LET FINNISH = (XX)
1520 RETURN
1530 CLS : LPRINT "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX?"
1540 LPRINT "*"
1540 LPRINT "                R E S U L T   S E C T I O N
1550 LPRINT " XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX["
1560 LPRINT "
1570 LPRINT "DATE : "; D$; "                TIME : "; T$
1580 LPRINT "RAT #: "; R$
1590 LPRINT "TREATMENT : "; TR$
1600 PL = P / 60
1610 IF PL <> 0 THEN LPRINT "PURSUIT LATENCY      ="; PL; " Min. "
1620 PF = INT(C + .5)
1630 LPRINT "PURSUIT FREQUENCY ="; PF
1640 IF N <> 0 THEN LPRINT "MOUNT LATENCY ="; (N / 60); "Min."
1650 LPRINT "MOUNT FREQUENCY ="; INT(D + .5)
1670 il = (O / 60)
1680 IF il <> 0 THEN LPRINT "INTROMISSION LATENCY ="; il; "Min."
1690 LPRINT "INTROMISSION FREQUENCY ="; INT(E + .5)
1700 el = (S - O) / 60: IF O > S THEN el = 0
1710 IF el <> 0 THEN LPRINT "EJACULATION LATENCY ="; el; "Min."
1720 LPRINT "EJACULATION FREQUENCY ="; INT(F + .5)
1730 IF FLAG <> 0 THEN LPRINT "PEI = "; (XX - S) / 60; "Min."
1740 LPRINT "R="; R / 60; "Min."
1750 LPRINT "G="; (M / 60); "Min."
1760 LPRINT "EOA="; (L / 60); "Min."
1780 IF FLAG = 0 THEN LET RDA = 0: ELSE LET RDA = 4
1790 MARK = (INT(C + .5) * 1 + INT(D + .5) * 2 + INT(E + .5) * 3 + RD
1800 LET tdura = (FINNISH / 60): REM TDURA = IL+EL
1810 IF FLAG = 1 THEN tdura = il + el
1820 SDS = MARK / (tdura)
1830 IF FLAG = 0 THEN LET LOVI$ = "TOTAL DURATION OF EXPERIMENT = "
1840 IF FLAG = 1 THEN LET LOVI$ = " FIRST EJACULATORY SERIES DURATION
1850 LPRINT LOVI$; tdura; " Min"
1860 IF E = 0 THEN LPRINT "MIII IS INFINITY": GOTO 1020
1870 IF el > 0 THEN LPRINT "MIII = "; (el / E)
1880 IF el = 0 THEN LPRINT "MIII = "; ((tdura / 60) / E)
1890 REM
1900 LPRINT "SDS = "; INT((SDS * 100) + .5) / 100
1910 INPUT " PRESS < -ENTER - > TO CONTINUE..... "; Z$
1920 RETURN
    
```

Fig. 2 : List of the programme used for recording male sex behaviour.

```

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                R E S U L T   S E C T I O N
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
DATE : 10-01-1992                TIME : 05:50:09
RAT #: 08
TREATMENT :SCREEN
PURSUIT LATENCY      =: .5701497 Min.
PURSUIT FREQUENCY =: 12
MOUNT LATENCY =: .7404948 Min.
MOUNT FREQUENCY =: 6
INTROMISSION LATENCY =: 1.012337 Min.
INTROMISSION FREQUENCY =: 21
EJACULATION LATENCY =: 6.144303 Min.
EJACULATION FREQUENCY = 1
PEI = : 2.526693 Min.
R=: .2589844 Min.
G=: .1601888 Min.
EOA=: 0 Min.
FIRST EJACULATORY SERIES DURATION = 7.156641 Min
MIII = : .2925859
SDS = 12.72
    
```

Fig. 3 : Computer output of the male sex behaviour programme in one of the recording sessions.

The advantages of this computer programmed event recording are :

1. Ease of entering data
2. High accuracy
3. Repetitive calculations are automatically done.

4. Give a print out of processed data.

ACKNOWLEDGEMENTS

The authors wish to thank Dr. R.S. Tyagi and Mrs. Asha for initially helping to make the programme in a programmable calculator.

REFERENCES

1. Hendrie CA, Bennet SA. A microcomputer technique for the detailed behavioural and automatic statistical analysis of animal behaviour. *Physiol Behav* 1984 ; 32 : 865-869.
2. Leu JR, Hendricks SE. Use of a microprocessor and a digital computer in the analysis of rodent mating behaviour. *Behav Res Methods Instrum* 1980 ; 12 : 388.
3. Rakerd B, Brigham DA, Clemens LG. A microcomputer based system for recording and analyzing behavioural data regarding the sexual activity of male rodents. *Physiol Behav* 1985 ; 35 : 999-1001.
4. Grunt JA, Young WC. Differential reactivity of individuals and the response of the male guinea pig to testosterone propionate. *Endocrinology* 1952 ; 51 : 237-243.
5. Aronson LR, Cooper ML. Desensitization of the glans penis and sexual behaviour in cats. In Diamond M. Ed. *Perspectives in Reproduction and sexual behaviour. Bloomington, Indiana University Press* 1968 ; 51-82.