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TISCON, A BASIC COMPUTER PROGRAM FOR THE CALCULATION OF THE BIODISTRIBUTION OF RADIONUCLIDE-LABELLED DRUGS IN RATS AND MICE

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ABSTRACT

Animal biodistribution studies on radionuclide-labelled drugs are labour-intensive and time-consuming. A method for rapidly carrying out these studies on rats and mice is presented. An interactive computer program, written in BASIC, is used to calculate parameters of interest, such as per cent injected dose (%ID),%ID per gram and target to non-target ratios.

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The following descriptors have been selected from the INIS Thesaurus to describe the subject content of this report for information retrieval purposes. For further details please refer to IAEA-INIS-12 (INIS: Manual for Indexing) and IAEA-INIS-13 (INIS: Thesaurus) published in Vienna by the International Atomic Energy Agency.

MICE; RADIONUCLIDE KINETICS; RADIOPHARMACEUTICALS; RATS; T CODES

CONTENTS

1. INTRODUCTION

Animal biodistribution studies are widely used in nuclear medicine to assess the tissue specificity of radionuclide-labelled drugs in the development of new radiopharmaceuticals [Risch et al. 1978]; in critical comparisons of radiopharmaceuticals from different manufacturers, or having different chemical characteristics that are directed to specific target tissues such as skeletal or tumour imaging agents [Hosain 1977; Glenn and Colombetti 1979]; and for the quality control of existing radiopharmaceuticals [Maddalena et al. 1977; US Pharmacopoeia 1980; Baker 1981].

Quantitative animal biodistribution studies involve the administration of a radionuclide-labelled drug to an animal. Most commonly, this is a small rodent such as the rat or mouse. After a prescribed time interval has elapsed, the animal is sacrificed for tissue samples which are then weighed and counted in a gamma counting device. The sample masses and counts, after correction for background and decay, are used to determine the biodistribution of the drug.

Such studies are often carried out on different formulations, each of which may be administered to three to six replicated animals per data point at different doses and over a number of time intervals. Each animal can be expected to yield from 20 to 30 tissue samples. Consequently, it is not uncommon to weigh and count from several hundred to several thousand samples from each experimental study. Without a reasonable degree of automation, the resultant sample and data manipulation can become rather tedious and prone to error.

At the AAEC Research Establishment, a Sartorius model 1219MP electronic balance facilitates sample weighing, and a Nuclear Data model 1185, 300-sample automatic gamma counter is used to automate sample counting. A computer program, TISCON, is used to carry out the data manipulation. With this system it is possible for two operators to carry out 1200 to 1500 routine animal biodistribution studies, involving the analysis of 30 000 to 40 000 tissue samples per annum.

2. BIODISTRIBUTION METHOD

The following method for biodistribution studies on rats and mice has been adopted at the AAEC Research Establishment. Each animal is lightly anaesthetised with diethyl ether and placed in a suitable restrainer. The test radiopharmaceutical solution is then intravenously injected into each animal using a glass microsyringe of suitable capacity (e.g. a Hamilton or SGE 100-µL syringe); the time of injection is recorded and the animal is placed in a metabolic cage for the collection of urine and faeces.

Where particulate suspensions are to be injected, a microsyringe cannot be used, since the fine bore of the needle can cause changes in the size distribution of the labelled particles. In such cases, a 1-mL disposable syringe fitted with a 23-25 gauge needle is used. The syringe is weighed accurately to 1 mg before and after injection, the difference between the two masses indicating the mass delivered.

Alternatively, the syringe can be counted before and after injection, the difference between the two counts being the activity delivered. However, this method can suffer from counting geometry problems.

When an injection is carried out, and there is doubt on whether the full dose was delivered into the vein, the animal is discarded and replaced by another. To verify the adequacy of injection, a section of the tail 2 cm below and 4 cm above the injection site is sampled.

A volume of the test solution equal to the dose administered to the animals is injected into a 10- or 25-mL volumetric flask, containing a small quantity of isotonic saline; the volume is then adjusted to full capacity with additional isotonic saline. Three 1-mL aliquots are transferred to sample counting containers for use as standards.

Five minutes before completion of the test period post injection, the animal is stimulated to urinate and defaecate, then transferred to a container loaded with diethyl ether for sacrifice. After sacrifice, each animal is weighed and tissue samples of similar size (0.5-2 g) are taken, transferred to pre-weighed counting containers and weighed. A sample data sheet is shown in Appendix A.

If sample counting containers are pre-weighed and pre-sorted into groups of the same mass, the balance can be tared for a group container mass, and hence eliminate the need to subtract individual sample container masses at a later date.

The urine is washed from the sides of the metabolic cage and, after total urine mass has been determined, a 1-mL aliquot is transferred to a sample counting container. All samples are counted in an automatic gamma scintillation counter. The three standards are counted at the front of the line and then transferred to the rear to be counted again. The standards are corrected for decay to give a mean standard count per unit time, calculated back to the start of each group of animal tissue samples (i.e. zero time). At this stage, data are ready to be entered into the TISCON program.

3. THE COMPUTER PROGRAM

The TISCON (TISsue CONcentration) program was first written in FORTRAN [Maddalena 1973] then rewritten [Wood 1975] in ACL, an AAEC developed interactive language [Sanger 1971]. The present interactive version has been written in the Digital Systems Corporation's version of BASIC [DEC 1976] and is run on a PDP11/45 computer. A Microsoft BASIC version of the program is in preparation.

The program is fully prompted, and can be used by students with minimal prior experience. A listing is given in Appendix B.

3.1 Input Data

The following input data are required:

(a) Initial Data.

(i) Animal species (rat or mouse).

(ii) Option to add extra tissue sample types. Nineteen tissue types are given, extras can be simply added if required at this stage.

(iii) Option to correct tissue sample counts for decay. This option enables a series of tissue sample counts to be corrected for decay back to time zero when the counting period plus sample handling periods are constant between samples, as is the case for a series of samples counted in an automatic multisample gamma scintillation counter.

(iv) Experimental details - title, names, dates, etc.

(v) Numbers of animals (N).

(vi) Option to determine net sample mass. This option is useful if there is a need for the program to calculate the net sample mass by subtracting the sample container mass from the combined masses of the sample plus sample container.

(b) Sample Data.

(i) Body mass for each rat (g); body mass and carcass mass for each mouse (g).

(ii) Standard for each rat or mouse (counts per unit time). This refers to the activity of the injected dose or the dose remaining in the animal corrected to time zero.

(iii) Information on sample mass, organ mass and sample counts. This gives the name of the tissue sample and requires sample mass (g), organ mass (g) and sample counts for each rat or mouse (counts per unit time).

3.2 *Input Data Error Correction*

(a) Correction of Initial Data. After initial data are entered, the option is given either to accept and continue or to re-enter initial data.

(b) Correction of Sample Data. If an incorrect entry is made for a tissue, the program will step backwards to the incorrect tissue for correction, by entering a negative number in lieu of the next sample mass.

(c) Extensive Correction of Sample Data. If a number of incorrect entries are made for the rat or mouse, it may be easier to re-enter all relevant data. This option is given after all the tissues for each animal have been entered.

3.3 Output Data

The TISCON program produces the following output:

(i) All the input information.

(ii) The sample counts and counts per organ corrected for decay.

(iii) The percentage injected dose (% ID) per gram, and tissue-to-muscle, tissue-to-blood and tissue-to-liver ratios for the group of animals.

(iv) The mean and standard deviations of the % ID, % ID per gram, and tissue-to-muscle and tissue-to-blood ratios.

An example of the program output is given in Appendix C.

4. METHOD OF CALCULATION

The results of biodistribution studies can be expressed in a variety of ways; however, the method most frequently employed is as follows [Risch et al. 1978; Glenn and Colombetti 1979]:

- Activity of each tissue is expressed as percentage dose per tissue.
- Activity concentration of each tissue is expressed as percentage dose per gram of tissue.
- Target to non-target ratios are estimated.

The percentage dose per tissue is an estimate of the quantity of the radionuclide-labelled drug localised in the tissue at a prescribed time. It can be based on either the activity of the dose at the time of injection (%

ID) or the activity remaining in the animal at the time of sacrifice (percentage dose remaining (% DR)). The former measurement usually includes excreta (urine, faeces) data whereas the latter does not. Hence

$$\%ID = \frac{C2 \times W2 \times 100}{W1 \times S}$$

where C2 is the decay corrected sample count per unit time, S is the count per unit time of an external standard of suitable geometry corrected for decay, W1 is the sample mass (g) and W2 is the organ mass (g).

It should be noted that the organ mass of the muscle, skin, bone and blood cannot be conveniently measured; in such cases, a factor based on the body mass of the animal is used.

At the AAEC Research Establishment the following factors are used for the rat (where B is the body mass (g)):

organ mass (muscle) = 0.45 x B
organ mass (skin) = 0.20 x B
organ mass (bone) = 0.12 x B
organ mass (blood) = 0.07 x B

These factors are based on results from the dissection of 20 pathogen-free Australian Albino Wistar (AAW) rats (10 male, 10 female), fasted overnight and with body weights between 200 and 300 g. Results are similar to those found for such tissues in other strains of rats [Schümichen et al. 1977; Altman and Dittmer 1964].

For fasted, pathogen-free Balb C mice with body weights between 20 and 30 g, the factors we use are based upon the carcass mass, which is defined as the body mass less the visceral organs, i.e. liver, spleen, kidneys, gastro-intestinal tract, reproductive organs, heart and lungs. This was found to give a more reproducible estimator. The factors are as follows (where E is the carcass mass (g)):

organ mass (muscle) = 0.54 x E
organ mass (skin) = 0.25 x E
organ mass (bone) = 0.15 x E
organ mass (blood) = 0.065 x B

It is noted that organ mass (blood) is normally expressed as a factor of body weight.

It should be remembered that the use of factors to determine the organ masses gives an estimate that is accurate to approximately ± 15 per cent. The alternative to the estimation of organ masses is to count the whole carcass and report the results as % ID in the carcass. This method, however, gives no idea of the amount of injected dose localised within the muscle, skin or bone compartments.

Calculations of the % DR are based on the amount of dose left in the whole body of the animal at the time of sacrifice. After correction for decay and geometry, the whole body counts are used as the standard count. Hence

$$\% \text{ DR} = \frac{C2 \times W2 \times 100}{W1 \times S1}$$

where S1 are the counts per unit time of animal whole body corrected for decay and geometry.

The percentage dose per gram of tissue is a measure of the activity concentration found in the tissue at the time interval post administration. Hence

$$\% \text{ ID/g tissue} = \frac{\% \text{ ID (tissue)}}{\text{organ mass}}$$

which reduces to

$$\% \text{ ID/g (tissue)} = \frac{C2 \times 100}{W1 \times S}$$

The target to non-target ratios give a relative measure of the concentration in the target tissue compared to other non-target tissues. High target to non-target ratios are desirable in external scintigraphic imaging studies [Glenn and Colombetti 1979].

$$\text{Target to non-target ratio} = \frac{\% \text{ ID/g of target tissue}}{\% \text{ ID/g of non-target tissue}}$$

Tissue-to-blood and tissue-to-muscle ratios are often quoted where radionuclide-labelled compounds are expected to localise in implanted tumours, whereas liver-to-lung and liver-to-spleen ratios are popular in studies on radionuclide-labelled particulate suspensions.

When tissue samples are counted in an automatic counting machine, the counting period and the time between samples, that is the time taken for the machine to move a sample from the counting well and replace it with the next, can be accurately determined. Knowing these periods makes it possible to correct all samples for decay to either the start or end of the series. Hence

$$N_o = N_t \times e^{\frac{\ell n\ 2 \times t \times N}{3600 \times H}}$$

where N_o is the decay corrected counts per unit time, N_t is the uncorrected counts per unit time, N is the sample number, t is the time between samples (s), and H is the isotope half-life (h).

5. CONCLUSIONS

The TISCON program and associated methods have been developed in an attempt to minimise the time and effort required for biodistribution studies on rats and mice with minimal loss of accuracy.

The structure and options available within the program should enable it to accommodate variations in biological technique with minimal changes to the program itself.

6. ACKNOWLEDGEMENTS

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APPENDIX A
TISCON DATA SHEET

ANIMAL NO.		
I.D. NO.		
BODY MASS		
CARCASS MASS		
STD. COUNT		

TISSUE	Mass Sample	Mass * Tube		Counts	Mass Sample	Mass * Tube		Counts
LIVER								
SPLEEN								
KIDNEY								
MUSCLE								
SKIN								
BONE								
LUNGS								
HEART								
BLOOD								
URINE								
BLADDER								
STOM								
GUT 1								
GUT 2								
GUT 3								
CAECUM								
RECTUM								

* Organ Mass in case of RATS

APPENDIX B
TISCON PROGRAM

```
1 REM TISCON VERSION 1.0
2 REM BY D.J.MADDALENA,ISOTOPE DIVISION,AAEC,NOV.1982.
3 REM PROGRAM FOR THE CALCULATION OF THE BIODISTRIBUTION
4 REM OF RADIOPHARMACEUTICALS IN RATS AND MICE
5 REM
100 PRINT:PRINT TAB(24);"TISCON 1.0":PRINT:PRINT
110 PRINT TAB(10);"RADIOPHARMACEUTICAL DISTRIBUTION STUDY"
120 PRINT TAB(9);STRING$(40,42):PRINT:PRINT
130 DIM W1(25),W2(25),C1(25),C2(25),C3(25)
140 DIM D1(6,25),D2(6,25),R1(6,25),R2(6,25),R3(6,25),M(5,2)
145 REM FOR >6 ANIMALS OR >25 SAMPLES INCREASE DIM
150 S$="LIVER  SPLEEN KIDNEY MUSCLE SKIN   BONE   LUNGS  HEART  BLOOD  "
160 S$=S$+"UR+BLADTOT.GUTSTOMACHGUT 1  GUT 2  GUT 3  CAEC.1 CAEC.2 RECTUM "
170 S$=S$+"FEMUR  TAIL   ":N1=INT((LEN(S$)+1)/7)
190 REM INPUT INITIAL DATA
200 INPUT"TYPE OF ANIMAL (RAT/MOUSE)";A$
210 R=0:IF LEFT(A$,1)="M" OR LEFT(A$,1)="m" THEN R=1
220 PRINT:INPUT"DO YOU WISH TO ADD EXTRA TISSUE TYPES";A$
230 IF LEFT(A$,1)="N" OR LEFT(A$,1)="n" THEN 300
240 INPUT"HOW MANY EXTRA TISSUE TYPES (MAX.=DIM-20)";S1
250 FOR I=1 TO S1
260 PRINT"NAME OF TISSUE NO. ";I;" (MAX. 7 CHR)= ";:INPUT A$
270 IF LEN(A$)>7 THEN 260
280 IF LEN(A$)<7 THEN A$=A$+STRING$((7-LEN(A$)),32)
290 S$=S$+A$:NEXT I:N1=N1+S1
300 PRINT:PRINT"FOR DECAY CORRECTION OF SAMPLES ENTER ISOTOPE HALF LIFE(HRS)"
310 PRINT:PRINT"    FOR NO DECAY CORRECTION ENTER ZERO";:INPUT H
320 IF H=0 THEN H=1:P=0:GOTO 340
330 PRINT:INPUT"ENTER PERIOD BETWEEN SAMPLES (SEC)";P
340 PRINT:INPUT"ENTER EXPERIMENT DETAILS";L$:PRINT
350 INPUT"NUMBER OF ANIMALS= ";N:PRINT
355 REM ENTER ANIMAL DATA
360 FOR I=1 TO N
370 PRINT"ENTER RESULTS OF ANIMAL NO. ";I:PRINT:PRINT
380 INPUT"ANIMAL BODY MASS= ";B(I):PRINT
390 IF R=1 THEN INPUT"MOUSE CARCASS MASS= ";E:PRINT
400 INPUT"STANDARD COUNTS= ";S:PRINT
410 INPUT"DO YOU WISH TO FIND NETT SAMPLE MASS (Y/N)";A$:PRINT
420 IF LEFT(A$,1)="Y" OR LEFT(A$,1)="y" THEN S9=1 ELSE S9=0
430 INPUT"DO YOU WISH TO CORRECT INITIAL DATA FOR THIS ANIMAL (Y/N)";A$
440 IF LEFT(A$,1)="Y" OR LEFT(A$,1)="y" THEN 380
450 PRINT:PRINT
500 K=1:GOTO 520
505 REM STEP BACKWARDS
510 IF W1(J)>-J THEN K=J+INT(W1(J)) ELSE K=J-1
520 IF K<1 THEN K=1
530 FOR J=K TO N1:A$=MID(S$,J*7-6,7)
540 IF A$="UR+BLAD" THEN A$="URINE  "
550 IF A$="TOT.GUT" THEN A$="BLADDER"
560 PRINT A$;:IF S9=0 THEN PRINT TAB(19);"SAMPLE MASS= ";:INPUTW1(J):GOTO 600
570 INPUT" SAMPLE+CONTAINER MASS= ";W3
575 IF W3=0 THEN 840
580 IF W3<0 THEN W1(J)=W3:GOTO 510
590 INPUT"                CONTAINER MASS= ";W4:W1(J)=W3-W4
600 IF W1(J)=0 THEN 840

Ready
```

(Continued)

```
610 IF W1(J)<0 THEN 510
620 IF R=1 AND J<>10 THEN 650
630 IF J=1 OR J=10 THEN PRINT TAB(19);"ORGAN MASS= ";:INPUT W2(J):GOTO 650
640 PRINT"                    ORGAN MASS= 0"
650 INPUT"                    SAMPLE CTS= ";C1(J)
660 IF R=0 THEN 750
690 REM CALCULATE ORGAN MASSES
700 IF A$="MUSCLE "THEN W2(J)=E*.54:GOTO 820
710 IF A$="SKIN   "THEN W2(J)=E*.25:GOTO 820
720 IF A$="BONE   "THEN W2(J)=E*.15:GOTO 820
730 IF A$="BLOOD  "THEN W2(J)=B(I)*.065:GOTO 820
740 GOTO 800
750 IF A$="MUSCLE "THEN W2(J)=B(I)*.45:GOTO 820
760 IF A$="SKIN   "THEN W2(J)=B(I)*.20:GOTO 820
770 IF A$="BONE   "THEN W2(J)=B(I)*.125:GOTO 820
780 IF A$="BLOOD  "THEN W2(J)=B(I)*.07:GOTO 820
790 IF A$="LIVER  "THEN 820
800 IF A$="URINE  "THEN 820
810 W2(J)=W1(J)
815 REM DECAY CORRECTION
820 C2(J)=C1(J)*EXP(0.0001925*P*J/H):C3(J)=(C2(J)/W1(J))*W2(J)
825 REM CALCULATE %INJ DOSE,% PER GRAM
830 D1(I,J)=C3(J)*100/S:D2(I,J)=D1(I,J)/W2(J):GOTO 850
840 C2(J)=0:C3(J)=0:D1(I,J)=0:D2(I,J)=0
850 IF A$="MUSCLE "THEN T1=D2(I,J)
860 IF A$="BLOOD  "THEN T2=D2(I,J)
870 IF A$="LIVER  "THEN T3=D2(I,J)
880 PRINT:NEXT J
895 REM CALCULATE TOT.GUT,URINE+BLADDER
900 IF R=1 THEN GOTO 970
910 C3(10)=C3(10)+C3(11)
920 W1(11)=0:C3(11)=0:FOR L=13 TO18
930 C3(11)=C3(11)+C3(L):W1(11)=W1(11)+W1(L):NEXT L
940 W2(11)=W1(11):C2(11)=C3(11):C1(11)=C2(11)
950 IF W2(11)=0 THEN W2(11)=1
960 D1(I,11)=C3(11)*100/S:D2(I,11)=D1(I,11)/W2(11)
970 GOSUB 1000:NEXT I:GOTO 2000
995 REM PRINT INPUT DATA
1000 PRINT"DO YOU WISH TO RE-ENTER DATA FOR THIS ANIMAL (Y/N)"
1010 INPUT"   IF NOT THEN START A NEW PAGE IF NECESSARY";A$
1020 IF LEFT(A$,1)="Y" OR LEFT(A$,1)="y" THEN 370
1030 PRINT:PRINT:PRINT L$:PRINT
1040 IF R=0 THEN A$=" RAT" ELSE A$=" MOUSE"
1050 PRINT"RESULTS OF ";A$;" BIODISTRIBUTION NO.";I
1060 PRINT STRING$(35,42)
1070 LET Z$="\   .   \ BODY MASS= ###.#  STANDARD CTS.= ########."
1080 PRINT USING Z$,A$,B(I),S
1090 IF R=1 THEN PRINT" CARCASS MASS = ";E
1100 PRINT:PRINT:PRINT
1110 PRINT"TISSUE        SAMPLE WT   ORGAN WT   SAMPLE CTS   DK COR CTS   CTS/ORGAN"
1120 Z$="\        \       ##.##       ###.#      #######.     #######.    #######."
1130 FOR L=1 TO N1:IF W1(L)=0 THEN 1160
1140 A$=MID(S$,L*7-6,7)
1150 PRINT USING Z$,A$,W1(L),W2(L),C1(L),C2(L),C3(L)
1160 NEXT L :PRINT:PRINT
1170 PRINT"TISSUE      %INJ DOSE  % PER GRAM  TIS/MUS    TIS/BLOOD    TIS/LIV"
1180 Z$="\        \    ##.##       ##.###     #####.#       ###.##      ###.##"
1190 REM CALCULATE TISSUE RATIOS
1200 FOR L=1 TO N1

Ready
```

```
1210 IF D1(I,L)=0 THEN 1280
1220 IF T1=0 THEN R1(I,L)=0 ELSE R1(I,L)=D2(I,L)/T1
1230 IF T2=0 THEN R2(I,L)=0 ELSE R2(I,L)=D2(I,L)/T2
1240 IF T3=0 THEN R3(I,L)=0 ELSE R3(I,L)=D2(I,L)/T3
1260 A$=MID(S$,L*7-6,7)
1270 PRINT USING Z$,A$,D1(I,L),D2(I,L),R1(I,L),R2(I,L),R3(I,L)
1280 NEXT L:PRINT:PRINT:PRINT:PRINT
1290 INPUT"START A NEW PAGE IF REQUIRED";A$
1300 RETURN
2000 IF N<2 THEN GOTO 2390
2010 PRINT:PRINT:PRINT:PRINT L$:PRINT
2020 IF R=0 THEN A$=" RATS" ELSE A$=" MICE"
2030 PRINT"MEANS AND STD DEVS. FOR ";N;A$
2040 PRINT STRING$(33,42):PRINT
2050 PRINT"TISSUE     %INJ     SD     %/G       SD       T/M       SD      T/B    SD"
2060 Z$="\       \  ##.##  ##.##  ##.###  ##.### #####.#  ###.#  ###.##  ###.##"
2100 REM CALCULATE MEANS & STD DEVS
2110 FOR J=1 TO N1
2120 IF D1(I,J)=0 THEN 2320
2130 K=1:FOR I=1 TO N
2140 W1(I)=D1(I,J):NEXT I
2150 GOSUB 2500
2160 K=2:FOR I=1 TO N
2170 W1(I)=D2(I,J):NEXT I
2180 GOSUB 2500
2190 K=3:FOR I=1 TO N
2200 W1(I)=R1(I,J):NEXT I
2210 GOSUB 2500
2220 K=4:FOR I=1 TO N
2230 W1(I)=R2(I,J):NEXT I
2240 GOSUB 2500
2300 A$=MID(S$,J*7-6,7)
2310 PRINT USING Z$,A$,M(1,1),M(1,2),M(2,1),M(2,2),M(3,1),M(3,2),M(4,1),M(4,2)
2320 NEXT J
2330 GOTO 2400
2390 PRINT"MEANS & STD DEVS. CANNOT BE FOUND FOR ONE ANIMAL"
2400 PRINT:PRINT:PRINT"DO YOU WISH TO CONTINUE (Y/N) ?"
2410 PRINT:INPUT"IF YES THEN START A NEW PAGE";A$
2420 IF LEFT(A$,1)="Y" OR LEFT(A$,1)="y" THEN 10
2430 GO TO 3000
2490 REM SUBROUTINE 2500 MEANS & STD DEVS WITH ZERO JUMP
2500 M1=0:M2=0:N3=0:FOR L=1 TO N
2510 IF W1(L)=0 THEN 2530
2520 M1=M1+W1(L):M2=M2+W1(L)^2:N3=N3+1
2530 NEXT L:IF N3<2 THEN M(K,2)=-1:GOTO 2550
2540 M(K,2)=SQR((M2-((M1^2)/N3))/(N3-1)):REM  STD DEV.
2550 M(K,1)=M1/N3:RETURN:  REM MEAN
3000 END

Ready
```

APPENDIX C
TISCON OUTPUT DATA

```
                RADIOPHARMACEUTICAL DISTRIBUTION STUDY
                **************************************

TYPE OF ANIMAL (RAT/MOUSE)? rat

DO YOU WISH TO ADD EXTRA TISSUE TYPES? yes
HOW MANY EXTRA TISSUE TYPES ? 2
NAME OF TISSUE NO.  1  (MAX. 7 CHR)= ? femur1
NAME OF TISSUE NO.  2  (MAX. 7 CHR)= ? femur2

FOR DECAY CORRECTION OF SAMPLES ENTER ISOTOPE HALF LIFE(HRS)

    FOR NO DECAY CORRECTION ENTER ZERO? 6.02

ENTER PERIOD BETWEEN SAMPLES (SEC)? 37.5

ENTER EXPERIMENT DETAILS? Tc99m Pyrophosphate

NUMBER OF ANIMALS= ? 1

ENTER RESULTS OF ANIMAL NO.  1


ANIMAL BODY MASS= ? 243.2

STANDARD COUNTS= ? 1489086

DO YOU WISH TO FIND NETT SAMPLE MASS (Y/N)? n

DO YOU WISH TO CORRECT INITIAL DATA FOR THIS ANIMAL (Y/N)? n


LIVER                SAMPLE MASS= ? 1.75
                     ORGAN MASS= ? 10.7
                     SAMPLE CTS= ? 19624

SPLEEN               SAMPLE MASS= ? .84
                     ORGAN MASS= 0
                     SAMPLE CTS= ? 2878

KIDNEY               SAMPLE MASS= ? .94
                     ORGAN MASS= 0
                     SAMPLE CTS= ? 10678

MUSCLE               SAMPLE MASS= ? 2.09
                     ORGAN MASS= 0
                     SAMPLE CTS= ? 686

SKIN                 SAMPLE MASS= ? 0

BONE                 SAMPLE MASS= ? 0

LUNGS                SAMPLE MASS= ?
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(Continued)

0

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HEART                SAMPLE MASS= ? 0


BLOOD                SAMPLE MASS= ? 1.12
                     ORGAN MASS= 0
                     SAMPLE CTS= ? 1603

URINE                SAMPLE MASS= ? 28.1
                     ORGAN MASS= ? 28.1
                     SAMPLE CTS= ? 22651

BLADDER              SAMPLE MASS= ? -1
URINE                SAMPLE MASS= ? 1.15
                     ORGAN MASS= ? 28.1
                     SAMPLE CTS= ? 22651

BLADDER              SAMPLE MASS= ? 11.0
                     ORGAN MASS= 0
                     SAMPLE CTS= ? 0

STOMACH              SAMPLE MASS= ? -1
BLADDER              SAMPLE MASS= ? 1.0
                     ORGAN MASS= 0
                     SAMPLE CTS= ? 69395

STOMACH              SAMPLE MASS= ? 0

GUT 1                SAMPLE MASS= ? 0

GUT 2                SAMPLE MASS= ? 0

GUT 3                SAMPLE MASS= ? 0

CAEC.1               SAMPLE MASS= ? 0

CAEC.2               SAMPLE MASS= ? 0

RECTUM               SAMPLE MASS= ? 0

FEMUR                SAMPLE MASS= ? 0

TAIL                 SAMPLE MASS= ? 1.0
                     ORGAN MASS= 0
                     SAMPLE CTS= ? 14804

femur1               SAMPLE MASS= ? .54
                     ORGAN MASS= 0
                     SAMPLE CTS= ? 19320

femur2               SAMPLE MASS= ? .53
                     ORGAN MASS= 0
                     SAMPLE CTS= ? 20186

DO YOU WISH TO RE-ENTER DATA FOR THIS ANIMAL (Y/N)
   IF NOT THEN START A NEW PAGE IF NECESSARY?
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Tc99m Pyrophosphate

RESULTS OF RAT BIODISTRIBUTION NO. 1
****
RAT BODY MASS= 243.2 STANDARD CTS.= 1489086.

TISSUE	SAMPLE WT	ORGAN WT	SAMPLE CTS	DK COR CTS	CTS/ORGAN
LIVER	1.75	10.7	19624.	19648.	120131.
SPLEEN	0.84	0.8	2878.	2885.	2885.
KIDNEY	0.94	0.9	10678.	10716.	10716.
MUSCLE	2.09	109.4	686.	689.	36094.
BLOOD	1.12	17.0	1603.	1620.	24630.
UR+BLAD	1.15	28.1	22651.	22924.	630465.
TAIL	1.00	1.0	14804.	15163.	15163.
femur1	0.54	0.5	19320.	19813.	19813.
femur2	0.53	0.5	20186.	20726.	20726.

TISSUE	%INJ DOSE	% PER GRAM	TIS/MUS	TIS/BLOOD	TIS/LIV
LIVER	8.07	0.754	34.0	7.76	1.00
SPLEEN	0.19	0.231	10.4	2.37	0.31
KIDNEY	0.72	0.766	34.6	7.88	1.02
MUSCLE	2.42	0.022	1.0	0.23	0.03
BLOOD	1.65	0.097	4.4	1.00	0.13
UR+BLAD	37.62	1.339	60.4	13.78	1.78
TAIL	1.02	1.018	46.0	10.48	1.35
femur1	1.33	2.464	111.2	25.36	3.27
femur2	1.39	2.626	118.6	27.03	3.48

START A NEW PAGE IF REQUIRED?
MEANS & STD DEVS. CANNOT BE FOUND FOR ONE ANIMAL

DO YOU WISH TO CONTINUE (Y/N) ?

IF YES THEN START A NEW PAGE? no

Ready

(Continued)

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          RADIOPHARMACEUTICAL DISTRIBUTION STUDY
          **************************************

TYPE OF ANIMAL (RAT/MOUSE)? mouse

DO YOU WISH TO ADD EXTRA TISSUE TYPES? yes
HOW MANY EXTRA TISSUE TYPES ? 1
NAME OF TISSUE NO.  1  (MAX. 7 CHR)= ? swab

FOR DECAY CORRECTION OF SAMPLES ENTER ISOTOPE HALF LIFE(HRS)

    FOR NO DECAY CORRECTION ENTER ZERO? 0

ENTER EXPERIMENT DETAILS? Gallium -67  1Hr p/i

NUMBER OF ANIMALS= ? 1

ENTER RESULTS OF ANIMAL NO.  1


ANIMAL BODY MASS= ? 26.3

MOUSE CARCASS MASS= ? 19.2

STANDARD COUNTS= ? 104786

DO YOU WISH TO FIND NETT SAMPLE MASS (Y/N)? yes

DO YOU WISH TO CORRECT INITIAL DATA FOR THIS ANIMAL (Y/N)? no


LIVER   SAMPLE+CONTAINER MASS= ? 5.184
               CONTAINER MASS= ? 3.645
                   SAMPLE CTS= ? 5727

SPLEEN  SAMPLE+CONTAINER MASS= ? 3.744
               CONTAINER MASS= ? 3.646
                   SAMPLE CTS= ? 338

KIDNEY  SAMPLE+CONTAINER MASS= ? 4.097
               CONTAINER MASS= ? 3.645
                   SAMPLE CTS= ? 3004

MUSCLE  SAMPLE+CONTAINER MASS= ? 4.113
               CONTAINER MASS= ? 3.643
                   SAMPLE CTS= ? 1394

SKIN    SAMPLE+CONTAINER MASS= ? 0

BONE    SAMPLE+CONTAINER MASS= ? 6\3.681
               CONTAINER MASS= ? 3.645
                   SAMPLE CTS= ? 268

LUNGS   SAMPLE+CONTAINER MASS= ?
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HEART    SAMPLE+CONTAINER MASS= ? 0

BLOOD    SAMPLE+CONTAINER MASS= ? 4.330
                CONTAINER MASS= ? 3.644
                   SAMPLE CTS= ? 11297

URINE    SAMPLE+CONTAINER MASS= ? 0

BLADDER  SAMPLE+CONTAINER MASS= ? 4.927
                CONTAINER MASS= ? 3.646
                   SAMPLE CTS= ? 9036

STOMACH  SAMPLE+CONTAINER MASS= ? 0

GUT 1    SAMPLE+CONTAINER MASS= ? 6.602
                CONTAINER MASS= ? 3.645
                   SAMPLE CTS= ? 10464

GUT 2    SAMPLE+CONTAINER MASS= ? 0

GUT 3    SAMPLE+CONTAINER MASS= ? 0

CAEC.1   SAMPLE+CONTAINER MASS= ? 0

CAEC.2   SAMPLE+CONTAINER MASS= ? 0

RECTUM   SAMPLE+CONTAINER MASS= ? 0

FEMUR    SAMPLE+CONTAINER MASS= ? 0

TAIL     SAMPLE+CONTAINER MASS= ? 4.192
                CONTAINER MASS= ? 3.645
                   SAMPLE CTS= ? 2307

swab     SAMPLE+CONTAINER MASS= ? 4
                CONTAINER MASS= ? 3
                   SAMPLE CTS= ? 611

DO YOU WISH TO RE-ENTER DATA FOR THIS ANIMAL (Y/N)
   IF NOT THEN START A NEW PAGE IF NECESSARY?
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(Continued)

Gallium -67 1Hr p/i

RESULTS OF MOUSE BIODISTRIBUTION NO. 1
****
 MOUSE BODY MASS= 26.3 STANDARD CTS.= 104786.
 CARCASS MASS = 19.2

TISSUE	SAMPLE WT	ORGAN WT	SAMPLE CTS	DK COR CTS	CTS/ORGAN
LIVER	1.54	1.5	5727.	5727.	5727.
SPLEEN	0.10	0.1	338.	338.	338.
KIDNEY	0.45	0.5	3004.	3004.	3004.
MUSCLE	0.47	10.4	1394.	1394.	30751.
BONE	0.04	2.9	268.	268.	21440.
BLOOD	0.69	1.7	11297.	11297.	28152.
TOT.GUT	1.28	1.3	9036.	9036.	9036.
GUT 1	2.96	3.0	10464.	10464.	10464.
TAIL	0.55	0.5	2307.	2307.	2307.
swab	1.00	1.0	611.	611.	611.

TISSUE	%INJ DOSE	% PER GRAM	TIS/MUS	TIS/BLOOD	TIS/LIV
LIVER	5.47	3.551	1.3	0.23	1.00
SPLEEN	0.32	3.291	1.2	0.21	0.93
KIDNEY	2.87	6.342	2.2	0.40	1.79
MUSCLE	29.35	2.830	1.0	0.18	0.80
BONE	20.46	7.104	2.5	0.45	2.00
BLOOD	26.87	15.716	5.6	1.00	4.43
TOT.GUT	8.62	6.732	2.4	0.43	1.90
GUT 1	9.99	3.377	1.2	0.21	0.95
TAIL	2.20	4.025	1.4	0.26	1.13
swab	0.58	0.583	0.2	0.04	0.16

START A NEW PAGE IF REQUIRED?
MEANS & STD DEVS. CANNOT BE FOUND FOR ONE ANIMAL

DO YOU WISH TO CONTINUE (Y/N) ?

IF YES THEN START A NEW PAGE? no

Ready