ANL-95/3

Studies of Acute and Chronic Radiation Injury at the Biological and Medical Research Division, Argonne National Laboratory, 1970-1992: The JANUS Program Survival and Pathology Data

by D. Grahn, B. J. Wright, B. A. Carnes, F. S. Williamson, and C. Fox

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February 1995

Work sponsored by the United States Department of Energy,
Office of Health and Environmental Research, under Contract No. W-31-109-Eng-38

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FOREWORD

In May 1994, the Center for Mechanistic Biology and Biotechnology of Argonne National Laboratory (ANL) published a report, ANL-94/26, that described the studies on acute and chronic radiation injury performed at the laboratory from 1953 to 1970. The present document covers the period from 1970 to 1992 and deals specifically with the survival and pathology data accrued during the course of the JANUS program. These data are from studies that used the JANUS reactor located in Building 202 at Argonne.

What might be the most remarkable fact about the JANUS program is that it actually came to pass. While this document cannot provide the detailed history of JANUS, both as a reactor and as a program, it can be said that the reactor itself had an unusual conception, a protracted and difficult gestation, and came perilously close to being stillborn. Conception occurred in the spring of 1958, but approval for full-power operation of the reactor finally used for the studies described in this document was not given until the spring of 1970. The intervening 12 years saw repeated safety reviews and evaluations of the reactor. In 1966, significant and unusual modifications were proposed to resolve some difficult safety and usability issues. These modifications were implemented, with the result that JANUS was born again in 1970, now as a sophisticated neutron source solely dedicated to experimental radiobiology. A brief history and description of the JANUS reactor facility is presented here with enough detail so that the unusual features can be understood and appreciated; the generation of a "clean" fission-neutron flux for experimental biology is a complex challenge.

After 22 years of successful operation, increases in operating costs, the age of the facility, and changes in program priority severely restricted the need for continuing the reactor's operation. In a letter to ANL management dated November 6, 1992, the Department of Energy ordered that the JANUS reactor be shut down. Authorization to remove the fuel elements and converter plates was given in January 1993. The elements were removed in February and March 1993, and the last fuel elements were shipped to the Savannah River Facility on March 24, 1993.

ACKNOWLEDGMENTS

In the course of a major program that existed for about a quarter of a century, many regular staff scientists, technical staff, and temporary staff participated, contributed, and moved on. The following list includes those who participated at some time between 1965 and 1994. All manner of expertise in experimental biology, pathology, physics, and statistics is represented in this cadre, and their individual and collective contributions are herewith acknowledged with great appreciation.

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We also acknowledge the continued support and assistance received from the Animal Facilities veterinary staff (R.J. Flynn, DVM; T.E. Fritz, DVM; C.M. Poole, DVM) and from dozens of animal care specialists. The veterinary staff supervised the production of a consistently high-quality experimental animal, the $B6CF_1$ hybrid mouse, in adequate numbers and in a timely manner. Many of the specialists proved especially skilled in the complex, computer-controlled animal loading and unloading procedures that were an essential part of the exposure process and the individual animal's experimental history.

Obviously, consistent and reliable operation of the JANUS reactor had to be maintained for the overall program to continue according to plan. Although the (former)

Division of Biological and Medical Research did not have direct responsibility for reactor operations and safety, programmatic needs were always achieved because of highly cooperative and competent operational crews.

NOTATION

Abbreviations

AEC	Atomic Energy Commission
ANL	Argonne National Laboratory
BIM	Biological and Medical Research Division
Co	cobalt
He	helium
HLGF	High-Level Gamma Facility
K	kerma (measured in gray [Gy])
MAS	mean after-survival
MDI	menu-driven interface
n	neutron
p	proton
RBE	relative biological effectiveness
SE	standard error
SPF	specific-pathogen-free
U	uranium

Units

cGy	centigray
cm	centimeter
d	day
ft	foot
g	gram
h	hour
in.	inch
keV	kiloelectron volt
kW	kilowatt
kW(th)	kilowatt (thermal)
L	liter
m	meter
µm	micrometer
MeV	megaelectron volt
min	minute
mL	milliliter
mm	millimeter
N	normal
pt	pint
R	roentgen
s	second
W	watt
wk	week
yr	year

STUDIES OF ACUTE AND CHRONIC RADIATION INJURY AT THE BIOLOGICAL AND MEDICAL RESEARCH DIVISION, ARGONNE NATIONAL LABORATORY, 1970-1992: THE JANUS PROGRAM SURVIVAL AND PATHOLOGY DATA

D. Grahn, B.J. Wright, B.A. Carnes,
F.S. Williamson, and C. Fox

ABSTRACT

A research reactor for exclusive use in experimental radiobiology was designed and built at Argonne National Laboratory in the 1960s. It was located in a special addition to Building 202, which housed the Division of Biological and Medical Research. Its location assured easy access for all users to the animal facilities, and it was also near the existing gamma-irradiation facilities. The water-cooled, heterogeneous 200-kW(th) reactor, named JANUS, became the focal point for a range of radiobiological studies gathered under the rubric of "the JANUS program." The program ran from about 1969 to 1992 and included research at all levels of biological organization, from subcellular to organismic. More than a dozen moderate- to large-scale studies with the $B6CF_1$ mouse were carried out; these focused on the late effects of whole-body exposure to gamma rays or fission neutrons, in matching exposure regimes. In broad terms, these studies collected data on survival and on the pathology observed at death. A deliberate effort was made to establish the cause of death. This archive describes these late-effects studies and their general findings. The database includes exposure parameters, time of death, and the gross pathology and histopathology in codified form. A series of appendices describes all pathology procedures and codes, treatment or irradiation codes, and the manner in which the data can be accessed in the ORACLE database management system. A series of tables also presents summaries of the individual experiments in terms of radiation quality, sample sizes at entry, mean survival times by sex, and number of gross pathology and histopathology records.

1 THE JANUS REACTOR AND RELATED FACILITIES

1.1 HISTORICAL BACKGROUND

The Division of Biological and Medical Research (BIM) of the Argonne National Laboratory (ANL) initiated a program in neutron radiobiological research in the early 1950s. A fission-neutron/^{60}Co γ irradiation chamber was employed in conjunction with an open thermal-neutron column initially at the ANL research reactor CP-3′ and later at CP-5 (Vogel et al. 1953). Plans to increase the reactor power level at CP-5 necessitated the consideration to build a small research reactor solely for biomedical research at BIM. Atomic Energy Commission (AEC) approval to build the reactor was given in October 1958.

The original concept of JANUS was to build a small reactor with two exposure faces to be located on opposite sides of the core (thus the name JANUS, the two-faced deity in Roman mythology). One face would be for a high-level exposure room and one for low-level exposure. The two-faced concept was attractive, although the operational requirements and constraints were never thought through. Ultimately, only the high-level exposure face was needed.

The design and construction of JANUS was not untroubled, and although initial criticality was achieved in August 1964, full power (200 kW, thermal) was not permitted for safety reasons until May 1965. Serious safety issues affecting both reactor operations personnel and users then emerged. Neutron leakage around the shutter operating mechanisms and neutron-induced activation products in the walls of the exposure rooms placed severe limitations on reactor power levels and on access to the exposure rooms. Modifications of the exposure rooms and shutters and related components were going to be required if JANUS was to become a useful research facility.

On AEC orders, JANUS was shut down while the required modifications were considered. Approval was given by AEC in early 1968 for modifications that were limited to the high-level exposure side and exposure room. The proposed modifications were actually quite clever and innovative in the fields of reactor design and physics. As a result, when all was done and JANUS was recertified in 1970, the facility emerged as a unique neutron irradiation facility with an excellent fission-neutron flux in terms of the energy spectrum, extremely low levels of γ-ray and thermal-neutron contamination, and a comparatively homogeneous radiation field in the exposure room that would permit large numbers of small animals to be irradiated at a single dose level at one time. Dose rate was also easily controlled by varying the reactor power level. JANUS was a perfect manifestation of the old adage, "If you've got a lemon, make lemonade." In this instance, the "lemonade" was of high quality.

1.2 THE JANUS REACTOR AND HIGH-FLUX EXPOSURE FACILITY

Detailed descriptions of the JANUS facility have been published in several articles (Grahn et al. 1972; ICRU 1979). The description from Grahn et al. (1972) is presented here in an abbreviated form to provide a good general sense of the overall facility, dosimetry, and exposure protocols. This descriptive material (Section 1.2.1 through the next-to-last paragraph of Section 1.3.3) has been left in the grammatical present tense; it describes the operating facility as it was between 1970 and 1984.

1.2.1 The JANUS Reactor

JANUS is a 200-kW(th) reactor that is cooled and moderated by light water. The core can accommodate 19 fuel elements, which consist of a uranium-aluminum alloy enriched to 93% in ^{235}U. The present fuel loading is approximately 2.5 kg of ^{235}U. There are two opposing faces of the reactor, which are provided with graphite thermal columns and movable shields (shutters) so that thermal neutrons may enter the exposure room adjacent to each face. Converter plates containing ^{235}U may be raised into position at each face so that a source of fast fission neutrons is presented to each exposure room. At the present time, the low-flux room is not being used. Low-intensity neutron irradiations are obtained in the high-flux room by reducing the reactor power level. The system operates in a stable manner between 20 W and 200 kW to provide at least a 10^4 range of dose rates.

Figure 1, a cutaway view of the reactor and the exposure room, reveals the relationships among the important features. Figure 2 is a cross-sectional view of the shutters and exposure face. The important aspects of the features of the exposure room are described below.

1.2.2 Shutters

The high-flux room shutters are 28.25 in. (71.8 cm) thick and are fabricated to give a stepped joint at closure against the shutter pedestals. The shutters and upper part of the pedestals are designed for optimum neutron shielding, using 2 in. (5.1 cm) of lead followed by borated polyethylene bricks. The gaps between the bricks are not expected to allow significant neutron leakage paths, but, should this be a problem, the shutters and pedestals both have provision for liquid filling by vacuum impregnation. The shutters are moved in or out of position within a 5-s period by means of a pneumatic drive system located on the floor level above the reactor (Figure 2).

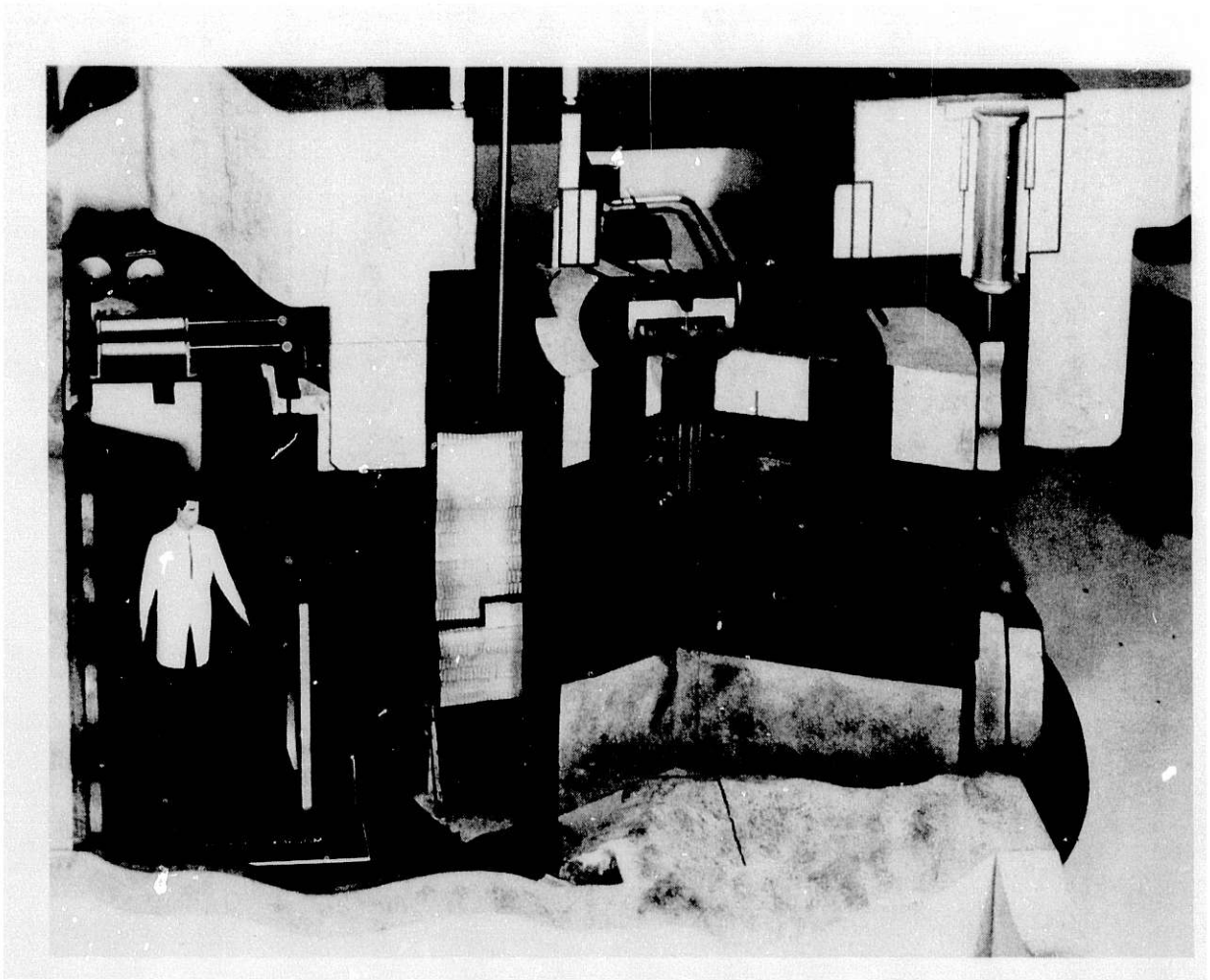

FIGURE 1 Cutaway View of a Model of the JANUS Reactor and the High-Flux Room

1.2.3 Lead Shield Plates

To provide adequate shielding against reactor-core γ radiation, 9 in. (22.9 cm) of lead is interposed between the shutters and the exposure room (Figure 2). This lead is in the form of curved plates, 46 in. (116.8 cm) high, 7 in. (17.8 cm) wide, and 1 in. (2.5 cm) thick. Measurements made on a simulation of this geometry indicated that 2 in. (5.1 cm) of lead would probably reduce prompt γ radiation from the converter plate to an insignificant level. Because transmission through lead has a deleterious effect on the high-energy end of a fission-neutron spectrum, the 9 in. (22.9 cm) is disposed in two locations: 7 in. (17.8 cm) on the reactor side of the converter and 2 in. (5.1 cm) on the exposure room side.

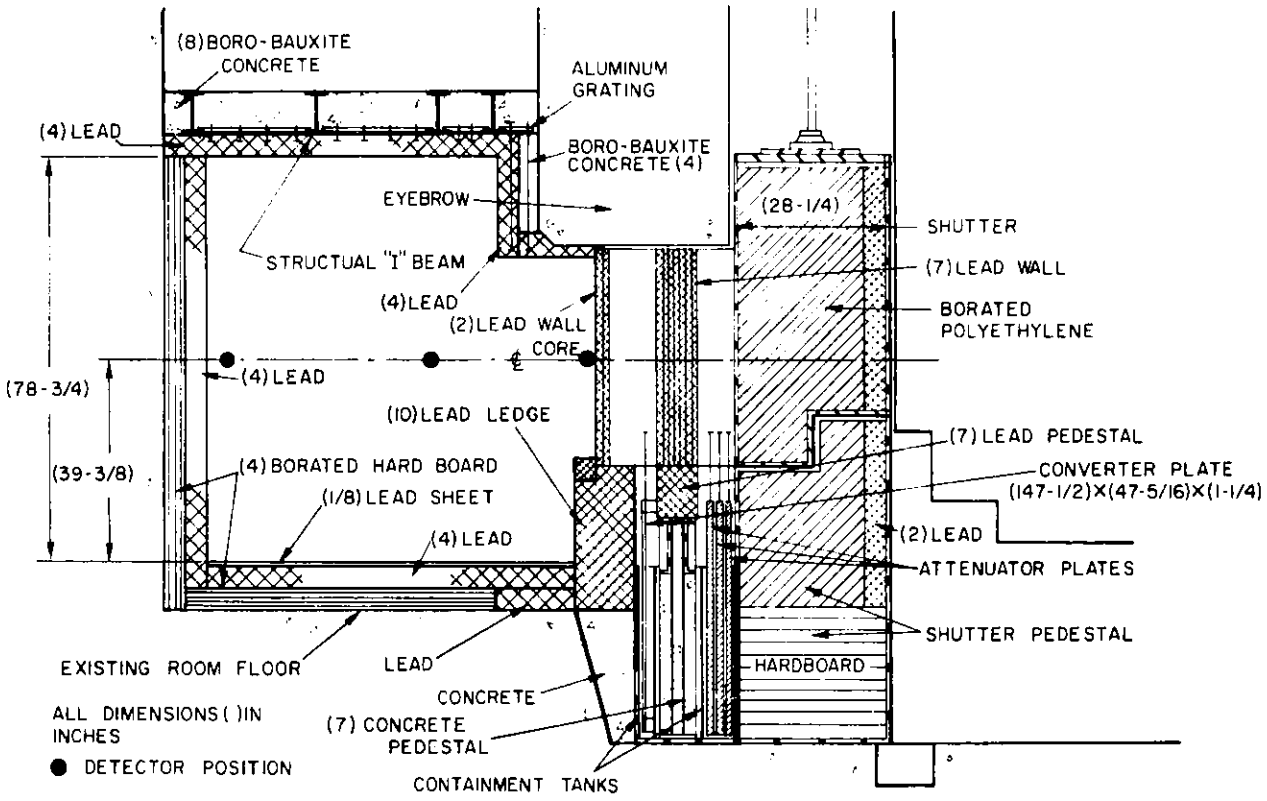

FIGURE 2 Cross-Sectional View of the Reactor Shutters and Exposure Face (exposure room at left, reactor at right)

1.2.4 Converter Plate

The converter plate contains a minimum of material that would scatter the fission neutrons and thereby degrade the spectrum. It consists of 34 foils, each 4 × 39 in. (10.2 × 99.1 cm) and 0.021 in. (0.05 cm) thick, encased in a jacket of stainless steel foil 0.007 in. (0.02 cm) thick. Each foil contains approximately 1 kg of ^{235}U. The foils are clamped between curved channel sections, which form the support frame.

1.2.5 Attenuators

Space is provided for three attenuators between the shutters and the 7-in. (17.8-cm)-thick lead wall section, but only one attenuator is being used. This is a graded attenuator to modify the distribution of thermal-neutron flux incident on the converter plate so that the neutron isodose contour in the exposure room may be shaped as required.

1.2.6 High-Flux Exposure Room

The concrete walls and floor are covered by a 4-in. (10.2-cm) layer of a borated hardboard. This material is, in turn, covered by 4 in. (10.2 cm) of lead. A false ceiling consists of tiles of lead, 12 × 12 in. (30.5 × 30.5 cm) and 4 in. (10.2 cm) thick, suspended by embedded aluminum studs from an aluminum grid work supported on the lower flanges of steel I-beams. These steel flanges are coated with a neutron-absorbing paint, consisting of gadolinium oxide in a polyurethane vehicle, in order to reduce neutron activation to a minimum. The lead ceiling assembly has 8 in. (20.3 cm) of a bauxite concrete, containing boron carbide, on the upper side to reduce neutron activation in the crawl space above. The false ceiling is located so that ceiling and floor are approximately symmetrical to the center line of the reactor face; this leaves a convenient crawl space, accessible from above, for the installation of four drive systems for the converter and attenuators.

This treatment of the walls, floor, and ceiling has effectively eliminated the problem of activation γ radiation from the concrete. Neutrons are either reflected back into the room or thermalized by the layer of hardboard. Gamma radiation emitted by activation products that might be induced in the wall are then reduced to insignificant levels by this 4-in. (10.2-cm) lead shielding. This wall treatment has been particularly successful in reducing the thermal-neutron component of the full neutron energy spectrum.

1.2.7 Animal Irradiation

Mice will be irradiated without food or water, housed singly in small polyethylene containers (about 500 cm^3 in volume) without lids. The containers are snapped into place in a shelf module of five mice, which corresponds to one living-cage unit. The shelf prevents the mice from escaping and is perforated to provide adequate ventilation. The shelves are stacked in a loading frame of up to 12 shelves, which is hung on a framework in the exposure room (Figure 3). These frames and shelves are made from a magnesium-aluminum alloy to minimize neutron activation.

1.3 NEUTRON DOSIMETRY

An acetylene and argon ionization chamber pair, described by Neary and Williamson (1961), is used for kerma measurements in mixed neutron and γ-ray fields. Chamber constants are those calculated by Batchelor for the Harwell GLEEP (Graphite Low Energy Experimental Pile)

FIGURE 3 Interior View of the JANUS High-Flux Room Showing Loading System of Racks Hanging along an Isodose Surface (see Figure 4)

facility, using the variable-W model proposed by Neary et al. (1957). Chamber volumes and electrometer sensitivity are always measured by exposure in our High-Level Gamma Radiation Facility (HLGF), hence any calibration changes in that facility will have no effect on neutron/γ-ray relative biological effectiveness (RBE) values.

Gamma field measurements are made with an air-equivalent Victoreen Model 415 Intercomparison Standard chamber. Depth-dose measurements in all cases are made using 0.05-mL muscle-equivalent and magnesium-walled argon chambers made and contributed by the late F.R. Shonka of the Physical Sciences Laboratory, Illinois Benedictine College, Lisle, Illinois.

1.3.1 Neutron Kerma Scanning

A Cartesian coordinate system has been established for the exposure room. Since the reactor face is curved, the opposing wall was chosen as the base plane. The line that is normal to the reactor face at its center forms the z-axis and intersects the wall at (0,0,0). The y-axis is vertical, with the floor at $y = -96$ cm, and the x-axis is horizontal. Thus, persons standing at the rear wall and looking at the reactor face see the face as they would a graph with vertical y and horizontal x.

Measurements made with the acetylene and argon ionization chambers at the reference location $x = -3$, $y = 0$, $z = 100$ cm, with the reactor at 200 kW and without the attenuator, gave a fast-neutron kerma rate of 23×10^2 erg/g·min with a γ-ray component of less than 3%. The addition of 456 phantom mice reduces the fast-neutron kerma rate by about 2%, while the γ-ray component maintains the same ratio.

The room was scanned at 50-cm intervals in x and z and at 25-cm intervals in y from −75 to +75 cm. The measurement technique was modified by adding a third electrometer connected to a Shonka tissue-equivalent ionization chamber used as a monitor. Data were obtained at 275 room locations.

These data are used to calculate the neutron and γ-ray kerma ratios (as a percentage of that at the reference location) for each mouse in a load frame at a specified room location and angle to the x-axis. A range of shelf positions to be used may be specified, and the average kerma ratio and individual deviations from the average can be calculated over this range of shelves.

Figure 4 shows one room layout with isodose contours corresponding to the height of mice in shelves about 100 cm above the floor.

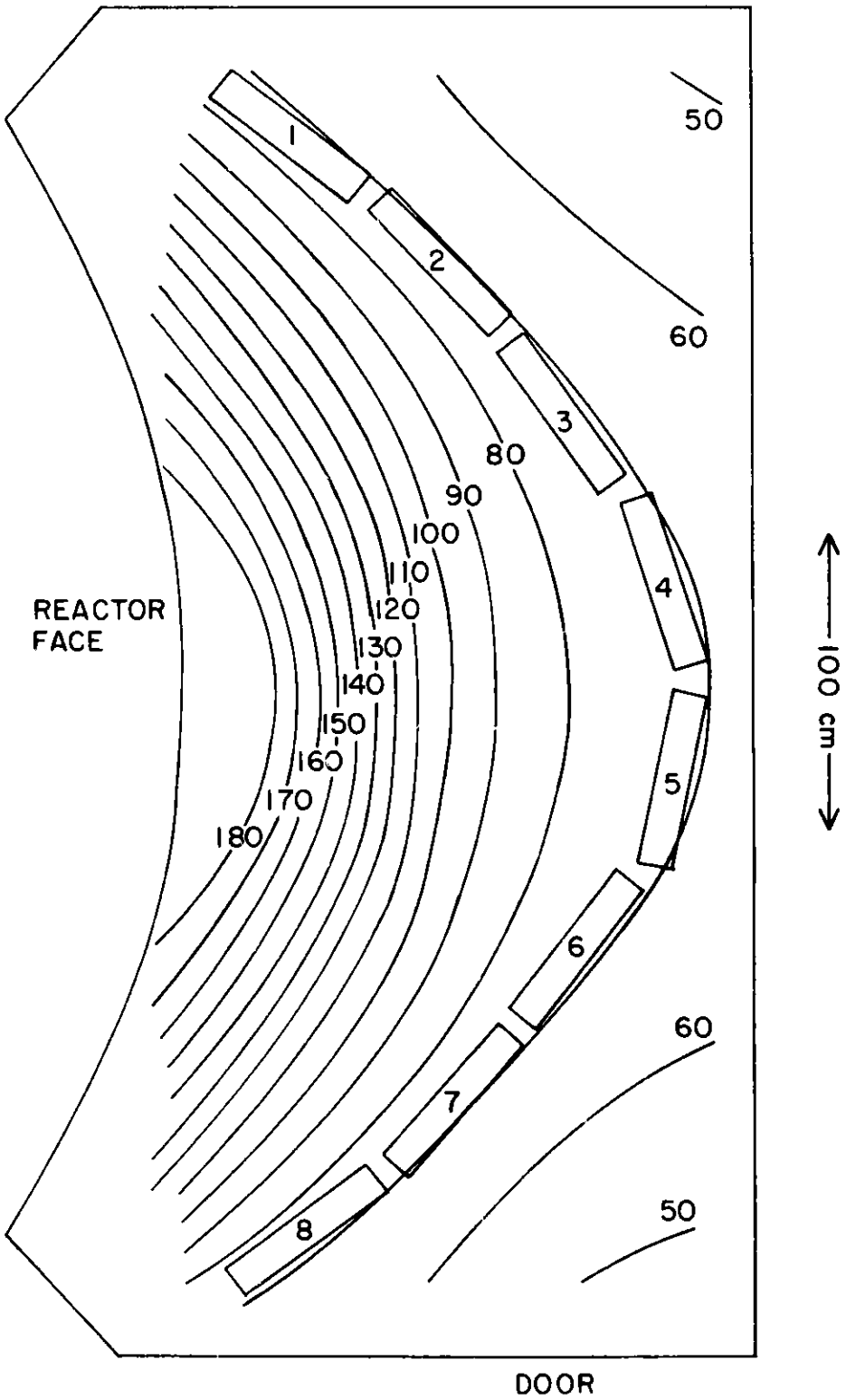

FIGURE 4 Plan View of JANUS High-Flux Room Showing Isodose Contours. Eight load frames are indicated on one contour line (see text for details).

The contours are in percentages of kerma at the reference location with the attenuator in use. This loading layout, with use of 10 shelves per frame as seen in Figure 3, has a worst-case deviation from average of –9.7% in the top and bottom shelves of frames 1 and 8 for the individual animal locations closest to the reactor face (1% of the animal loading). The animals are placed at random in the loading frame to compensate for these deviations in dose, and the positions are monitored by the computer so that individual animal accumulated doses can be calculated.

1.3.2 Thermal-Neutron Contribution

Measurements with gold foils at the standard reference location, for 200 kW with no attenuator, show a thermal flux (under cadmium) of approximately 1.72×10^6 n/cm^2·s, which corresponds to a kerma rate (due to N[n, p] reactions only) of less than 0.02% of the fast-neutron kerma rate. A full load of 400 mouse phantoms approximately doubles the thermal-neutron flux and contribution. In most neutron facilities, the thermal-neutron flux is greater than that of other energy groups below 10 keV, but in the JANUS high-flux room, the walls act as thermal-neutron sinks so that this flux is depressed below the level of any other energy group. Since measurements of absorbed dose will always be made with tissue-equivalent devices, the contribution from thermal neutrons will be included.

1.3.3 Neutron Spectrometry

Spectra were taken at five locations in the JANUS high-flux room, identified by the x, y, z coordinates as A, in the center of the room at (0,0,100); B, at the converter lead wall (0,0,184); C, at the rear lead wall (0,0,5); D, near the unleaded room door (–129,0,50); and E, in the completely leaded corner opposite the door at (216,0,50). Effective reactor power levels were monitored over the range 100 W to 200 kW with a series of overlapping ^{3}He and ^{235}U counters, and all spectra were normalized to the reactor 200-kW level.

Spectra obtained at the central point, A, are shown in Figure 5. The proton-recoil spectrum obtained by Bennett and Yule (1972) at the same point and corrected for end and wall effects is shown for comparison. All spectra are given in absolute units and are completely independent of each other.

The arithmetic-mean neutron energy and kerma rate at the five room locations are as follows:

Room Position	Mean Energy (MeV)	Kerma Rate at 200 kW (erg/g·min)
A	0.855	20.4×10^2
B	1.140	51.1×10^2
C	0.716	14.4×10^2
D	0.562	8.9×10^2
E	0.646	10.2×10^2

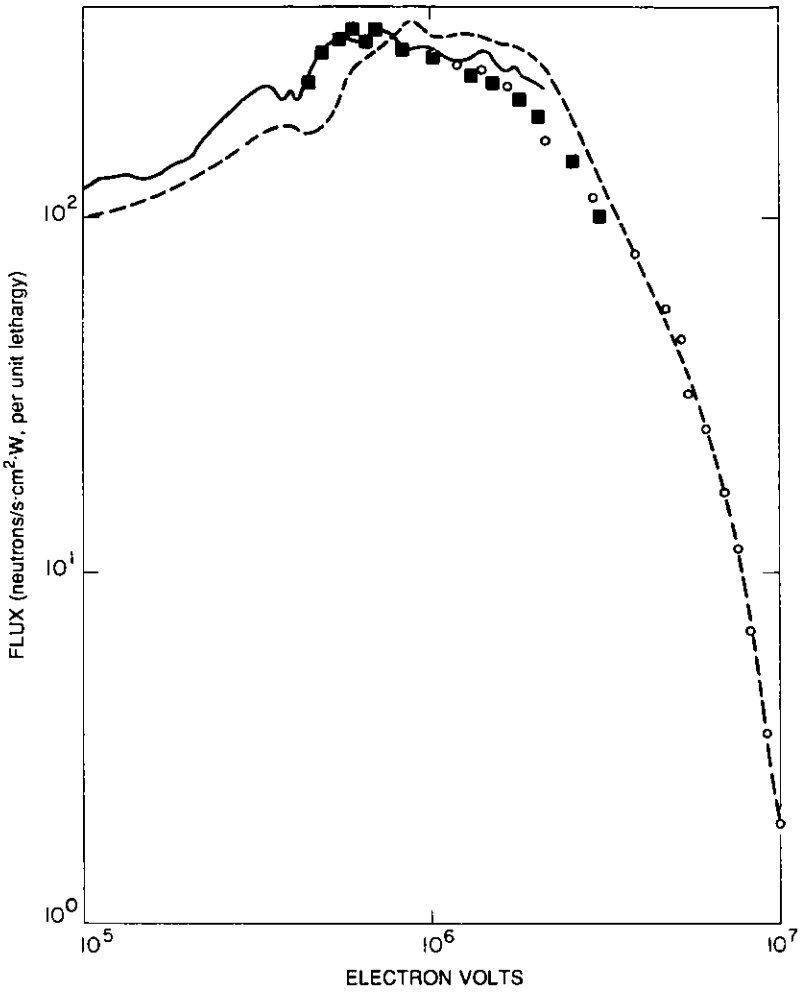

FIGURE 5 Neutron Energy Spectra in the High-Flux Room. Solid line, proton recoil and/or ^{3}He spectra; squares, with ^{6}Li spectrometer; circles, with activation foils; dashed line, predicted spectrum

The spectrum-derived kerma rates are in excellent agreement with the ionization chamber measurements.

A more complete spectrum, taken from Williamson and Frigerio (1972) and given in terms of kerma rate vs. neutron energy, is presented in Figure 6. The influence of neutron scattering on the energy spectrum can be clearly identified.

1.4 GAMMA IRRADIATIONS

With few exceptions, all neutron irradiations were matched with γ irradiations to develop the data needed to calculate RBE values for diverse somatic and genetic endpoints. All γ irradiations (except for experiments JM-4L1 and JM-4L2) were done with ^{60}Co sources in the HLGF located near the reactor.

The service floor of ANL Building 202, located approximately 18 ft (5.5 m) below ground level, contains both the HLGF and the JANUS high-flux exposure facility. Entrances to the two facilities are about 36 ft (10.9 m) apart and open on a common 5-ft (1.5-m) corridor. The two exposure facilities, the corridor, and the preparation and control areas share a common environment in terms of heating and ventilation, though the high-flux room itself is ventilated through a closed and monitored pathway.

The exposure room of the HLGF is 23 × 23 × 18 ft (6.7 × 6.7 × 5.5 m), and access is through a double-L maze, entrance to which is electromechanically controlled. The walls and ceiling are 2 ft (0.6 m) thick except for the wall facing the control console, which is 4 ft (1.2 m) thick. A standard commercial unit, a Gammabeam 650 Irradiator, built and installed in April 1973 by Atomic Energy of Canada Limited, is located in the center of the room. The unit has 12 stainless steel source tubes, each containing three encapsulated ^{60}Co sources, the active portion of which is approximately 1 × 0.5 in. (2.5 × 1.3 cm). The unit can use a single

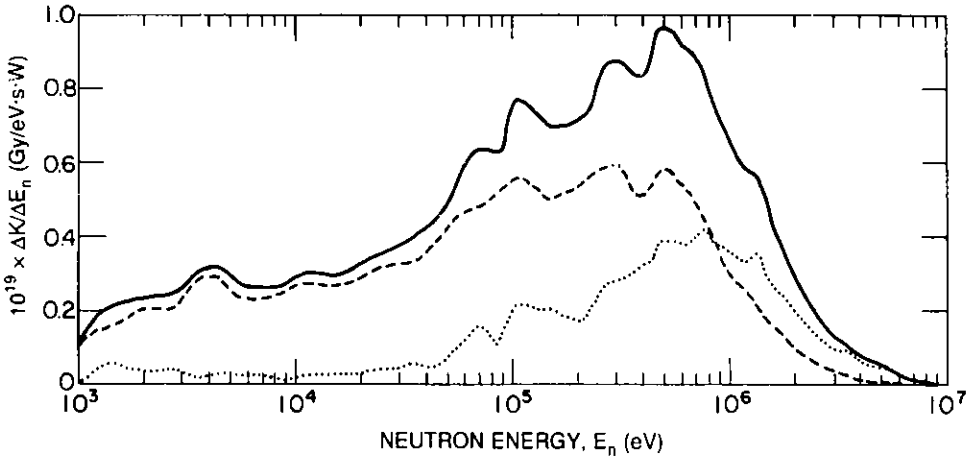

FIGURE 6 Neutron Energy Spectra in the High-Flux Room, from Williamson and Frigerio (1972). Dotted line, at face of converter plate; dashed line, at lead wall opposite face; solid line, sum of separate spectral measurements

source tube or any number and combination of tubes up to the full 12 tubes. The many source configurations available permit exposures at a 1-m distance that range from about 20 to 30,000 R/h. Curiages (the radioactivity in curies at the sources) range between 18 and 5000. Mean source height above the floor is 68 in. (172.7 cm). The source storage cask rests on the floor and is 50 in. (127 cm) tall and 35 in. (88.9 cm) in diameter. Therefore, the exposed sources are only 18 in. (45.7 cm) above the cask.

Field dosimetry in the HLGF uses a Victoreen Model 415 chamber. As in the JANUS high-flux room, a given dose rate measured from a fixed source forms a doubly concave isodose surface or contour. The curvature is obviously more prominent in the HLGF because of the point source compared with the broad exposure face of JANUS. Within a single exposure frame hanging vertically in the contour, the worst-case deviations from the average are about –12% at 1.3 m from the source and –5.5% at 2.2 m. These deviations occur in the top and bottom shelves in the 10-shelf exposure frame (see Figure 3). For a multiple-exposure series, the deviations are averaged out by a computer-managed randomization of the location for each mouse as it is repeatedly exposed. For single exposures, the irradiation procedure avoided loading animals in the extreme locations of the frames.

The Gammabeam 650 was used for all experiments described in this report except for the first, JM-2, and for the two low-dose-rate studies, JM-4L1 and JM-4L2. The irradiations for JM-2 were carried out between March 1971 and June 1972 and used the original sources and source-handling mechanisms installed in the HLGF in 1954 and 1958. Those sources were 12-in. (30.5-cm) linear ^{60}Co rods encapsulated in stainless steel and held about 48 in. (121.9 cm) above the floor (the source storage cask was in the floor). The original HLGF was constructed as part of the original Building 202 in 1950–1952, along with the low-level facility described by Grahn et al. (1994) in the pre-JANUS archive document for the 1953–1970 period. At the time, they were unique among AEC facilities, though, in retrospect, they were little more than large concrete pillboxes. The original source-handling mechanisms were designed, built, and installed by the then-existing Remote Control Engineering Division at ANL.

1.5 DEPTH-DOSE ESTIMATES

A critical factor in the development of data that can be used for accurate comparisons of the effects of neutrons vs. γ rays concerns the dose terms. Obviously, the two radiations, fission neutrons and ^{60}Co γ rays, had to be "normalized" before comparisons could be made. Normalization was achieved by making the dose term a tissue dose, specifically, the midline tissue dose for the mouse. Unfortunately, the dosimetric procedures and results have never been presented in complete form in a single report; however, much information can be gleaned from Grahn et al. (1972), Williamson and Frigerio (1972), Williamson et al. (1971, 1972, 1973), Borak and Stinchcomb (1979), and Marshall and Williamson (1985). A brief description of the results of the depth-dose studies is presented here.

A 30-g "muromorphic" mouse, having dimensions of 5 × 3 × 2 cm and made of a tissue-equivalent plastic known as Shonka A150, was used for the studies. Dr. F.R. Shonka,

of Illinois Benedictine College, developed the tissue-equivalent plastic and also constructed a pair of 0.05-mL ionization chambers to be used in the tissue-equivalent mouse. The elemental composition of the A150 plastic, in terms of percent by weight, was as follows: H = 10.25, C = 77.28, N = 3.49, O = 3.99, F = 2.43, and Ca = 2.57.

Two 0.05-mL chambers were used to measure doses at the approximate center of the phantom. One chamber was made of tissue-equivalent material; the other was of magnesium and was filled with argon. Measurements of dose were made with the phantom at five different orientations to the γ-ray source or to the reactor face: 0° (nose to the source), 45°, 90°, 135°, and 180° (tail to the source). Measurements were also made without the phantom. The average midline neutron dose in rads was 80% of the neutron kerma "in air." For γ radiation, the midline dose was 90% of the measured roentgens "in air." Specifically, for γ rays, the ratios were 0.96 *K*/R and 0.934 midline tissue dose rad/*K* (0.96 × 0.934 = 0.897). The delivered doses in the JM studies were the calculated midline tissue dose values measured in rads (0.01 Gy). Details can be found in Grahn et al. (1972), Williamson and Frigerio (1972), Williamson et al. (1972), and ICRU Report 30 (1979). Because all delivered doses were midline tissue doses, dose-response coefficients in terms of response per rad of γ rays or neutrons can be directly applied to the estimation of RBE values or other measures of fission-neutron effectiveness when compared with responses to ^{60}Co γ rays.

2 EXPERIMENTAL PROCEDURES

2.1 ANIMAL HUSBANDRY AND HOUSING

2.1.1 Animal Source and Supply

2.1.1.1 *Mus musculus*

All of the JM series studies used the $B6CF_1$ mouse, the F_1 from the cross of C57BL/6 females with BALB/c males. The parent inbreds were originally obtained from the Jackson Laboratory, Bar Harbor, Maine, in 1953 (Grahn et al. 1994) and were maintained by full-sib matings as conventional stocks. In 1965, breeding stock from the two strains were given to the ANL animal facilities staff, under R.J. Flynn, DVM, to produce a germ-free breeding stock from which specific pathogen-free (SPF) strains could be derived for the production of large numbers of $B6CF_1$ mice for the JANUS program. The correct designations for these SPF parent strains are BALB/c ANL (ANL 66) and C57BL/6/ANL (ANL 66). The "(ANL 66)" designates the institution of origin and the year when the SPF status was obtained. The inbred strains were rederived in 1970, so some records will note $B6CF_1$/ANL (ANL 70), others $B6CF_1$/ANL (ANL 66). This is not a critical difference. The strain is numerically coded as 08, following from its original designation in 1954 (Grahn et al. 1994).

The SPF status was periodically checked by the animal facilities staff and by commercial laboratories. No unusual or unacceptable microbiological or virological deviations from the SPF status were noted over the years. All mice were vaccinated for ectromelia (mouse pox) before entry into an experiment.

Animals were weaned into large cages with dimensions of approximately 16 × 8 × 5 in. (40.6 × 20.3 × 12.7 cm, length by width by height), 15 or 20 to the cage. At 110 ± 5 d of age, the mice were recaged into small plastic cages of 11 × 7 × 5 in. (27.9 × 17.8 × 12.7 cm), five per cage. These cages were then randomly assigned to their ultimate experimental status and to holding rooms in the animal facilities.

2.1.1.2 *Peromyscus leucopus*

In 1963, G. Sacher and E. Staffeldt trapped wild *Peromyscus leucopus* (the white-footed deer mouse) on the Argonne site and established a breeding colony in the animal facilities. Additional breeders were periodically captured in the wild. The colony was maintained by random outcross matings, and conventional caging and husbandry methods were employed. Though G. Sacher performed a number of radiobiological and gerontological studies with *P. leucopus* and other small mammals taken from the wild, *P. leucopus* was selected for use in the JANUS program for one major study (JM-10). This study compared responses to single and fractionated neutron and γ-ray exposures with those seen in the $B6CF_1$ subjected to the same exposure regimes. *P. leucopus* is slightly larger than the $B6CF_1$

mouse, ranging from 20 to 45 g at about 140 d of age when they were entered into the study. Their life expectancy from birth is about 1450 d (Sacher and Hart 1978), which is about 50% greater than that of the $B6CF_1$ mouse.

2.1.2 Housing

A critical lesson that was learned in the early studies (Grahn et al. 1994) concerned the importance of maintaining both experimental and control animals in a common environment. In the JANUS studies, this was accomplished by keeping all mice in a common home environment or animal rooms except when actual irradiations were performed. All controls, with one exception (JM-7), were sham-irradiated in the corridor of the service floor between the HLGF and the reactor. As previously noted, all mice were housed in a clear plastic cage, five per cage. The stainless steel cage top was screened in the back half and held a water bottle and food bin in the front half. Originally, a corncob bedding was used, but it was found to carry the organism *Enterobacter cloacae*, which caused an acute intestinal syndrome. Sterilized wood chip shavings were thereafter consistently used for cage bedding.

Room management and housing assignments were made by a computer-generated procedure. Cages were located (according to experiment) in home rooms and positioned on a random basis with respect to radiation quality (including control), sex, treatment dose and exposure pattern, replication number, and cage number. The animals in every experiment were always located (housed) in two or more separate animal rooms to minimize any effects due to differential room environment.

2.1.3 Animal Husbandry

Routine animal care was the responsibility of the animal facilities staff and was carried out by trained and experienced animal care specialists. Periodic sampling of food, water, feces, etc. for infectious organisms was performed by the scientific staff of the animal facilities. During the period that the JANUS studies were being carried out, the ANL animal facilities were fully accredited by the American Association for the Accreditation of Laboratory Animal Care.

Cages would normally be changed weekly but more frequently if conditions required. Water bottles were changed twice weekly, and the water was acidified to pH 2.5 ± 0.1 with 0.1 N HCl. This successfully eliminated water-borne infection by *Pseudomonas aeruginosa*. Acidified water did not otherwise influence the health status of the mice. Food was always available and was normally Wayne Mouse Lab Blox. All rooms and cages were checked every day (7 d/wk).

The animal rooms were maintained at 73 ± 3 °F (22.8 ± 1.7 °C) and humidity at 50 ± 5%. Filtered and conditioned air was turned over between 10 and 15 times per hour and was exhausted into the corridors of the animal facilities. Animal holding rooms were at a positive air pressure compared with that of the hallways. There were no windows in the

animal facilities, and a 12-h light/dark cycle was maintained with electric timers; the light period was from 6 AM to 6 PM.

2.2 IRRADIATION PROCEDURES

Special exposure frames were used for all irradiations. These were constructed of a magnesium-aluminum alloy (to minimize neutron activation) and had dimensions of about 5 ft (1.5 m) in height by 2 ft (0.6 m) in width. They were suspended from ceiling hangers in the JANUS high-flux room (Figure 3) and from portable floor stanchions in the HLGF. A frame could hold up to 12 shelves (10 were normally used), each suspending five 1-pt (0.5-L) polyethylene cups in a row, each cup holding one mouse. Missing mice were replaced by a tissue-equivalent dummy. Because the frames occupy a vertical space in a nonlinear isodose contour, only those shelves were used for a given exposure where the deviation from mean dose would be less than 10%.

The frames were loaded by the animal care specialists, according to computer-generated loading instructions. Each frame contained mice to be located in a single dose group, although several frames could be used for each dose. Cages to be loaded were identified by the animal identification code and the cage location in the holding room. Sham-irradiated controls were handled exactly as the mice to be irradiated, but their frames were hung in the hallway outside the JANUS and HLGF rooms. After irradiation, frames were unloaded in the home rooms by the animal care specialists according to computer-generated instructions.

Long-term exposures (22 h/d) in the low-level γ-ray facility, used only for experiments JM-4L1 and JM-4L2, employed the same frame, basic shelf unit and 1-pt (0.5-L) cups, but the units were modified to hold a 5-oz (0.15-L) plastic water bottle and a spring-loaded vertical feeder unit behind the bottle. Wood chip litter was provided for the individual mouse in each cup. Mice remained in this housing unit for 5 d of each week of exposure, Monday morning to Saturday morning. The other 2 d were spent in the standard home cage, five mice per cage. Controls and irradiated mice were handled in the same manner, with the controls remaining in the corridor of the facility entrance maze.

We emphasize that for all of these exposure procedures, computer programs managed all operations and randomized all cage loadings per dose, sex, and radiation quality, for each replication within the specific dose contour, so that all deviations from mean delivered dose would be randomly distributed among all mice within the dose group. The computerized randomization process that managed all irradiations and housing locations is the manifestation of the policy to minimize, or even eliminate, any environmental or irradiation heterogeneity that might confound response variables or challenge the credibility of any finding.

2.3 POST-IRRADIATION FOLLOW-UP PROTOCOLS

2.3.1 Death Checks

Throughout the JM experimental series, mice were usually relocated within the animal facility after their irradiations were completed. This facilitated the death checks that were performed daily, 7 d/wk, including holidays. On regular work days, members of the program staff performed the checks, usually twice daily. The afternoon check would identify moribund animals that were expected to die overnight. Moribund mice were euthanized with ether. On weekends and most holidays, death checks were performed once daily by animal care specialists who were experienced in this procedure.

A dead animal was removed from the cage and placed in a disposal bag, and a JANUS death tag was stapled to the bag. A sample copy of the death tag and a copy of a cage card, from which the essential identification data were taken, are seen in Appendix A. The cage card contained all information pertaining to the identification and location of the dead mouse. The animal identification code included the radiation quality (C, control; G, γ ray; N, neutron); the sex (M, male; F, female); treatment group, which is usually a dose code; replication number; and cage number. This provides an eight-character alpha-numeric code for the identifying "family name." The number of animals in a cage ranged from 1 to 5. The individual animals were not preidentified. Numbering was based on which died first, second, . . . , fifth; number 1 was the first recorded and number 5 the last. This individual number gave a "first name" to each animal, and thus, the nine characters provided each animal with an unique identification. The death tag was filled out with the appropriate information from the cage card that identifies the experiment, animal identification code, date of death, etc. The date of death was entered on the cage card and the card was returned to the cage. The dead animal was either refrigerated or taken directly to the necropsy prosector. According to the condition of the animal, the prosector determined if a necropsy should be done. Ultimately, an exit code and an autopsy code were assigned to the individual identified on the death tag, and the codes were entered along with the date of autopsy and the initials of the prosector. The exit codes and autopsy codes are defined in Appendix B.

2.3.2 Pathology Protocols

2.3.2.1 Necropsy Procedure

The necropsy report (Appendix C) is made up of three pages: page 1, coded MACRO observations; page 2, a carbon copy of the top of page 1 that was used to enter the MACRO data into the computer; and page 3, coded MICRO diagnoses. The first page was filled out as the necropsy was performed. The data from the JANUS death tag were transferred to the necropsy report, and the death tag number (upper right corner) became the autopsy number. As the necropsy progressed, sketches of lesions and tumors were placed on

the drawings of the mouse, observations were circled, and the tissues fixed were indicated in the appropriate boxes at the bottom of the page.

The necropsy protocol, presented in detail in Appendix D, specifies the gross characteristics to be identified or sought out for all organs and tissues by the prosector. It also describes the specific appearances of organs and tissues that are directly defined by specific gross pathology codes. The full MACRO dictionary of three-letter nontumor and four-letter tumor codes is given in Appendix E in alphabetical order. Part 6 of Appendix D discusses the criteria to be considered for establishing a probable cause of death on the basis of the gross findings. The probable cause of death was entered on the necropsy report. In addition, the presence or absence of a tumor was indicated as T or NT, and MACRO diagnoses were recorded as tumor or nontumor codes. After the necropsy was completed, the second page of the necropsy report was removed and used to enter the gross pathology into the computer MACRO records for the experiment.

2.3.2.2 Collection of Tissues and Preparation for Histopathology

Tissue sampling for histopathology followed a standard procedure throughout the JM series. In some studies, selected additional tissues might have been taken for special purposes, but the procedure outlined in Appendix F can be considered the basic protocol. The procedure for fixing, staining, and mounting the tissues on slides is outlined in Appendix G. Obviously, not all tissues or organs were routinely sampled, other than those listed, and no effort was made to detect occult tumors or other lesions that were considered to be noncontributory to the animal's death. As stated in the original description of the JANUS program in 1972 (Grahn et al. 1972), the intention was always "to ascertain the cause of death to as high a degree of accuracy as practicable." We were concerned, as well, with all major contributory and noncontributory pathology. Although funding and manpower limitations forced some compromise, nevertheless about 93% of all deaths did have an accompanying gross pathology. The majority of the necropsies were performed by only four prosectors, which ensured a high degree of consistency in the gross diagnoses. Of all the animals examined for gross pathology, only about 49% subsequently had a histopathologic examination, and this proportion varied among the studies (see Section 3).

2.3.3 Histopathology Codes

As the pathologist read the slides, the diagnoses were recorded and coded on the bottom of the first page of the necropsy report. The MICRO dictionary of the four-letter histopathology codes is given in Appendix H.

All histopathological findings were classified as either lethal (L), contributory (C), or noncontributory (N). These findings may or may not have confirmed the decision made on the gross findings. The coded diagnoses were transferred to the third page of the necropsy report. This coded information was entered into the computer MICRO records for the experiments.

Histopathology was performed by several pathologists over the years. L.S. Lombard, a board-certified veterinary pathologist, was involved throughout the JANUS series, except for JM-14, and she performed the majority of the histopathological evaluations. Dr. Lombard died in 1987.

J.H. Rust, DVM, carried out many evaluations for the earliest studies, such as JM-2, -3, and -4. R.J.M. Fry also performed both gross and histopathological evaluations in the early years of the programs, before he took a position at the Oak Ridge National Laboratory in late 1977.

In the MICRO Dictionary (Appendix H), the content and codes were jointly developed by Drs. Fry, Lombard, and Rust. One might say the dictionary was developed iteratively during the late 1960s and early 1970s, and it reflects the cumulative experience of the three pathologists plus the pragmatic need to codify the principal pathology seen in the mouse in a reasonably simple and descriptive manner.

2.4 RECORD KEEPING AND DATA MANAGEMENT

Computerized record keeping and data management reached a high level of development for the JANUS program. This capability evolved over the many years preceding the program; in a sense, it started with the earliest studies in the 1940s. It resulted from the fortunate confluence of skills, needs, and opportunities. The capability reached its highest form in the JANUS program, and it is being used as a role model for other DOE animal research programs. In 1988, the JANUS database was transferred from the ANL IBM mainframe to the ORACLE relational database management system. The use of ORACLE has permitted the JANUS data to be articulated with other ORACLE databases, such as that from the studies at ANL with the beagle.

The ORACLE system is organized into tables that contain all the information necessary to initiate experiments, to enter experimental data, or to be used in data analysis. Appendix I contains a list of the ORACLE tables and the definition of the fields in each table. Tables GENERAL, EXIT, FRACTIONS, MACBASE, MACFIND, MICBASE, and MICFIND contain all of the data for JM-2 through JM-14. The other tables are used in the initiation of new experiments. The computer-managed aspects of the JANUS experiments and data analysis are set into operation by the use of menu selections. These menu items are primarily for experimental setup, data entry, and data analysis, but with a little instruction, the database may be queried directly.

2.4.1 Data Entry

The hard-copy records and codes presented in Appendices A, B, C, E, and H were used for data entry as described in Sections 2.2 and 2.3. The data were routinely entered into the appropriate tables by use of the menu. As every individual mouse was uniquely coded for experiment, radiation quality, sex, treatment, replicate number, cage number, and

individual number, entries into the database were internally controlled against random error. Nevertheless, all entries were subject to a quality control follow-up performed by a second party who was not involved in the original entry.

2.4.2 Specialized Data Organization

For special applications, data from the tables may be merged for analysis. It is also necessary to have the radiation protocol codes for each experiment in the JANUS series available for use in a separate file (Appendix J). Users can thus select data for analysis by any array of codes for experiment, radiation quality, sex, and dose. Additional data may be extracted into separate files for special use.

The MACRO and MICRO codes have been grouped into MACRO and MICRO combined pathology glossaries (Appendices K, L, and M). These glossaries are used in analyses of the occurrence of pathological conditions. To compare the incidence of different diagnoses, there is a need to group similar diagnoses. Grouping similar findings can increase numbers as some individual diagnoses are not very plentiful and therefore not significant. Each of the combined pathology glossaries <E>, <F>, and <H> comprises 28 groups of definite composition: a group may be composed of 1) cause of death undetermined, 2) tumors or nontumors, 3) primary or secondary (metastatic) tumors, 4) like tumor types, 5) individual tumor type, 6) tumors of like tissue type, 7) tumors of specific organs or organ systems, 8) metastatic tumors, 9) metastatic tumors of specific sites or of specific origin, 10) nontumors, or 11) nontumors of specific organs or organ systems. Glossaries <E>, <F>, and <H> may have some groups in common but for the most part are different.

Glossary <E> contains all the possible codes in the dictionaries divided into the 28 groups: 3 major classes of connective tissue tumors, 13 classes of epithelial tissue tumors, 4 classes of secondary tumor occurrences, 7 classes of non-neoplastic disease, and 1 class of undetermined cause of death. One important use for this glossary, made possible by the singularity of each code, is in the analysis of concordance and discordance between gross and microscopic pathology. The specific contents of <E> are found in Table 1 (tables begin on p. 43) and Appendix K.

Glossary <F> regroups some components and subdivides others found in <E>. This glossary contains only tumor diagnoses, as over 75% of the cause-of-death diagnoses are a neoplasm. The contents of <F> are listed in Table 2 and Appendix L.

The third combined pathology glossary <H> (Table 3 and Appendix M) contains some groups repeated from <F> but has separated some classes of lymphoreticular tumors, connective and epithelial tissue tumors, and selected metastatic tumors in order to make more detailed comparisons of these diagnoses.

The use of the glossaries allows for the creation of a combined pathology database for each of the JANUS experiments. The combined pathology database contains each individual mouse scored for the occurrence of a diagnostic code found within the 28 groups.

A different database may be constructed for MACRO and MICRO diagnoses found for Glossaries <E>, <F>, and <H>. These databases are used in conjunction with the JANUS radiation protocol (Appendix J) in many of the analysis procedures.

2.4.3 Reliability and Potential Use of the Pathology Data

A summary of the 13 JM series studies, which will be described in detail in Section 3, is presented in Table 4. This table provides the total numbers in the three major categories of death records, gross pathology records, and histopathology records. Between 90% and 98% of all death records have an accompanying gross pathology record, while between 0% and 85% of the gross records have an accompanying histopathology record. Obviously, the gross pathology data have both uniformly and adequately sampled the death records. The reliability (and, therefore, the usability) of the gross pathology records becomes an important consideration for any comparative analysis.

The issue of reliability and consistency of the pathology data, as the data accrued over the years, escaped neither our attention nor the attention of outside reviewers. An independent audit of the gross and microscopic pathology records was therefore contracted and was performed by Pathology Associates, Inc., of Frederick, Maryland, in 1986. The complete radiation, death, autopsy, and pathology records were randomly selected for about 50% of the animals from the data for two experiments, JM-4K and JM-13. The results of the audit confirmed the consistency and repeatability of the gross diagnoses and of the judgments on the causes of death made by the prosectors. The pathologists performing the audit concurred with the gross and microscopic diagnoses in over 90% of the cases examined. This was considered an excellent level of agreement, and the auditors also acknowledged that some of the differences in opinion on cause of death were equivocal.

2.4.3.1 Analysis of Concordance between the Gross and Microscopic Pathology

As a consequence of the audit's findings, we established the principle that the histopathological findings could be held as the ultimate truth and used, therefore, to test quantitatively the level of concordance or agreement between the gross and microscopic pathology. As noted in previous sections, the gross pathology record always suggested a "cause of death," a lethal (L) tumor or other lesion, including an undetermined cause (CDU). The histopathology classified each finding as either lethal (L), contributory (C), or noncontributory (N). By grouping the histopathological findings as either lethal (L) or lethal plus contributory (LC), comparisons can be made with the gross finding of L to determine the accuracy of that original judgment. The comparison of the two L classes is straightforward. The test of gross L against histopathology LC broadens the basis of comparison and recognizes realistically that the gross finding has limitations that are somewhat alleviated by including the histopathologically defined lesions that are clearly contributory to the animal's death.

The concordance test for all observed pathology, that is, all observed gross diagnoses vs. all observed microscopic diagnoses (lethal plus contributory plus noncontributory, LCN), is essentially a test of the thoroughness and accuracy of the observations made by the prosectors at necropsy. It is not a test of judgment of the severity of a lesion, but rather, on its presence.

A summary of concordance analyses for a portion of the JM series (JM-2, -3, -4K, -4L1, -4L2, and -9) is given in Table 5 for selected single and grouped endpoints from pathology glossaries <E> and <F>. About 13,400 matched records are included in this summary. The level of concordance (percentage of gross diagnoses confirmed by histopathology) is presented for the three categories of L, LC, and LCN. Only tumor-related deaths and tumor occurrences were analyzed because these account for over 75% of all terminal pathology and causes of death.

Table 5 reveals that, at best, only seven gross pathology categories could be consistently used, on the assumption that the concordance rate should be 85% or greater. These categories are the underlined values in the table, and the best array is that under the LC column. In other words, a less rigid definition of cause of death that includes contributory lesions provides a good cross section of pathologies: three connective tissue groups, three epithelial tissue groups, and the all-inclusive class of "all primary tumors." The inclusion of tumors of the Harderian gland is of special note because this tumor is highly responsive to neutron exposure.

The all-observed-pathology analysis (LCN) does not materially improve the concordance rates, though many of the pathology groups do have significantly increased sample sizes. That fact, in turn, should improve statistical factors.

2.4.3.2 Analysis of the Discordance between the Gross and Microscopic Pathology

The test for discordance is an analysis of errors of judgment regarding the presumed cause of death defined by the prosector. This analysis can only be done for the lethal category with pathology glossary <E> for both gross and microscopic pathology, because the analysis requires a nonconflicting matching pair of diagnoses for each animal. The animal can only be represented by a single diagnosis for the gross and for the microscopic pathology. Multiple entries per mouse, as for the LC category, confuse the computer. In spite of limitations, the discordance analysis allows detection of patterns of error in the gross pathology that can be valuable in the interpretation of any analysis of the gross findings.

Although the analysis runs the full 28 × 28 matrix, not all cells in the matrix have entries, and many have sample sizes too small to give useful information. Table 6 presents a selected 7 × 7 matrix involving diagnoses that not only have adequate sampling but also produce information that reveals the nature or pattern of diagnostic errors. Simply stated, the errors are not random.

The undetermined cause category (CDU) is large, and the majority of discordant diagnoses became reclassified as lymphoreticular tumors. This latter class has a very small discordance rate, and most of these go to the CDU class. For the most part, misdiagnoses among connective tissue tumors are reclassified within that general category. On the other hand, errors among the epithelial tissue tumors (lung, liver, and ovarian tumors) are predominantly reclassified after microscopic study into the connective tissue diagnoses, mostly as lymphoreticular tumors. The reader should note that liver tumors have a high rate of discordance (about 50%) and nearly two-thirds become reclassified as lymphoreticular or vascular tumors. Thus, data from grossly detected liver tumors cannot be used with sufficient reliability to warrant the statistical effort.

As a final note, any reclassification to another type of tumor within the broad categories of either connective or epithelial tissue tumors is not as serious as a reclassification to the other category. For example, a lung tumor that is reclassified as a lymphoreticular tumor is of more concern than a vascular tumor reclassified as a lymphoreticular tumor. Dose-response and radiation quality factors are quite different for the two major categories.

2.5 ANALYTICAL APPROACHES

Although ORACLE is a powerful data management tool that permits the database to be easily transported to a variety of computer platforms and operating systems, its power also means that an elaborate and complex programming language exists between a researcher and the database. Consequently, an interactive menu-driven interface (MDI) on the computer system in the Center for Mechanistic Biology and Biotechnology was developed as an alternative to ORACLE for accessing the JANUS database. The MDI was designed specifically to be a flexible and easy-to-use tool for the researcher.

The philosophy governing the MDI has evolved through the years. Originally, the MDI provided options to perform such functions as regression analysis and the computation of various actuarial statistics. As new methods of analysis have constantly emerged, it was recognized that an analysis-oriented MDI would become progressively more complex and require constant vigilance over quality control in order to satisfy the demands of a changing set of researchers interested in the database. As a consequence, the generation of data files for subsequent analysis has become the primary function of the MDI today. One philosophical element of the MDI has remained invariant: the MDI provides access to the database, but it does not permit the database itself to be modified.

Age at death (failure time) is a fundamental unit of information in any study designed to investigate the biological effects resulting from exposure to radiation. Quantitative methods used to analyze failure times can be divided into either those that require individual death times or those that require the death times of individuals to be grouped into discrete time intervals. The MDI for the JANUS database provides the researcher with the option to select either of these two formats for data output. In the

discrete case, the MDI also allows the specification of a fixed interval width format for the output file or an output file organized by user-defined intervals of varying widths.

The MDI database provides several additional capabilities for the analysis of failure times. For example, treatment codes (see Appendix J) can be provided during the dialog session to select the dose groups, exposure patterns, or radiation qualities that will be included in the output file. Gender-specific selections for individual dose groups in the output file can also be made.

Methods for failure-time analysis can also be subdivided into those used to analyze data on "cause of death" and those used to analyze data on incidence or prevalence. The MDI addresses the data requirements for these types of analyses by requiring the researcher during the dialog session to specify whether the data for the output file are for lethal events only (L), lethal plus contributory events (LC), or any observed pathology (LCN). It is also necessary to specify whether the data being output should be based on observations made at necropsy (gross pathology) or by histopathologic examination. As not all animals underwent histopathological examination, an option also exists to generate analysis files containing histopathology data for those mice where this information is available and gross pathology data for those mice lacking histopathology diagnoses.

When a specific cause of failure is the focus of an analysis (e.g., death resulting from a specific neoplasm), it is necessary to identify the subset of animals that died of the event of interest. When ungrouped data is being generated, those pathology endpoints considered events (lethal, or lethal plus contributory) for a mouse are set to unity and the pathology variables for non-events are set to zero. For grouped data, the selection of lethal or lethal plus contributory determines how the count of events for each pathology endpoint is computed.

In order to perform analyses, the codes used to describe specific pathologic events in the JANUS studies have been merged into three larger assemblages called combined pathology glossaries (Appendices K, L, and M). Each file generated by the MDI can contain up to 28 groups of these combined pathology codes. If the need arises, new databases can be created from combined pathology glossaries tailored to the specific research interests of the investigator. Once created, the new databases can be automatically accessed within an MDI session. The only restriction imposed on the researcher is that the analysis files generated through the MDI cannot contain more than 28 groups of pathology codes.

The MDI for the JANUS database is so easy to use that it can quickly lead to a proliferation of analysis files, which under typical work environments could lead to confusion over what information is actually contained in a given file. Fortunately, the MDI provides an automatic audit trail through the convention used to assign names to every file generated. Every file name begins with "LIFE" and ends with a five-digit number that provides a running count of the number of files that have been generated by the MDI. The data files are given the extension SIN (e.g., LIFE00932.SIN) and come paired with an IDX file (e.g., LIFE00932.IDX) that provides an index of the pathology versions and treatment group selections specified in the dialog session. In addition, a batch (extension BAT) file is created

to actually generate the analysis files when a normal termination of the MDI session occurs. This batch file also contains an echo of the responses given in the MDI session. The MDI, therefore, allows an investigator to go back and determine exactly when a file was created, what it was called, and what information is contained within that file.

At present, direct access to the JANUS database is restricted to authorized personnel at ANL. However, access to analysis files generated from the database is available via collaborative arrangements with staff members in the Center for Mechanistic Biology and Biotechnology. Arrangements are currently being made to transfer an electronic version of the entire animal database to the National Radiobiology Archive, an organization at Pacific Northwest Laboratory charged with the Department of Energy (DOE) mandate to archive and provide public access to data generated from animal studies funded by DOE.

3 THE JANUS PROGRAM EXPERIMENTS

3.1 INTRODUCTION

The JANUS program was first conceived in mid-1958 and subsequently went through a series of modifications and reevaluations. Generally, the plans tended to be grandiose, with the predictable criticism that the program would not be able to achieve programmatic goals either quickly or inexpensively. The program that ultimately emerged is probably best defined in Grahn et al. (1972) in a simple statement:

> The primary program objectives are to obtain data for the development of realistic models of chronic radiation morbidity and mortality whereby long-term radiation injury can be understood and predicted in terms of: (1) cell injury and recovery; (2) tissue and organ injury, repair and regulation; and (3) the actuarial statistics of disease and death.

These goals were not beyond reach, but in many respects, they were not fully achieved generally because funding levels were not adequate, and the need for compromise prevailed. This archive contains the "actuarial statistics" and the associated pathology. There is no equivalent archive of the many studies done on hematology, immunology, cell injury and repair, and other areas, including dosimetry. Much of the work concerning nonactuarial data has been published, and a list of publications from the JANUS program is appended to this document (Appendix N).

3.2 THE JANUS (JM) SERIES

3.2.1 JM-2

JM-2 was the first, the largest, and the most ambitious of the JM series. One necessary objective was to test the additivity of small increments of neutron dose, when given in different patterns of exposure over a 24-wk period. With use of five different exposure patterns (Table 7 and Appendix J), a common total neutron dose of 240 cGy was delivered. These ranged from a high-dose-rate single exposure to a fractionated exposure given in three low doses per week for 24 wk. A matching set of γ-ray exposures delivered a total dose of 855 cGy in 24 wk and a 788-cGy single dose. These γ-ray and neutron exposures compared the influence of changes in dose rate, in the number of fractions, and in the protraction period on the long-term response. A three-dose/single-dose series was also included along with a matching set of sham-irradiated controls. This test of exposure patterns was important for future planning because the JANUS facility could not be used, for logistical and economic reasons, for 5–7 d of irradiation per week for 6–8 h/d as had been done in our earlier studies with γ rays (Grahn et al. 1994).

The important objective was to evaluate the influence of these different exposure regimes on the endpoints of life shortening and neoplastic disease incidence and, in turn, on the estimation of RBE values. Sample sizes per sex, dose, and exposure pattern were sufficient to yield accurate estimates of the life table and pathology at death.

It was well known from previous studies that fractionation of a γ-ray dose would reduce its effectiveness, but the characteristics of specific exposure parameters were critical to the magnitude of this dose-rate effect. We were obliged to match every neutron pattern with γ-ray irradiations and were uncertain as to the additivity, or the magnitude of any deviations therefrom, of the neutron exposures. The choice of 24 wk was a compromise that permitted an adequate protraction period (about 20% of the control mean after-survival [MAS]) yet also permitted a large and necessary experiment to be executed over a reasonable period. In fact, 10 full replications, involving a total of over 11,000 mice, were completed between March 1971 and June 1972.

A small age-dependence test was also included in JM-2. This involved two single doses of neutrons and of γ rays given at about 200 and 300 d of age, spanning the 24-wk (168-d) fractionation period from 100 to 268 d of age. The single doses matched those given at 100 d of age.

No new studies were initiated until March 1974. This 2-yr hiatus permitted the Gammabeam 650 irradiator to be installed in the HLGF. The JM-2 data also accrued in this period to provide guidance for the next series of studies, JM-3, -4K, -4W, -7 and -8, which were initiated in the spring and summer of 1974.

The results of JM-2 were presented in an interim status by Ainsworth et al. (1974, 1976) and in a more complete form by Thomson et al. (1981a). An important finding was the nonlinear response, in terms of life shortening, to the single neutron doses of 20, 80, and 240 cGy. The response was concave downward, with the effect at 20 cGy being about 4-fold greater per centigray than at 240 cGy. The 24 weekly fractionation procedure at 240 cGy augmented the life-shortening response from about 1 d lost per centigray to about 1.5 d. This type of dose- and fractionation-dependent response to neutrons, opposite to that seen for γ-ray irradiation, was an important consideration in program planning.

With regard to dose additivity for individual neutron exposures, there was no significant difference between the response to three exposures per week of 15 min each and one per week for 45 min. Similarly, there was no difference in the response to one neutron exposure per week for 45 min and one per week for 360 min. However, one exposure per 4-wk period for 180 min per exposure did cause a shift in response for both γ rays and neutrons, but in opposite directions. The six larger once-monthly γ-ray increments were more effective than the smaller weekly exposures, while the opposite effect was noted for neutrons; the smaller weekly increments were more damaging. As a consequence of these results, all subsequent long-term neutron exposures employed the once-weekly, 45-min exposure paradigm, though there were some exceptions. Exposures to γ rays matched the neutron exposures.

3.2.2 JM-3

This was a straightforward single-dose study composed of seven replications that were run between April 1974 and June 1977. A small dose-rate comparison was also included in the last replication. It involved a single dose of 240 cGy of neutrons given to males only. One group was exposed for the usual 20 min, and a second group was exposed for 8 h. Table 8 gives the full inventory and dose array for JM-3. Because of funding constraints, only about one-half of the originally intended number of females were included in the final inventory. Some were discarded after about 1 yr, and others were simply not entered in the study. However, as with JM-2, both MACRO and MICRO pathology records are quite complete in relation to the number entered.

The reason the entries into this study were stretched out over 3 yr was due to competition for the available experimental animals. Concurrent with JM-3, five other studies were also being carried out, as will be noted.

3.2.3 JM-4

There are four experiments under the JM-4 rubric (we acknowledge this happenstance to be one of our few coding errors). The data are given in Tables 9 and 10, as well as in Appendix J. The basic study is known as JM-4K, as per the treatment codes for the total doses given in Table 9, and it involved the 24 once-weekly exposure procedure that was employed in JM-2. Irradiations were carried out in 10 replications between August 1974 and April 1977. Some of the total doses were repeated in JM-3, JM-4L1, and JM-7 to provide a more direct test of dose-rate and protraction factors. The study was done concurrently with JM-3, JM-7, and JM-8.

Another concurrent study was JM-4W, which only employed females and two total dose levels each for γ rays and neutrons (Table 9). The study, done in six replications between June 1974 and June 1978, was intended for a sacrifice-series study of vascular damage, which was carried out, but the original sample sizes were more than adequate (see Table 9) so that excellent survival data became available. No histopathology was performed; however, there are complete records for the gross findings.

The two studies listed as JM-4L (Table 10) were done in the early 1980s, 3–5 yr after the JM-4K study was executed. The first of these, JM-4L1, was originally intended to be carried out in parallel with JM-4K, as it involved four of the same total doses used in that study. The study involved γ-irradiated males only, and the protraction period was 23 wk, the same elapsed time for the 24 once-weekly procedure of JM-4K. Dose rate was reduced by a factor of about 150 in the JM-4L1 study. Total doses were delivered over a 22-h day, 5 d/wk for the 23 wk (6600 min of exposure per week vs. one 45-min exposure per week). No comparable neutron exposures were possible. Irradiations were done in four replications between November 1980 and June 1981.

The second low-dose-rate study, JM-4L2, was planned to parallel the JM-13 study, which involved a 60-exposure, once-weekly regime. The JM-4L2 experiment employed the same exposure procedure as JM-4L1, but it extended the protraction period to 59 wk, the elapsed time for the 60 once-weekly exposures. Again, only males were used, and no neutron exposures could be done to match the γ-ray irradiations. Five replications were exposed between July 1983 and October 1984.

The exposure, caging, and animal handling procedures had to be different for these two low-dose-rate studies. These were described in Section 2.2. The irradiations were performed in the low-level γ-ray facility previously described in Grahn et al. (1994). A portable Gammabeam 150 irradiator with a single ^{60}Co source was used for the irradiations. Dose rate was controlled by distance from the irradiator, which was located in an off-center position in the room. A constant exposure day of 22 h, 5 d/wk, was used throughout the two studies. Both studies used the same three lowest weekly total doses, 8.96, 18.13, and 41.7 cGy/wk, but source decay prevented our being able to accommodate a fourth dose in JM-4L2 at 4–5 cGy/wk and still include the highest level.

The source-handling mechanism described in Grahn et al. (1994) had been decommissioned in the late 1970s and was replaced with the "portable" Gammabeam 150 unit, originally fitted with a 6- to 8-Ci ^{60}Co source. This unit was used for both JM-4L experiments. There were no unusual dosimetric aspects, so the same kerma-to-midline-tissue-dose parameters were used as in the HLGF.

3.2.4 JM-7

JM-7 (Table 11) used a 60-exposure, once-weekly procedure (treatment code Q) to extend the protraction period to approximately 50% of the normal life expectancy from 100 d of age, when the weekly exposures were initiated. This experiment used only two total doses each for γ rays and neutrons, and these matched two that were used in JM-4K. One γ-ray dose and both neutron doses were also a repeat of JM-3, and both γ-ray doses were repeated in JM-4L1. To evaluate the age-at-exposure variable, JM-7 also included a single-dose component (treatment code R) at approximately 520 d of age, the end of the 60 once-weekly series. Two doses each for γ rays and neutrons were used, and these matched doses used in JM-3 and JM-4.

The 60-week series involved 10 replications over the period from March 1974 to July 1978. The six replications of the single-dose test were irradiated between April 1975 and April 1977. These replications were from an unexposed portion of the first six replications of the 60-week series. They were then irradiated on the same date as the last of the 60 weekly exposures.

3.2.5 JM-8

This was the only duration-of-life exposure experiment done in the JM series. It was ostensibly intended to link the JANUS program to the extensive duration-of-life studies done in pre-JANUS experiments (see Grahn et al. 1994) and to compare protraction factors between the 24 and the 60 once-weekly paradigms with the duration-of-life procedure.

The exposures were given once weekly, as in the 24- and 60-wk studies, and three weekly dose levels were used for both γ rays and neutrons. The weekly dose levels are found in Table 12. Mean total doses would be the product of these weekly doses and the mean number of weeks of survival. The lowest and highest weekly doses of the three, for both γ rays and neutrons, were the same weekly doses used for the JM-7 60 once-weekly series, which tied these two experiments together. The middle dose levels, 17.4 and 1.67 cGy/wk for γ rays and neutrons, respectively, were the same rates used in JM-4K to reach total doses of 417 and 40 cGy in 24 wk of exposure. Between 1 and 10 replications were used, and these were initiated between April 1974 and May 1980. Sample sizes for the females were not adequate for most dose groups but were sufficient for males.

3.2.6 JM-9

Owing to administrative and budgetary changes in mid-1977, experimental priorities changed. One change was the more pressing need for truly low-dose studies, especially with neutrons, because of accumulating evidence that higher levels of damage per centigray were induced at doses below 20–40 cGy as compared with that at doses above that level. The JM-9 experiment developed from this background. It consisted of two phases (Table 13). The first was a preliminary study carried out between June 1977 and March 1978 and was composed of only five replications. Only two neutron dose levels were used, 5 and 10 cGy. The latter was delivered in both the single dose and the 24 once-weekly regimes.

The second phase was performed with 10 replications between February and August 1980. Though restricted to the female, it was a large study that used larger sample sizes at the lowest doses than had been used in any previous studies. An excellent gross pathology file was created, and about 40% of the mice had a histopathology follow-up. This study also provided the first good example of an essentially null response dose, the 1-cGy neutron dose.

3.2.7 JM-10

From the outset, the JANUS program intended to include studies that compared the responses of several species, though the primary species was always to be *Mus musculus*, the mouse. Plans included studies with beagles, guinea pigs, and several species of wild mammals that had been captured and established in breeding colonies in the ANL animal facilities. The original intention was to provide a multiple-species database for comparisons that would enable an improved interspecies modeling effort, with the ultimate goal of predicting human responses to neutron and γ-ray exposures. The usual funding, manpower,

and programmatic deficiencies limited this interspecies comparison effort to one laboratory-maintained, long-lived field mouse, *Peromyscus leucopus* (see also Section 2.1.1.2).

The exposures of *P. leucopus* were done between November 1977 and March 1979 in 10 replications. Only males were employed. The dose levels were repeats of those used in JM-3 and JM-4K. Single exposures to both γ rays and neutrons were employed, and two total dose levels of neutrons were given in the 24 once-weekly procedure (Table 14, treatment codes VV and VW).

As shown in Table 14, the control MAS for *P. leucopus* is about 50% longer than that of the $B6CF_1$ mouse, though body size was not that much greater. In general, the response in terms of life shortening was not particularly different from that of the $B6CF_1$ mouse, but a different spectrum of pathology was seen at death. No histopathology is available, however.

3.2.8 JM-12

A curious aspect of the response to neutrons concerns the so-called reverse dose-rate effect; that is, as neutron doses are protracted or fractionated, life shortening (among other responses) is augmented. This was seen in JM-2 and in the comparison of JM-3 with JM-4K. A small study, JM-12 (Table 15), was carried out to test the relationship of this augmentation phenomenon to the short-term fractionation of dose specifically, by delivering a given total dose in only 1, 2, 4, or 6 fractions at 1-wk intervals. Only males were used, and the irradiations were carried out in six replications between November 1979 and April 1980. Though no histopathology was done, the gross pathology record is complete.

3.2.9 JM-13

The last major study of the life-shortening and pathologic responses was the JM-13 experiment (Table 16). In contrast to all previous studies, JM-13 was not funded by the U.S. Department of Energy (DOE). It was fully funded by the U.S. Nuclear Regulatory Commission (NRC), which was concerned about the potential risks associated with the periodic exposure of utility workers in the nuclear power industry to fission neutrons, especially at pressurized-water reactor facilities. The lowest total neutron dose of 2 cGy, delivered in 60 once-weekly exposures of 20 min each, required a dose rate of only 0.00167 cGy/min. This was achieved with a high degree of reliability.

Another unique feature of the JM-13 study was the inclusion, from concept to completion, of a series of periodic genetic evaluations of males drawn randomly from the control and irradiated groups during the course of the exposures. The paradigm of 60 wk of exposure was chosen as it was a reasonable approximation of a working lifetime for persons in the industry. Sixty weeks is also about 50% of the MAS for a young adult mouse. This would be roughly equivalent to a 30- to 40-yr period starting at 20 to 25 yr of age for a human population in the United States.

A concurrent issue at the time JM-13 was being executed (February 1981 to August 1982 for the exposure sequence) was the "quality factor" (Q) or, experimentally, the RBE for neutrons at very low doses delivered at low dose rates. The accepted value of 10 for fission neutrons was believed by many to be an underestimate. We expected JM-13 to make a significant contribution toward the resolution of this concern about the neutron RBE, because the study was addressing both somatic and genetic responses to low total neutron doses (<10 cGy) delivered at extremely low rates.

Table 16 indicates that, on average, only about 50% of the autopsied animals were subject to a histopathological examination. This level of pathology study was set by agreement with the NRC, the funding agency.

3.2.10 JM-14

JM-14 (Table 17) was the last major study of the JANUS program, now under the leadership of D.J. Grdina. Funding for this experiment was divided among the DOE, the National Cancer Institute of the National Institutes of Health, and the Center for Radiation Therapy of the University of Chicago. The primary purpose was to evaluate the efficacy of several radioprotector agents against the induction of late effects, specifically life shortening and tumorigenesis. The agents were WR-2721 [*S*-2-(aminopropyl-amino)ethylphosphorothioic acid] and WR-151327 [*S*-3(3-methylaminopropylamino)propyl-phosphorothioic acid].

The study used single doses of γ rays and neutrons at levels previously employed in the program (JM-3, JM-9). Animals were injected intraperitoneally 30 min before irradiation with either the radioprotector or saline. The irradiations were carried out between October 1984 and October 1985. At this time, the histopathology record is incomplete; however, a complete gross pathology record is in the file.

4 SUMMARY

4.1 INTRODUCTION

A complete review of all results of the long-term effects of whole-body γ-ray and neutron irradiations performed in the JANUS program cannot be given here. Instead, this brief summary will identify the major findings and, also, some of the unresolved issues as we currently see them. The results are presented in more complete form in published articles (see Appendix N), but there is no single summarizing published report. At the writing of this report (late 1994), there are still portions of the data that have not been fully analyzed and, in some cases, that have not been analyzed at all. A quick introduction for the reader to the life-shortening data of the individual JM experiments can be found in the following references:

JM-2	Ainsworth et al. (1976); Thomson et al. (1981a)
JM-3	Thomson et al. (1981a)
JM-4K,-4W	Thomson et al. (1981a)
JM-4L1, -4L2	Thomson and Grahn (1989)
JM-7	Thomson et al. (1981b)
JM-8	Thomson et al. (1981b)
JM-9	Thomson et al. (1983, 1985b)
JM-10	Thomson et al. (1986)
JM-12	Thomson et al. (1985a)
JM-13	Thomson and Grahn (1988)
JM-14	Grdina et al. (1991a,b); Carnes and Grdina (1992)

Comprehensive analyses and modeling of life-shortening effects are in Carnes et al. (1989) and Carnes and Grahn (1991). A summary and analysis of major tumorigenic responses are in Grahn et al. (1992). A combined, but incomplete, summary of genetic, life-shortening, and tumorigenic responses was published earlier in Grahn et al. (1986).

4.2 THE NEUTRON/GAMMA-RAY RBE

Obviously, there is no single best estimate of the RBE. The major variables that influence the RBE value are discussed in the following sections.

4.2.1 Sex

There is no specific sex-related factor influencing the RBE that cannot be related to sex-specific tumor incidence or death. While there are sex differences in neoplastic disease incidence, there is no significant sex difference in overall life shortening per unit dose.

4.2.2 Total Dose/Dose Rate/Protraction Period/Fractionation Pattern

One always wishes that the dose variables could be stratified to bring out the specific contributions of each variable. Unfortunately, they are a matrix of interdependent variables, and the JM series certainly did not exhaust the options. In terms of life-shortening estimates per cumulative dose (centigray), the RBE for single, low neutron doses would be about 10 (–4 d/cGy of neutrons vs. –0.4 d/cGy of γ rays), but this RBE would drop to 5 or less as the neutron dose goes above 40 cGy. Assuming complete additivity of small increments of neutron doses accumulating to 10 cGy or less, the RBE would range between 25 and 40 against comparable γ-ray exposures. Neutron effectiveness is lower per centigray at doses above 40 cGy than at doses of 20 cGy or less, regardless of exposure parameters.

For γ rays, decreasing the dose rate, increasing the protraction period, and reducing the size of a dose fraction all act to diminish life-shortening effects. The "round numbers" for this series of experiments, the number of days lost per centigray of γ rays, are as follows:

single dose	0.40	23 wk, 5 × 22-h days	0.16
24 weekly doses	0.20	59 wk, 5 × 22-h days	0.08
60 weekly doses	0.14	duration-of-life, weekly dose	0.09

The life-shortening effect of daily duration-of-life exposure to γ rays for 8 h/d is 0.04 d per cumulative centigray at doses less than 20 cGy/d, as was seen repeatedly in the pre-JANUS studies at ANL (Grahn et al. 1994). Thus, while the maximum n/γ RBE in the JM series is about 50 (4.0/0.08), it would be 100 (4.0/0.04) if the pre-JANUS studies at ANL were used as the low-LET baseline.

4.2.3 Dose-Response Functions

There were no unusual dose-response functions for any of the long-term somatic or genetic endpoints. The response to γ rays was predominantly linear, regardless of the exposure variables involved. Not only were they usually linear, but they uniformly extrapolated close to the 0,0 intercept. The occasional response was linear-quadratic, a second degree polynomial with a positive dose-squared term.

For neutron exposures, the responses were mixed. Depending on the range of total doses involved, they were either linear or linear-quadratic, with a negative second-degree term.

A variety of dose-response models were evaluated, but the simplest models prevailed (Carnes et al. 1989). RBE values were therefore easily derived from the ratio of linear terms, $\beta n/\beta \gamma$.

4.2.4 Age at Exposure

This variable was only tested with single doses at three ages greater than the standard age of 100 ± 15 d. The three ages were approximately 200, 300, and 500 d of age. The RBE value at the older ages was not substantially different from that at 100 d of age at exposure when measured in terms of the life-shortening response. Life shortening itself was dependent on age at exposure. In terms of days lost per centigray, the values for γ rays were 0.5, 0.3, 0.2, 0.2, for 100, 200, 300, and 500 d of age at exposure, respectively; for neutrons, the values were 1.0, 0.6, 0.3, and 0.5. These rather low values for neutron exposures were due to the unfortunate choice of dose levels (40 cGy up to 240 cGy), where the life-shortening effect steadily diminishes with increasing dose.

Though these data did not have a specifically identified control group from which the after-expectations of life could be derived for each age-at-exposure group, reasonable approximations can be made from other controls. The diminishing life-shortening term is probably reasonably accurate; however, the data also reveal that this phenomenon is likely to be a reflection of a reduction in age-specific tumor-related death rates at fixed age intervals as age at exposure increases. Latency may not be shortened as age at exposure increases, and tumor yields may be similar at comparable elapsed time periods after irradiation. These elapsed time periods, when converted to ages, reveal that tumors occur progressively later in life and thus have less influence on life shortening. These data need further analysis.

4.2.5 Endpoint

Obviously, RBE values are dependent on the endpoint. In general terms, the RBE values for life shortening are the best estimates for overall somatic effects, because life shortening at low doses principally reflects excess mortality attributable to neoplastic disease. The maximum RBE values occur at low doses, where about 85% or more of the life shortening can be attributed to excess tumor-related mortality. Within the broad class of neoplastic disease, however, considerable heterogeneity exists in the induction rates for different types of tumors for the two radiation qualities.

Epithelial tissue tumors are induced by neutrons at higher rates per centigray than are connective tissue tumors. The lowest RBE value, 2 ± 0.3, is thus seen for lymphoreticular tumors induced by single doses, and the highest significant values are between 50 and 100 for tumors of the liver, Harderian gland, and other glandular and reproductive system tumors, except for those of the ovary. The RBE range for life shortening is between 5 and 45, depending on the dose-rate factors that parallel the same range for tumorigenesis. This range of RBE values and its relationship to dose-rate and fractionation factors is also seen in the cumulative induction of reciprocal chromosome aberrations in the stem cells of the male germ line.

4.3 UNRESOLVED ISSUES

No series of experiments in radiation biology has ever succeeded in solving all the problems it set out to resolve, and, usually, a new set of problems is created. The JANUS program was no different from other experiences.

4.3.1 Dose-Response Functions

There remains a need for more data on the responses to γ radiation at doses between 5 and 50 cGy for both sexes. Similarly, the data from neutron exposures at 2–20 cGy need to be reinforced equally for both sexes. While we believe the response to γ rays is linear at low doses and will continue to extrapolate to the 0,0 intercept, this assumption needs more support. For neutron irradiations, the essentially linear response, through the intercept, at doses between 1 and 20 cGy needs to be confirmed for both sexes with a broader variety of dose-rate and fractionation factors.

4.3.2 Dose Rate, Fractionation and Protraction Factors

The JM series left some gaps in this area. Dose-response data for both sexes were not balanced, and the short-term 24 once-weekly sequence was particularly not satisfactory. The one duration-of-life series left unanswered the matter of bridging the databases from the pre-JANUS studies with those of the JANUS studies. The once-weekly duration-of-life procedure was twice as effective for life shortening than the daily, 8 h/d, duration-of-life procedure for γ radiation. The neutron duration-of-life series, unfortunately, did not go to a low enough total dose, so the response to lifetime accumulations of less than 20–40 cGy remains unanswered, though we would predict it would converge on the responses to the short-term exposure parameters that were employed.

4.3.3 Age at and during Exposure

This issue encompasses problems of long standing in radiobiology: Why do responses seem to lessen with increasing age, and why does the concept of "wasted radiation" still find adherents? The JM series noted that responses to γ rays declined from 1 to 24 to 60 wk of exposure and that a lower instantaneous dose rate within the 24 and 60 procedures also had a reduced effectiveness. There was a significant difference between 60 once-weekly and duration-of-life once-weekly, but no difference appeared between the latter and exposures for 59 weeks, 22 h/d for 5 d/wk. Nevertheless, both procedures were still twice as effective as daily duration-of-life exposures for 8 h/d. Obviously, radiation cannot be "wasted" in the sense that it truly lacks any effectiveness. Depending on the endpoint, effectiveness diminishes under certain long-term exposure conditions, and this remains to be rationalized.

4.3.4 Neoplastic Diseases

Several issues that relate to tumor incidence and mortality have yet to be addressed in this database. One concerns the question of tumor multiplicity, that is, are there important radiation quality, dose, sex, and age factors that may be manifest in the occurrence of two or more neoplastic conditions in the same animal? Another issue concerns the degree of malignancy of induced tumors and its relation to the noted variables. This could be addressed by a careful survey of metastatic tumors. A third concern relates to the variability in tumor induction that may be conditioned by genetic background. As the JM series used only one F_1 hybrid mouse, which was characterized by a high spontaneous frequency of both lymphoreticular and lung tumors, there is somewhat limited information on the full spectrum of tumors that might be seen and on their rates of induction, dose-response parameters, and RBE values.

4.3.5 Other Issues

The circumstance wherein groups exposed to low doses, low dose rates, or both have an MAS greater than their specific controls (the "hormesis" issue) was not a problem in these studies. There were three cases of "over-survival," all nonsignificant. These were, in terms of life shortening, JM-3: 0 vs. 90 cGy of γ rays, females, -5 ± 20 d; JM-9: 0 vs. 1 cGy of neutrons, females, -2 ± 10 d; and JM-13: 0 vs. 2 cGy of neutrons, males, -9 ± 11 d.

The 90- and 2-cGy groups both showed a deficit in the cumulative risk of lymphoreticular tumors, a dominant cause of death in the $B6CF_1$ mouse. Both groups also showed an excess risk for epithelial tissue tumors, many of which are classed as contributory or nonlethal. The 1-cGy neutron group of females was an almost exact replication of its control for all causes and all dominant pathology. In other words, this instance is the closest to a threshold exposure in our experience. Even the ovarian tumor incidence was unchanged from the control, but there were small excess risks at 1 cGy for lymphoreticular, kidney, gastrointestinal, adrenal, and Harderian gland tumor occurrences. Thus, while life shortening may seem to show an hormetic effect, many specific tumor occurrences will demonstrate radiation injury, as will the germinal tissues.

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TABLE 1 Composition of Combined Pathology Database <E>

Group	Included Pathology
1	Cause of death undetermined
Tumor pathology	
2	Lymphoreticular tumors
3	Vascular tumors
4	Connective tissue tumors other than lymphoreticular and vascular
5[a]	Respiratory system
6[a]	Harderian gland
7[a]	Liver and gallbladder
8[a]	Kidneys and urinary bladder
9[a]	Gastrointestinal tract
10[a]	Adrenal gland
11[a]	Pituitary gland
12[a]	Thyroid gland
13[a]	Testes and seminal vesicles
14[a]	Mammary glands
15[a]	Uterus
16[a]	Ovaries
17[a]	Skin and other epithelial tissue tumors not included in groups 5 through 16
18	Any secondary connective tissue tumor at any site
19	Secondary tumors of Harderian gland origin, any site
20	Secondary tumors of respiratory system origin, any site
21	All other secondary tumors, any site
Nontumor pathology	
22	Acute or chronic disease of the liver
23	Acute or chronic pulmonary disease
24	Acute or chronic cardiovascular disease
25	Acute or chronic renal disease
26	Ovarian cyst
27	Amyloid infiltration
28	All other nonneoplastic diseases, acute or chronic

[a] Groups 5 through 17 involve neoplastic diseases of epithelial tissue origin, with the exception of certain tumors of mixed origin involving the adrenal and mammary glands.

TABLE 2 Composition of Combined Pathology Database <F>

Group	Included Pathology
1	Any primary tumor of connective and/or epithelial tissue origin, including ovarian tumors
2	Any primary connective tissue tumor
3	Any primary epithelial tissue tumor, excluding ovarian tumors
4	Lymphoreticular tumors (group 2, database <E>)
5[a]	Histiocytic lymphoma, type A reticulum cell tumor
6[a]	Lymphocytic-lymphoblastic leukemia
7[a]	Lymphocytic-lymphoblastic lymphoma
8[a]	Unclassified lymphoma
9[a]	Mixed histiocytic-lymphocytic lymphoma, type B reticulum cell tumor
10[a]	All other lymphoreticular tumors
11[b]	Hemangioma, any site
12[b]	Angiosarcoma, any site
13	All vascular tumors (group 3, database <E>)
14	Fibroma, fibrosarcoma, undifferentiated sarcoma, any site
15	All other connective tissue tumors not included in groups 5 through 14
16	Connective tissue tumors other than lymphoreticular and vascular (group 4, database <E>)
17	Liver, hepatocellular tumors
18	Liver, bile duct tumors
19	Adrenal cortical tumors
20	Adrenal medullary tumors
21	Ovary, all tumors (group 16, database <E>)
22[c]	Ovary, granulosa cell tumor
23[c]	Ovary, tubular adenoma
24[c]	Ovary, luteoma (thecoma)
25[c]	All other ovarian tumors
26	Tumors of the kidneys, liver, gastrointestinal system, and skin
27	Tumors of the mammary glands, adrenal glands, pituitary gland, thyroid gland, uterus, testes, and seminal vesicles
28	As in group 27 plus the Harderian gland

[a] Specific cellular subclasses of the lymphoreticular tumors.

[b] Subclasses of vascular tumors.

[c] Sublasses of ovarian tumors.

TABLE 3 Composition of Combined Pathology Database <H>

Group	Included Pathology
1	Any primary tumor of connective and/or epithelial tissue origin, including ovarian tumors (group 1, database <F>)
2	Any primary connective tissue tumor (group 2, database <F>)
3	Any primary epithelial tissue tumor excluding ovarian tumors (group 3, database <F>)
4	Lymphoreticular tumors (group 2, database <E>)
5	Lymphosarcoma
6	Reticulum cell sarcoma
7	Lymphocytic leukemia
8	All carcinomas
9	All sarcomas
10	All fibromas
11	All fibrosarcomas
12	Alveologenic tumor (adenoma), benign
13	Alveologenic tumor (adenocarcinoma), malignant
14	All adrenal tumors (group 10, database <E>)
15	Adrenal cortical tumors (group 19, database <F>)
16	Adrenal medullary tumors (group 20, database <F>)
17	Hepatocellular tumors (group 17, database <F>)
18	Kidney tumors
19	All mammary gland tumors (group 14, database <E>)
20	All gastrointestinal tract tumors (group 9, database <E>)
21	All bone tumors
22	Metastasis from lung tumor to any site (group 20, database <E>)
23	Metastasis from kidney to any site
24	Metastasis from Harderian gland tumor to any site (group 19, database <E>)
25	Metastasis from bone tumor to any site
26	Metastasis from any site to lung
27	Metastasis from any site to kidney
28	All metastatic tumors (secondaries)

TABLE 4 JANUS Program Records Summary

Experiment No. (JM-)	Input	Death Records	Gross Pathology	Histopathology
2	11,590	9,947	9,205	7,838
3	3,280	2,867	2,732	2,204
4K	6,070	4,739	4,465	3,193
4W	2,200	1,519	1,462	0
4L1	620	598	567	364
4L2	525	516	508	371
7	2,735	2,676	2,554	438
8	1,880	1,292	1,197	239
9	5,450	5,385	4,923	1,465
10	2,390	2,187	1,959	0
12	600	600	537	0
13	7,895	6,317	5,935	2,760
14	4,000	3,978	3,668	623
Total	49,235	42,621	39,712	19,495

TABLE 5 Analysis of Concordance between Gross and Microscopic Findings for the Classifications of Lethal (L), Lethal Plus Contributory (LC), and All Observed (LCN) Pathology (percentage of gross diagnoses confirmed by histopathology and number of confirmed events [*n*])

Tumor Type or Grouping	L		LC		LCN	
	(%)	*n*	(%)	*n*	(%)	*n*
All primary tumors	94.1	8,828	97.8	9,177	98.6	12,222
All connective tissue	93.2	5,540	96.6	5,740	95.2	7,346
Lymphoreticular	96.7	4,432	98.0	4,494	96.0	5,501
Vascular	72.7	497	89.5	612	88.5	1,015
Other connective tissue tumors	52.4	354	58.9	398	47.7	605
All epithelial tissue	76.0	2,394	88.9	2,800	89.2	7,456
Lung	86.9	1,643	98.0	1,853	91.7	5,489
Liver	52.6	170	71.5	231	60.0	689
Harderian gland	78.5	142	87.3	158	81.2	1,333
Ovary	23.4	68	33.8	98	68.3	1,281
Kidneys, liver, gastrointestinal, and skin	53.5	416	69.4	540	67.5	1,681
Endocrine and reproductive system	53.3	256	69.0	331	70.6	1,934

TABLE 6 Analysis of Discordance between Gross and Microscopic Pathology[a]

Diagnostic Code, *n*, Discordance (%)	Connective Tissue				Epithelial Tissue		
	CDU	LR	VAS	CON	ADN	LIV	OVE
CDU, *n* = 1,530	966	530	68	33	81	14	8
63.1	100.0	54.9	7.0	3.4	8.4	1.4	0.8
LR, *n* = 4,585	67	153	25	4	22	0	2
3.3	43.8	100.0	16.3	2.6	14.4	0.0	1.3
VAS, *n* = 684	65	61	187	3	13	9	0
27.3	34.8	32.6	100.0	1.6	7.0	4.8	0.0
CON, *n* = 676	59	54	108	322	24	2	0
47.6	18.3	16.8	33.5	100.0	7.5	0.6	0.0
ADN, *n* = 1,890	42	138	13	9	247	1	1
13.1	17.0	55.9	5.3	3.6	100.0	0.4	0.4
LIV, *n* = 323	21	60	37	3	14	153	0
47.4	13.7	39.2	24.2	2.0	9.2	100.0	0.0
OVE, *n* = 290	58	52	41	2	6	5	222
76.6	26.1	23.4	18.5	0.9	2.7	2.3	100.0

[a] Values on the diagonal (boxed) are the number of discordant events in the diagnostic class stated as 100%. The other values in each row give the number of diagnoses reclassified to another diagnostic code (column) and the percentage of the discordants so reclassified.

Diagnostic codes are as follows:

CDU = Cause of death undetermined
LR = Lymphoreticular tumor
VAS = Vascular tumor
CON = Other connective tissue tumors (fibroma, sarcoma)
ADN = Lung tumor
LIV = Liver tumor (hepatocellular)
OVE = Ovarian tumor

TABLE 7 Inventory of Death and Pathology Records for Experiment JM-2

Radiation Quality	Total Dose (cGy)	Treatment Code[a]	Males					Females				
			Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records	Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records
Control	0	AC	200	159	835 ± 15	156	123	200	145	863 ± 15	140	124
		DC	200	158	859 ± 14	49	32	200	198	818 ± 15	64	51
		EC	200	169	864 ± 15	168	137	200	194	832 ± 13	186	165
		HC	200	157	840 ± 18	68	44	200	120	816 ± 18	38	27
		S0	200	200	843 ± 13	198	174	200	200	852 ± 13	198	185
γ Rays	855	AI	200	148	711 ± 15	146	113	200	93	690 ± 19	87	78
		BI	200	156	691 ± 14	154	132	200	124	673 ± 16	122	112
		EI	200	151	697 ± 14	149	113	200	121	687 ± 14	117	105
		HI	200	152	666 ± 14	150	122	200	125	641 ± 14	119	105
	1110	DI	200	148	619 ± 14	146	115	200	200	610 ± 11	193	166
	90	S1	400	386	810 ± 10	382	328	400	397	790 ± 9	391	367
	268	S2	200	185	727 ± 13	179	155	200	198	706 ± 12	193	183
	788	S3	200	196	460 ± 17	184	133	200	200	431 ± 17	182	136
	268	Y2[c]	200	200	710 ± 13	192	157	100	99	693 ± 18	95	87
	788	Y3[c]	200	200	492 ± 15	180	146	100	100	486 ± 18	94	72
	268	Z2[d]	200	193	635 ± 14	189	160	100	100	601 ± 18	94	81
	788	Z3[d]	200	199	520 ± 13	181	147	95	95	498 ± 18	92	71
Neutrons	240	AI	200	151	546 ± 16	148	118	200	108	505 ± 15	99	81
		BI	200	134	518 ± 14	130	101	200	121	499 ± 13	111	97
		EI	200	149	544 ± 14	147	119	200	128	495 ± 12	118	100
		HI	200	149	572 ± 14	144	124	200	136	528 ± 12	131	110
	80	DI	200	149	666 ± 15	146	115	200	167	675 ± 13	163	147
	20	S1	400	383	789 ± 10	382	335	400	380	759 ± 10	366	343
	80	S2	200	178	724 ± 14	175	157	200	200	667 ± 14	185	173
	240	S3	200	157	632 ± 15	154	135	200	199	580 ± 13	187	167
	80	Y2[c]	200	200	693 ± 15	197	169	100	100	655 ± 18	93	83
	240	Y3[c]	200	199	612 ± 13	184	161	100	99	593 ± 15	96	84
	80	Z2[d]	200	199	609 ± 12	193	159	95	95	600 ± 18	91	76
	240	Z3[d]	200	200	570 ± 13	193	153	100	100	573 ± 16	96	85

[a] See Appendix J for details.

[b] Mean after-survival [MAS] values based on all death records.

[c] 194 days of age at exposure.

[d] 287 days of age at exposure.

TABLE 8 Inventory of Death and Pathology Records for Experiment JM-3

Radiation Quality	Total Dose (cGy)	Treatment Code[a]	Males					Females				
			Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records	Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records
Control	0	S0	200	200	872 ± 13	191	142	200	190	820 ± 16	175	152
γ Rays	90	S4	200	199	858 ± 14	189	138	200	200	825 ± 13	189	171
	143	S5	160	160	827 ± 16	150	113	80	7	–[c]	7	6
	206	S6	160	160	802 ± 16	155	122	80	6	–[c]	6	4
	417	S7	120	120	744 ± 18	117	102	60	60	706 ± 27	54	49
	569	S8	120	120	646 ± 20	118	99	120	78	645 ± 25	74	66
Neutrons	20	S4	250	249	826 ± 13	242	189	250	244	778 ± 13	231	208
	40	S5	200	199	798 ± 14	181	153	80	7	–[c]	6	5
	60	S6	200	200	780 ± 14	191	169	80	7	–[c]	7	7
	120	S7	120	120	719 ± 18	117	104	60	7	–[c]	7	5
	160	S8	120	119	714 ± 18	115	101	120	120	646 ± 17	117	99
	240	SL	50	50	678 ± 25	49	0	0				
	240	SH	50	45	702 ± 25	44	0	0				

[a] See Appendix J for details.

[b] MAS values based on all death records.

[c] Females discarded before about 500 d after exposure.

TABLE 9 Inventory of Death and Pathology Records for Experiments JM-4K and JM-4W

Radiation Quality	Total Dose (cGy)	Treatment Code	Males					Females				
			Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records	Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records
JM-4K:												
Control	0	K0	280	195	928 ± 15	185	129	180	140	890 ± 16	134	110
γ Rays	206	K1	675	598	854 ± 8	585	391	120	7	–[c]	7	0
	417	K2	455	400	802 ± 9	385	278	400	394	783 ± 9	378	329
	959	K3	275	194	725 ± 12	185	146	80	5	–	5	0
	1919	K4	225	150	441 ± 12	143	105	60	13	–	12	0
	3820	K5	190	147	269 ± 7	117	48	30	25	244 ± 12	23	0
	5111	K6	140	100	143 ± 3	50	0	40	40	112 ± 2	28	0
Neutrons	20	K1	675	593	846 ± 8	563	328	600	593	800 ± 8	578	496
	40	K2	475	400	799 ± 10	378	259	80	3	–	3	0
	60	K3	275	194	762 ± 15	184	139	40	0	–	0	0
	120	K4	225	150	666 ± 16	145	121	30	0	–	0	0
	168	K5	190	150	631 ± 15	141	110	150	150	596 ± 13	144	127
	320	K6	140	95	511 ± 16	90	77	20	3	–	2	0
JM-4W:												
Control	0	W0	0					400	324	853 ± 11	314	0
γ Rays	807	W1	0					450	307	703 ± 9	302	0
	2690	W2	0					500	333	351 ± 7	304	0
Neutrons	80	W1	0					400	263	695 ± 10	261	0
	240	W2	0					450	292	554 ± 10	281	0

[a] See Appendix J for details.

[b] MAS values based on all death records.

[c] Dash indicates a number of deaths too small to allow estimation of MAS.

TABLE 10 Inventory of Death and Pathology Records for Experiments JM-4L1 and JM-4L2 (only males used)

Radiation Quality	Total Dose (cGy)	Treatment Code[a]	Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records
JM-4L1:							
Control	0	L0	200	189	862 ± 15	181	111
γ Rays	206	L1	200	194	830 ± 13	180	118
	417	L2	100	99	806 ± 22	97	57
	959	L3	80	76	675 ± 23	72	48
	1918	L4	40	40	579 ± 32	37	30
JM-4L2:							
Control	0	LC	175	173	803 ± 16	172	120
γ Rays	529	L5	175	170	767 ± 15	165	121
	1070	L6	100	99	719 ± 16	99	79
	2460	L7	75	74	608 ± 22	72	51

[a] See Appendix J for details.

[b] MAS values based on all death records.

TABLE 11 Inventory of Death and Pathology Records for Experiment JM-7

Radiation Quality	Total Dose (cGy)	Treatment Code[a]	Males					Females				
			Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records	Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records
Control	0	00	330	310	887 ± 11	293	0	180	175	886 ± 15	164	0
γ Rays	417	Q1	135	135	862 ± 16	131	92	30	27	786 ± 41	25	0
	1918	Q2	180	178	627 ± 12	167	124	180	178	621 ± 10	166	0
Neutrons	40	Q1	150	146	789 ± 15	138	95	30	30	763 ± 38	29	0
	160	Q2	200	189	632 ± 12	180	127	200	194	599 ± 11	187	0
γ Rays	206	R1[c]	150	148	460 ± 14	147	0	50	50	408 ± 24	47	0
	569	R2[c]	180	178	392 ± 11	168	0	180	176	374 ± 12	175	0
Neutrons	40	R1[c]	150	150	429 ± 13	147	0	50	49	434 ± 23	46	0
	160	R2[c]	180	172	410 ± 11	174	0	180	177	395 ± 12	170	0

[a] See Appendix J for details.

[b] MAS values based on all death records.

[c] 515 d of age at exposure to the single dose indicated.

TABLE 12 Inventory of Death and Pathology Records for Experiment JM-8

Radiation Quality	Dose per Week (cGy)	Treatment Code[a]	Males					Females				
			Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records	Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records
Control												
	0	U0	140	60	904 ± 25	54	40	50	50	853 ± 22	44	39
γ Rays	6.95	U1	260	181	819 ± 13	170	56	180	174	819 ± 13	158	0
	17.4	U2	200	120	755 ± 15	115	43	20	20	670 ± 35	15	0
	31.9	U3	170	86	631 ± 14	79	0	15	15	603 ± 37	13	0
Neutrons	0.67	U1	260	179	783 ± 14	169	61	180	169	737 ± 13	158	0
	1.67	U2	200	112	680 ± 13	105	0	20	20	608 ± 36	19	0
	2.67	U3	170	91	644 ± 17	85	0	15	15	553 ± 32	13	0

[a] See Appendix J for details.

[b] MAS values based on all death records.

TABLE 13 Inventory of Death and Pathology Records for Experiment JM-9

Radiation Quality	Total Dose (cGy)	Treatment Code[a]	Males					Females				
			Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records	Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records
Preliminary study:												
Control	0	X0	200	200	935 ± 13	189	0	200	199	891 ± 14	184	0
		XX	0					200	200	865 ± 13	186	0
Neutrons	5	X2	0					300	289	850 ± 12	261	0
	10	X3	200	200	876 ± 14	193	0	200	200	827 ± 13	188	0
	10	XX	0					200	197	846 ± 15	183	0
Final study:												
Control	0	XC	0					750	739	856 ± 7	656	248
γ Rays	22.5	X1	0					500	497	844 ± 9	453	177
	45	X2	0					350	346	850 ± 11	314	121
	90	X3	0					200	194	819 ± 14	177	73
Neutrons	1	X4	0					750	735	859 ± 7	661	253
	2.5	X5	0					450	445	848 ± 9	411	169
	5	X6	0					350	349	822 ± 11	312	132
	10	X7	0					250	245	805 ± 13	230	91
	20	X8	0					200	200	797 ± 13	183	78
	40	X9	0					150	150	753 ± 16	142	123

[a] See Appendix J for details.

[b] MAS values based on all death records.

TABLE 14 Inventory of Death and Pathology Records for Experiment JM-10 (males only)

Radiation Quality	Total Dose (cGy)	Treatment Code[a]	Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records
Control	0	V0	245	211	1255 ± 35	181	0
	0	W0	210	203	1321 ± 33	171	0
γ Rays	90	V1	200	189	1225 ± 38	164	0
	143	V2	200	182	1211 ± 36	158	0
	206	V3	200	190	1185 ± 35	175	0
	417	V4	170	159	1027 ± 35	146	0
Neutrons	20	V1	200	182	1183 ± 34	161	0
	40	V2	200	180	1179 ± 30	167	0
	80	V3	150	141	979 ± 31	121	0
	160	V4	150	140	890 ± 25	129	0
	40	VV	250	219	1151 ± 29	203	0
	160	VW	215	191	841 ± 22	183	0

[a] See Appendix J for details.

[b] MAS values based on all death records.

TABLE 15 Inventory of Death and Pathology Records for Experiment JM-12

Radiation Quality	Total Dose (cGy)	Treatment Code[a]	Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records
Control	0	J0	120	120	904 ± 19	112	0
Neutrons	240	J1	120	120	668 ± 18	98	0
	240	J2	120	120	620 ± 21	112	0
	240	J4	120	120	548 ± 22	105	0
	240	J6	120	120	601 ± 19	110	0

[a] See Appendix J for details.

[b] MAS values based on all death records.

TABLE 16 Inventory of Death and Pathology Records for Experiment JM-13

Radiation Quality	Total Dose (cGy)	Treatment Code[a]	Males					Females				
			Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records	Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records
Control	0	0X	810	592	882 ± 8	565	196	600	584	873 ± 8	541	214
γ Rays	100	1X	600	594	861 ± 7	571	212	600	598	846 ± 8	552	223
	200	2X	220	178	840 ± 14	168	115	180	174	819 ± 15	167	127
	300	3X	295	83	832 ± 20	79	57	80	79	782 ± 20	76	59
	450	4X	290	86	813 ± 19	83	62	80	75	784 ± 18	70	57
	600	5X	290	90	793 ± 20	85	56	80	79	745 ± 19	74	59
Neutrons	2	1X	600	566	893 ± 8	538	174	600	568	869 ± 8	528	218
	7.5	2X	455	271	869 ± 11	255	94	250	247	837 ± 12	215	95
	13.5	3X	250	242	855 ± 11	230	78	250	237	809 ± 11	221	104
	21	4X	450	254	817 ± 12	231	94	250	244	790 ± 12	230	111
	30	5X	150	149	779 ± 16	141	102	150	150	771 ± 15	142	121
	40	6X	285	98	805 ± 18	95	67	80	79	717 ± 19	78	65

[a] See Appendix J for details.

[b] MAS values based on all death records.

TABLE 17 Inventory of Death and Pathology Records for Experiment JM-14

Radiation Quality	Total Dose (cGy)	Treatment Code[a]	Males					Females				
			Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records	Input	Death Records	MAS[b] ± SE (d)	MACRO Records	MICRO Records
Control	0	0P[c]	200	194	886 ± 13	173	0	200	199	858 ± 13	182	0
		0S[d]	200	199	891 ± 13	189	0	200	200	858 ± 14	188	0
γ Rays	206	C0[e]	200	199	790 ± 14	184	0	200	198	770 ± 13	186	157
	206	CP	200	198	821 ± 14	182	0	200	200	824 ± 13	180	161
	417	DP	200	199	796 ± 15	182	0	200	200	738 ± 13	192	0
Neutrons	10	A0	200	198	850 ± 13	180	0	200	199	812 ± 14	182	156
	10	AP	200	199	843 ± 16	183	0	200	199	836 ± 14	186	149
	10	AR[f]	200	200	874 ± 14	186	0	200	200	836 ± 13	184	0
	40	BP	200	199	797 ± 14	183	0	200	200	762 ± 13	186	0
	40	BR	200	200	797 ± 14	182	0	200	198	751 ± 13	178	0

[a] See Appendix J for details.

[b] MAS values based on all death records.

[c] Code P: treated with radioprotector WR-2721.

[d] Code S: treated with saline.

[e] Code 0: no treatment.

[f] Code R: treated with radioprotector WR-151327.

APPENDIX A:

JANUS DEATH TAG AND CAGE CARD

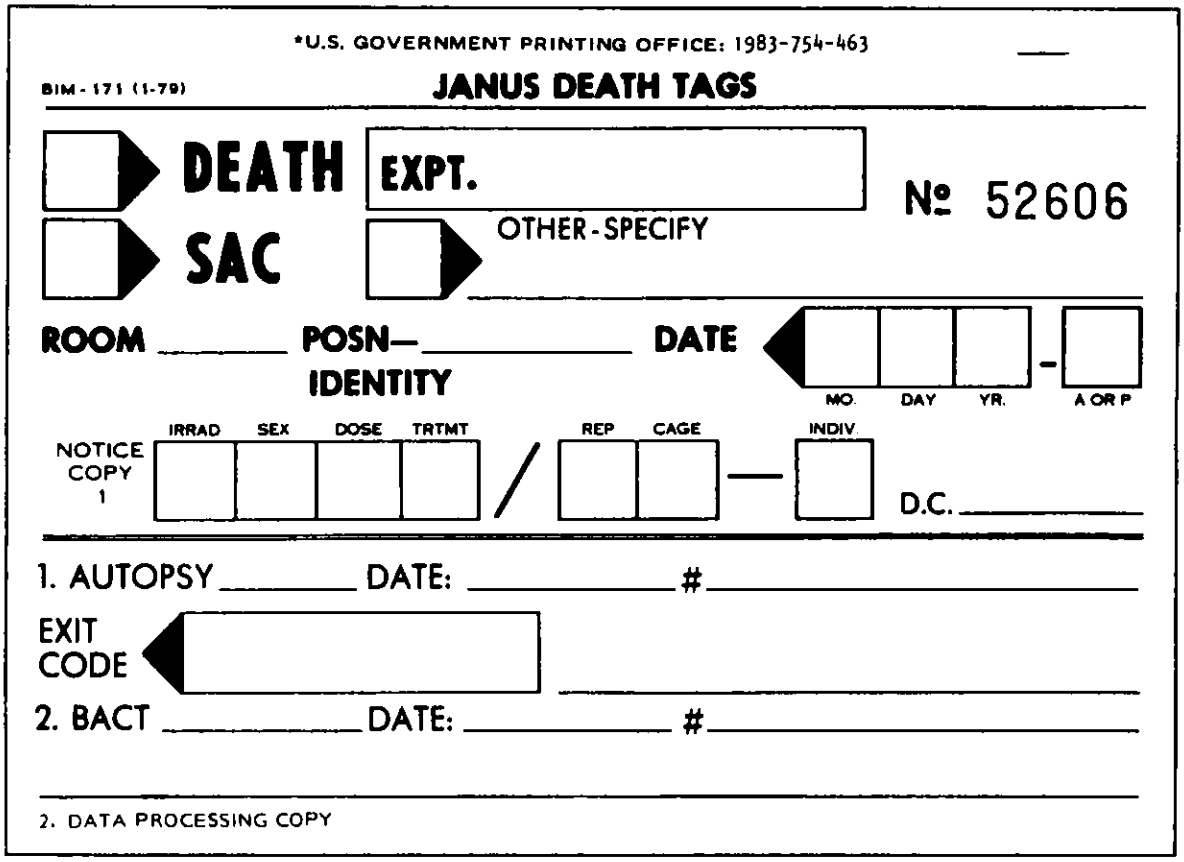

FIGURE A.1 JANUS Death Tag

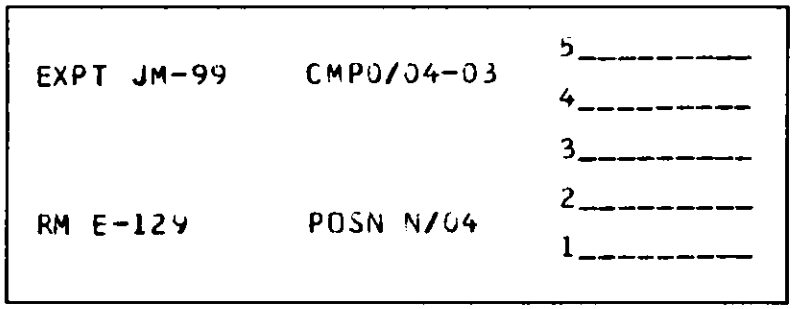

FIGURE A.2 Cage Card

APPENDIX B:

JANUS EXIT AND AUTOPSY CODES

JANUS EXIT CODES

In Combined Pathology Databases	In ORACLE Database	Original Prosector's Code	Definition
0			Not dead yet
1	1.0	1.1	Died during fractionation exposure period
1	1.0	1.2	Late radiation death
1	1.0	1.3	Acute radiation death
2	2.0	2.1	Sacrificed, moribund
3	3.1	3.1	Escaped during irradiation
3	3.2	3.2	Improper irradiation
3	3.3	3.3	Accidental death
3	3.4	3.4	Unknown, cannibalized
3	3.5	3.5	Missing
4	4.1	4.1	Programmed sacrifice
5	5.1	5.1	Discard
6	6.1	6.1	Removed to another experiment
7	6.2	6.2	Grahn mice, nonbreeders
8	6.3	6.3	Grahn mice, breeders
9			Anything else

JANUS AUTOPSY CODES

A = Autopsied

N = Not autopsied

D = Decomposed, not autopsied

C = Cannibalized, not autopsied

APPENDIX C:

NECROPSY REPORT

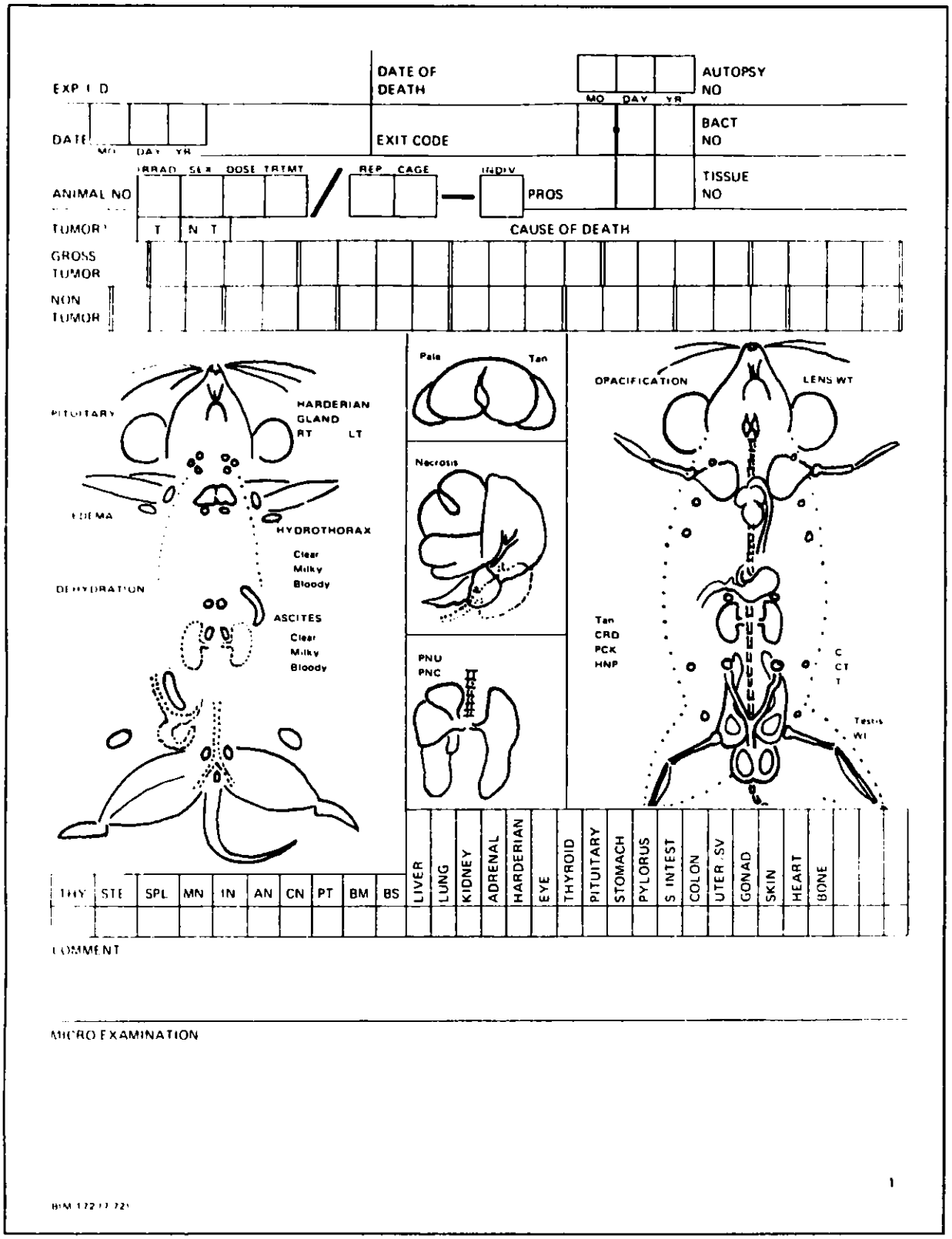

FIGURE C.1a Necropsy Report, page 1

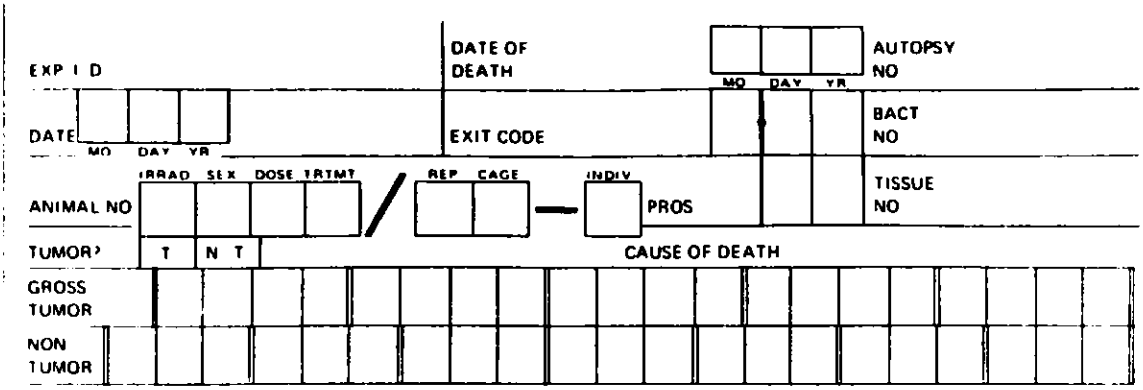

FIGURE C.1b Necropsy Report, page 2

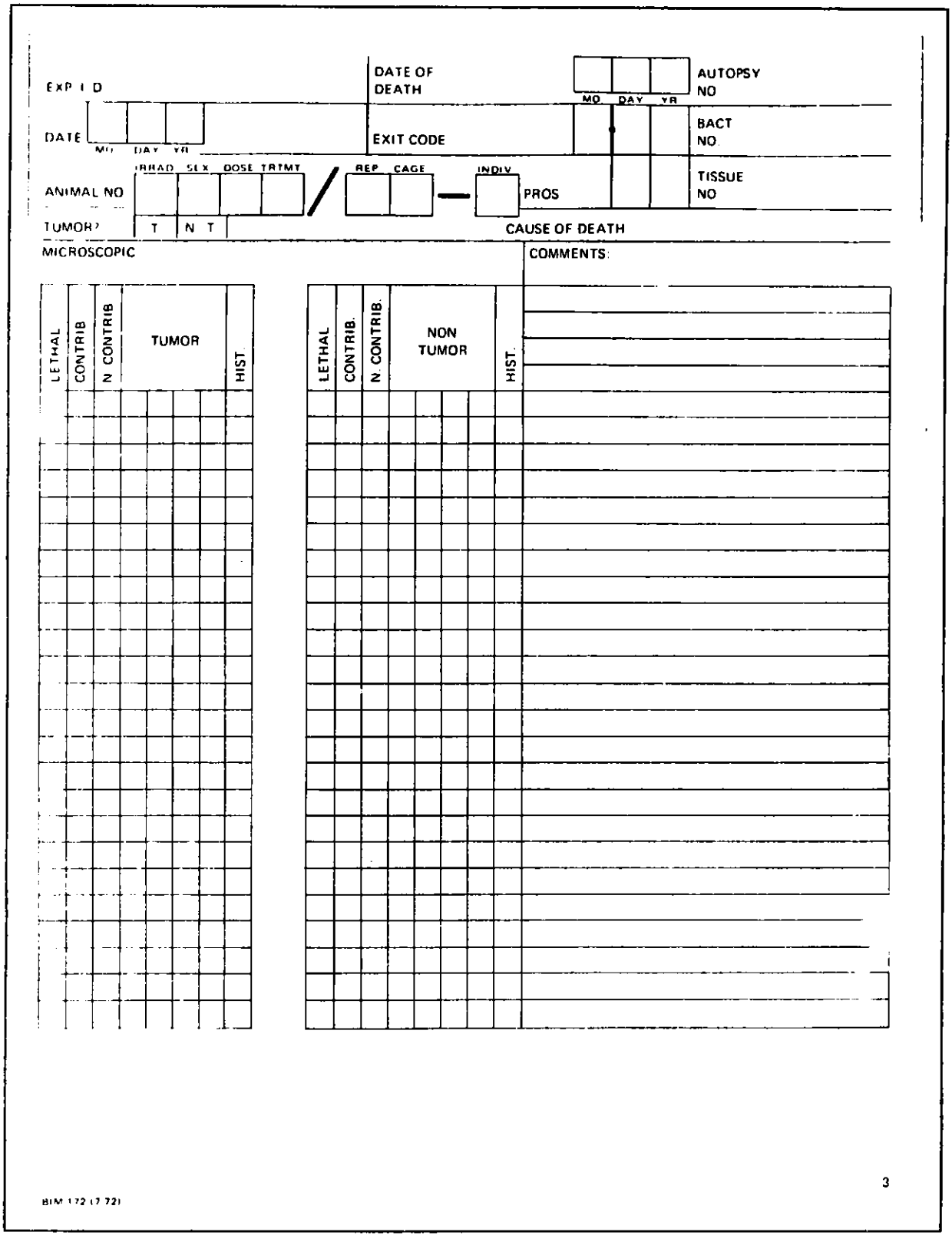

FIGURE C.1c Necropsy Report, page 3

APPENDIX D:

PROTOCOL FOR NECROPSY

APPENDIX D:

PROTOCOL FOR NECROPSY

D.1 EQUIPMENT NEEDED

Corkboard
Pushpins
Iris scissors
Hound's-tooth forceps
Fine curved forceps, ophthalmologic forceps
Cardboard tags
Vials of AFA fixative (70% alcohol, formalin, acetic acid; 20:2:1)
Necropsy sheet
Killing jar
Ether

D.2 OVERVIEW

All animals are checked daily for deaths and for those that are moribund. The moribund animals are sacrificed in the necropsy laboratory in a killing jar with ether. All of the information gathered from an animal is recorded by the prosector on a standardized necropsy report (see Appendix C).

All animals are examined externally to determine if a necropsy can be performed or if the animal has been cannibalized or is autolyzed and a necropsy is not possible. Evidence of trauma, external lesions, or any unusual conditions are also noted at this time. The necropsy is carried out by a systematic examination of the mouse, first ventrally and then dorsally. The subcutaneous structures are examined, followed by an examination of the abdominal cavity. Examination of the abdominal organs aids in the determination of the degree of autolysis; sometimes it is too advanced to fix tissues for histopathology, but a gross examination may determine the probable cause of death. In some cases, autolysis is so advanced that no cause of death can be determined. In any event, the animal is always recorded, and an exit code and autopsy code are assigned.

The usual course of examination proceeds with the removal and examination of the spleen, the pancreas, and then that part of the digestive system including the stomach to the rectum. The reproductive organs and the urogenital system are examined next. The liver is removed for easier examination. The thoracic cavity is then examined, and the heart and lungs are removed for examination. Finally, the head and dorsal aspect are examined. The eyes, Harderian glands, brain, pituitary gland, and vertebral column are checked for lesions and tumors. As the necropsy is carried out, a set of tissues is fixed according to the procedure for collection of tissues for histopathology (Appendices F and G). The necropsy

report accompanies the tissues to histological preparation and on to the pathologist who reads the slides and records the histopathological diagnosis.

A more detailed description of the necropsy procedure containing descriptions of normal and disease conditions follows. A description is also presented for each of the codes used in the reporting of the diagnoses of gross observations.

D.3 PROCEDURE

The dead animal is examined for external lesions (e.g., dermatitis, skin tumors, missing parts) and then pinned to the board ventral side up with a pushpin in each foot. With the scissors and hound's-tooth forceps, a midventral incision is made in the skin from the external genitalia to the angle of the lower jaw. The skin is carefully peeled away exposing the submaxillary salivary glands along with the cervical lymph nodes. Side cuts are made in the inguinal and axillary regions so the skin will lie flat on the board. Examine subcutaneously for edema (graded + to ++++), enlarged lymph nodes in the axillary and inguinal regions, active mammary glands, mammary gland tumors, or other lesions that might occur.

SUBCUTANEOUS LESIONS

Connective Tissue Tumors

These can appear almost anywhere (subcutaneous, intraperitoneal) and are usually opalescent white and firm on section.

Muscle Tumors

These usually appear on limb muscles.

Mammary Gland Tumors

These appear subcutaneously at the mammary gland sites. They are lobular in shape and when cut with a razor blade have a white, moist surface.

Vascular Tumors

These tumors (hemangiomas and angiosarcomas) can appear in all organs and in connective, muscular, and nervous tissue.

ABDOMINAL CAVITY

Open the abdominal cavity with a midventral slit in the peritoneum from the pubis to the diaphragm. Side cuts are made so that the peritoneum will lie flat on the board. If not previously done, the degree of autolysis is determined. Autolysis may be scaled + to ++++. If no necropsy is performed, the animal is always recorded, and exit and autopsy codes are assigned.

Note ascitic fluid or hemorrhage in the abdominal cavity. Ascitic fluid can be clear, milky, and/or bloody, and the severity is graded on a + to ++++ scale. Attempt to identify the source of the ascitic fluid or hemorrhage.

Spleen

Remove the spleen and note its size and appearance. The color may be pale, a normal deep red, or a darker red. Note any increase in the white pulp and a reticular or nodular (lumpy) consistency. There may be areas of hemorrhage or vascular tumor. The entire spleen is fixed for all animals.

Pancreas

The pancreas lies in the mesentery between the stomach and duodenum and is attached to the spleen. A piece may be fortuitously fixed for examination with the spleen because of this attachment. Note the size of the pancreas and any unusual appearance.

Digestive Tract

Detach the stomach at the esophageal end and from the mesenteries and strip the intestine. Examine for enlarged nodes and diverticula, adhesions, hemorrhage, or infection. Watch for the mesenteric node and leave attached to the colon.

Stomach. Note if the stomach is filled with food or gas or is empty. Split it open to look for tumors in the cardiac, pyloric, or glandular regions or at the pyloric-duodenal junction. Tumors may also be found on the exterior of the stomach.

Intestine. Examine for lesions, inflamed areas, hemorrhages, diverticula, or enlarged nodes. An enlarged mesenteric node can be seen in the mesentery of the colon. If enlarged or abnormal, fix this node with a piece of the colon for identification.

Urogenital System

Reproductive System

Examine the organs individually, paying particular attention to the following:

Ovaries. Note their size and the presence of tumor or cyst. Ovaries may be blood filled or ruptured and may be surrounded with fat or lymphoid tissue.

Uterus. Note if the uterus is distended, fluid-filled, cystic, or contains a tumor.

Testes. Examine and note their size and consistency and the presence of hemorrhagic foci or tumors.

Epididymis and seminal vesicles. Note if distended and fluid-filled. Record color and presence of tumors.

Prostate, Cowper's, and preputial glands. Note size and condition.

Renal System

Examine the organs individually, paying particular attention to the following.

Urinary bladder. Note if the bladder is full or distended or contains a tumor, and if the urine contains blood or calculi. If the bladder is full and the seminal vesicles are distended, check for a plug in the urethra or a tumor at the neck of the bladder or at the junction of the urethra and the seminal vesicles.

Kidneys. Note size and color of kidneys. Check for multiple cysts, scarred or pitted surfaces. Check for tumors. Hydronephrosis is scaled + to ++++. One kidney with attached adrenal gland is routinely fixed.

Adrenal Glands. Note their color and size and the presence of cysts and tumors. Fix with kidney.

Liver

Check its color and size and the presence and location of lesions such as tumors or cysts; note the appearance of the surface as mottled, pitted, or tan areas. Note if the gallbladder is distended. Fix the median lobe containing the gallbladder as well as any tumors.

Lymph Nodes

If enlarged, note all and fix at least representative nodes of the periphery (subcutaneous) and in the abdominal cavity.

THORACIC CAVITY

Open the thorax with a side cut through the ribs, a cut across the diaphragm, and a second cut through the ribs on the other side so that the ribs and sternum can be laid back to expose the heart, lungs, thymus, parathymus, and trachea with thyroid. Fluid in the thorax can be clear, milky, and/or bloody, and the amount is graded a + to ++++ scale; identify source. The heart and lungs are removed for examination.

Lung

Examine each lobe for tumors, congestion, or consolidation. Pink is normal; dark red or liver-colored indicates pneumonia; an in-between color is indicative of congestion. Tumors should be drawn to scale and placed in the proper location on the lobes. Metastatic tumors frequently develop in the lungs. The entire lung with bronchus is routinely fixed.

Heart

The heart can be enlarged or small, hard or soft, and pale. Note the presence of tumors or enlarged auricle, which is indicative of a thrombus. The entire heart is routinely fixed.

Lymph Nodes

The thoracic nodes may be increased in number and enlarged and cause pressure on blood or air flow.

Thymus and Parathymus

The thymus and parathymus may be enlarged due to lymphoma and are graded + to ++++. If enlarged, these may be fixed attached to the heart.

Thyroid

The thyroid straddles the esophagus at the larynx and may be enlarged, cystic, or tumorous.

Ribs

Examine the ribs for attached lymph nodes and secondary tumors.

HEAD

Remove the pins and place the mouse on its ventral side. Clip the skin at the nape of the neck and pull skin forward over head to expose skull.

Brain

Examine the calvarium for abnormalities and then remove it to expose the brain. Examine for hemorrhage and tumors.

Pituitary

Lift the brain away from the floor of the skull at the olfactory end to expose the pituitary. Examine and carefully scrape aside optic and olfactory nerves. Note any enlargement or discoloration. Fix the pituitary if any abnormalities are noted. If the pituitary adheres to the brain, remove it with the brain and fix them together. If not, fix the pituitary by placing it on a small piece of card and fixing the pituitary attached to the card.

Eyes and Harderian Glands

Remove the eyes and Harderian glands together. Examine the eyes for opacity. Check the glands for tumors or increased size. Enlarged glands may be either solid tumor or filled with a milky secretion. Fix both eyes and glands if any abnormalities are noted.

SKELETAL SYSTEM

Examine the long bones for tumors. Strip the skin off the back to expose the dorsal surface of vertebral column and pelvis. If it has been noted that the mouse was paralyzed, check carefully for a spinal tumor.

D.4 CODES FOR GROSS TUMOR DIAGNOSES

NTYG (non-thymic lymphoma, generalized): Characterized by any or all of the following: (1) enlarged spleen with increased white pulp areas, may be all white and lumpy; (2) enlarged liver sometimes with discrete white areas, an overall grainy or rough appearance and texture; (3) enlarged nodes, deep and peripheral; (4) fluid in abdominal cavity and thoracic cavity; fluid may be clear, milky, or bloody; (5) edema; (6) lungs are often severely congested.

NTYL (non-thymic lymphoma, localized): Only one reticular tissue involved, most commonly the mesenteric node, a lymphoid diverticulum of the gut, or the spleen.

TADN (lung): Nodular, opalescent or white, may be located in any lobe and sometimes more than one in a lobe and in more than one lobe, and size may vary considerably.

TADP (adipose): Enlarged or consolidated area in abdominal fat; more vascularization.

TADR (adrenal): Abnormal size and clear deviation from normal creamy white.

TBLA (bladder): Enlarged bladder is probably distended and urine-filled; abnormality most commonly found at neck of bladder. Urine is usually cloudy, sometimes bloody.

TBON (bone): Visibly enlarged and eroded areas on bones, particularly spine and long bones. No radiographs are taken in this protocol. Bone tumor secondaries may be found in lungs and other organs.

TBRN (brain): May be enlarged area or depressed area, a noticeable change in contour and symmetry, and an increased vascularization.

TCEC (caecum)[1]

TCGL (Cowper's gland): Enlarged Cowper's gland; may "squeeze shut" the urethra.

TCNS (central nervous system): Any enlargement found on/in the spinal cord.

TCOL (colon)[1]

TCON (connective tissue): Hard, opalescent, translucent-to-opaque white mass; can be found almost anywhere (subcutaneous, intraperitoneal); may be large, as this type of tumor is the largest identifiable isolated tumor mass seen. Connective tissue tumor secondaries can be found in lungs, liver, etc. It should be noted that one type of mammary gland tumor may look like a connective tissue tumor.

TDUO (duodenum)[1]

TEPI (epididymis): Enlarged and vascularized.

TESO (esophagus)[1]

TGBL (gallbladder): Thickened and often distended because of a block at the neck.

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[1] TCEC, TCOL, TDUO, TESO, TILE, TJEJ, TPYL, and TSTO are all codes that refer to tumors of the gastrointestinal tract. Most often these appear as a local thickened area, sometimes with muscle involvement. When the gut is split open longitudinally, the tumor is seen protruding into the lumen. Do not confuse a lymphoid diverticulum with a gastrointestinal tumor.

THGL (Harderian gland): Creamy white and enlarged, some glands may just be hyperplastic; tumors often push the eye out of the orbit and cover part of the skull. Skull may be domed. Secondaries may be found in lungs.

THIB (hibernating gland): Very rare; the few seen have been hard, discrete nodules in the brown fat between the shoulders.

THRT (heart): Auricles or ventricles may be enlarged; more commonly, discrete inflammatory lesions are seen, but they are easily identified by their texture, color, and overall appearance. There may be a vascular tumor of the heart.

TILE (ileum)[1]

TISO (isograft): Isograft (applies to only JM-11.).

TJEJ (jejunum)[1]

TKID (kidney): May appear to be just a single nodular focus on the surface of the kidney or more diffuse on inside, in which case the kidney may appear larger. Check for secondaries both in the other kidney and from the kidney into other organs; can be differentiated from the usual degenerative diseases.

TLIV (liver): Enlarged lobes, usually "liver-colored"; white areas may be lymphoid. Liver tumors often protrude as large, discrete nodules that sometimes, after long residence, become umbilicated and may involve entire lobes. A large, "bloodier than normal" tumor may be a vascular tumor of the liver; these are not easily distinguished at the gross level and require a histopathological diagnosis.

TMGL (mammary gland): Subcutaneous at mammary gland sites; lobular, white, and moist in appearance. They can extend dorsally, particularly in the anterior region around the back of the neck. One type of mammary gland tumor (MICRO code TMAC) looks more like a connective tissue tumor.

TMIC (miscellaneous connective tissue)[2]

TMID (miscellaneous digestive system)[2]

TMIE (miscellaneous endocrine)[2]

TMIG (miscellaneous glandular)[2]

TMIL (miscellaneous lung): In lung, but not typical TADN appearance.[2]

TMIN (miscellaneous nervous system)[2]

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[2] All "TM _ _ (miscellaneous)" codes are used when there is not a typical appearance to the tumor.

TMIR (miscellaneous reticular system)[2]

TMIS (miscellaneous miscellaneous): Found in uncoded organs or locations.[2]

TMUG (miscellaneous urogenital)[2]

TMUS (muscle): Increased muscle mass, particularly upper forelimb or thigh.

TOVE (ovary): Enlarged; may be cystic at the same time and blood-filled or with ruptured cyst; may be white or yellow. Ovaries may also have vascular tumors but are difficult to distinguish from a bloody cyst or tumor at the gross level; ovaries may also be infiltrated by lymphoid cells.

TPAN (pancreas): Enlarged and sometimes nodular appearance.

TPIT (pituitary): Enlarged, may be bloody. Look particularly for mammary gland or adrenal abnormalities.

TPNS (peripheral nervous system): Enlargement of nerves to limbs, etc. (not spinal cord).

TPPT (preputial gland): Gland may be enlarged and infected (site of acute infection) but may not be a tumor.

TPST (prostate): Enlarged; may obstruct urethra.

TPYL (pylorus)[1]

TSEC (secondary): indicative of secondary tumor in another organ (Harderian gland tumor in lung; kidney tumor in lung; liver tumor in lung).

TSGL (salivary gland): Enlarged salivary gland to be differentiated from enlarged cervical nodes attached to the salivary gland.

TSKN (skin): Eroded areas; raised area especially around the edges of the lesion; sometimes a "weeping" lesion.

TSMV (seminal vesicle): Enlarged, but not to be confused with blockages associated with advanced age.

TSPL (spleen): Enlarged, but to be distinguished from a lymphoid spleen (mostly white pulp) or a vascular tumor of the spleen (bloody).

TSTO (stomach)[1]

TTGE (tongue): Presumably an enlarged tongue. A tumor at this site has not been seen in these studies.

TTRD (thyroid): Enlarged thyroid; may cause constriction of trachea. Many thyroids are quite large but simply hyperplastic and nontumorous. A microscopic diagnosis is necessary to be sure.

TTST (testis): Enlarged testis (or testes). Testis may also have a vascular tumor.

TTYG (thymic lymphoma, generalized): Enlarged thymus and other lymphoid tissue (see NTYG description).

TTYL (thymic lymphoma, localized): Only the thymus enlarged; no other apparent lymphoid proliferation.

TUTE (uterus): Enlarged uterus; solid mass usually, but sometimes with areas of necrosis. Not to be confused with the overall enlargement associated with lymphoid infiltration or a generalized metritis.

TVAG (vagina): Enlarged vagina because of a mass on the inside.

TVAS (vascular): Vascular tumors can occur in any organ or be located in connective, muscular, or nervous tissue. Common locations are the spleen and liver. Vascular tumors are characterized by a large amount of blood with more or less stroma.

D.5 CODES FOR NONTUMOR DIAGNOSES

Most of the codes for nontumor diagnoses are indicative of pathological conditions with the usual descriptions for such terms. When the code for an organ (e.g., adrenal [ADR], brain [BRN]) is used, it means that the organ appears abnormal, usually in size, color, etc., but there is no apparent tumor. Most of the nontumor diagnoses are descriptive, and only a few may represent a cause of death. Some of the codes that may be used for a cause of death are

ACI	acute infection
ANE	anemia
ANU	aneurysm
CRD	chronic renal disease
ENT	enteritis
HRG	hemorrhage
HNP	hydronephrosis
MAL	malocclusion
MET	metritis
PCK	polycystic kidney
PER	peritonitis
PNC	pneumonitis
PNU	pneumonia
PRO	prolapse
THR	thrombus
TYP	typhlitis

These are more indicative of disease states rather than descriptive of conditions. A complete list with definitions of nontumor MACRO codes is found in Appendix E.

D.6 CAUSE OF DEATH

To establish a probable "cause of death" from the gross findings, there are several criteria that may be applied to the observations. These include

1. Size and extent of the lesion

2. Site of the lesion (some sites/organs may have lesions that are not life threatening even if large)

3. Life-threatening conditions that result from an associated disease (e.g., pneumonia resulting from even a small lung tumor; perforating diverticulitis from NTYG or TTYG; THGL secondaries in the lung)

In addition, there are hints that may be given to the prosector by the overall appearance of the mouse, premortem and postmortem (i.e., difficult breathing, edema, weight loss, lumpy abdomen).

APPENDIX E:

JANUS MACRO DICTIONARY

JANUS MACRO DICTIONARY - SNOMED/SNOVET CONVERT Ordered by MOUSCODE July 11, 1994 bjw

JANUS Code	JANUS Description	PSN	Topography	Morphology	SNOMED Description
ABS	ABSCESS	N	00003	M41740	- NOT ASSIGNED - * ABSCESS
ACI	ACUTE INFECTION	N	00003	M41400	- NOT ASSIGNED - * SUPPURATIVE INFLAMMATION
ADH	ADHESION	N	00003	M49400	- NOT ASSIGNED - * ADHESION
ADR	ADRENAL	N	93000	M00010	ADRENAL GLAND * UNKNOWN MORPHOLOGY
AMY	AMYLOID	N	00003	M55100	- NOT ASSIGNED - * AMYLOIDOSIS
ANE	ANEMIA	N	00010	M40100	TOTAL BODY * ANEMIA
ANU	ANEURYSM	N	40000	M32400	BLOOD VESSEL * ANEURYSM
ASC	ASCITES	N	Y4500	M36300	PERITONEAL CAVITY * EFFUSION
BAC	BACTEREMIA	N	0X000	D0110	BLOOD * BACTERIAL INFECTION
BDY	BLOODY - HTX OR ASC	N	00003	M36330	- NOT ASSIGNED - * SEROSANGUINOUS EFFUSION
BLA	URINARY BLADDER	N	74000	M00010	URINARY BLADDER * UNKNOWN MORPHOLOGY
BON	BONE	N	1X500	M00010	BONE * UNKNOWN MORPHOLOGY
BRN	BRAIN	N	X2000	M00010	BRAIN * UNKNOWN MORPHOLOGY
BSC	BLOODY ASCITES	N	Y4500	M36330	PERITONEAL CAVITY * SEROSANGUINOUS EFFUSION
CAE	C(A)ECUM	N	67100	M00010	CECUM * UNKNOWN MORPHOLOGY
CAL	CALCIFICATION	N	00003	M55400	- NOT ASSIGNED - * CALCIFICATION
CAT	CATARACT	N	XX700	M51100	LENS * CATARACT
CDU	CAUSE OF DEATH UNKNOWN	N	00010	FY3500	TOTAL BODY * UNDETERMINED MANNER OF DEATH
CGL	COWPER'S GLAND	N	75170	M00010	COWPER'S GLAND * UNKNOWN MORPHOLOGY
CHO	CHOLECYSTITIS	N	57000	M40000	GALL BLADDER * INFLAMMATION
CIR	CIRRHOSIS	N	56000	M49500	LIVER * CIRRHOSIS
CLI	CALCULI (URINARY BLADDER)	N	74000	M30000	URINARY BLADDER * CALCULUS
CLR	CLEAR HTX OR ASC	N	00003	M36300	- NOT ASSIGNED - * EFFUSION
CNS	CENTRAL NERVOUS SYSTEM	N	X0090	M00010	CENTRAL NERVOUS SYS. * UNKNOWN MORPHOLOGY
COL	COLON	N	67000	M00010	COLON * UNKNOWN MORPHOLOGY
CRD	CHRONIC RENAL DISEASE	N	71000	M43000	KIDNEY * CHRONIC INFLAMMATION
CYS	CYST	N	00003	M33400	- NOT ASSIGNED - * CYST
DER	DERMATITIS	N	01000	M40000	SKIN * INFLAMMATION
DHY	DEHYDRATION	N	00010	F01790	TOTAL BODY * DEHYDRATION
DIV	DIVERTICULUM (GI)	N	50100	M32700	GI TRACT * DIVERTICULUM
DUO	DUODENUM	N	64300	M00010	DUODENUM * UNKNOWN MORPHOLOGY
EDA	EDEMA	N	00010	M36500	TOTAL BODY * EDEMA
EMB	EMBOLUS	N	30000	M35300	CARDIOVASC. SYSTEM * EMBOLUS (THROMBOEMBOLUS)
EMP	EMPHYSEMA	N	28000	M32800	LUNG * EMPHYSEMA
ENT	ENTERITIS	N	50500	M40000	INTESTINE * INFLAMMATION
EPL	EPILATION	N	01000	M58600	SKIN * ALOPECIA
ESO	ESOPHAGUS	N	62000	M00010	ESOPHAGUS * UNKNOWN MORPHOLOGY
FIT	FIGHTING	N	00010	FY3710	TOTAL BODY * VICT.OF PHYS.TRAUMA
GBL	GALL BLADDER	N	57000	M00010	GALL BLADDER * UNKNOWN MORPHOLOGY
GEN	EXTERNAL GENITALIA	N	70210	M00010	EXTERNAL GENITALIA * UNKNOWN MORPHOLOGY
GON	GONAD	N	70205	M00010	GONAD * UNKNOWN MORPHOLOGY
GRY	GRAYNESS	N	00010	M57140	TOTAL BODY * HAIR GRAYNESS
HEM	HEMATOMA	N	00003	M37100	- NOT ASSIGNED - * HEMATOMA

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JANUS Code	JANUS Description	PS N	Topography	Morphology	SNOMED Description
HEP	HEPATITIS	N	56000	M41000	LIVER * ACUTE INFLAMMATION
HGL	HARDERIAN GLAND	N	XX836	M00010	HARDERIAN GLAND * UNKNOWN MORPHOLOGY
HNP	HYDRONEPHROSIS	N	72000	M33300	PELVIS OF KIDNEY * FLUID RETENTION
HRG	HEMORRHAGE	N	00003	M37000	- NOT ASSIGNED - * HEMORRHAGE
HRT	HEART	N	32000	M00010	HEART * UNKNOWN MORPHOLOGY
HTX	HYDROTHORAX	N	Y2200	M33300	THORACIC CAVITY * FLUID RETENTION
ILE	ILEUM	N	65200	M00010	ILEUM * UNKNOWN MORPHOLOGY
INF	INFLAMMATION	N	00003	M40000	- NOT ASSIGNED - * INFLAMMATION
INT	INTUSSUSCEPTION	N	50500	M31130	INTESTINE * INTUSSUSCEPTION
ISO	ISOGRAFT	N	00003	M15600	- NOT ASSIGNED - * TRANSPLANTED TISSUE
JAU	JAUNDICE	N	00010	M57600	TOTAL BODY * JAUNDICE
JEJ	JEJUNUM	N	65100	M00010	JEJUNUM * UNKNOWN MORPHOLOGY
KID	KIDNEY	N	71000	M00010	KIDNEY * UNKNOWN MORPHOLOGY
LIV	LIVER	N	56000	M00010	LIVER * UNKNOWN MORPHOLOGY
LOB	LOBAR PNEUMONIA	N	28000	M40000	LUNG * INFLAMMATION
MAL	MALOCCLUSION	N	54010	F60430	TOOTH * MALOCCLUSION
MET	METRITIS	N	82000	M40000	UTERUS * INFLAMMATION
MGC	MEGACOLON	N	67000	M32220	COLON * HYPERDISTENTION
MGL	MAMMARY GLAND	N	04000	M00010	MAMMARY GLAND * UNKNOWN MORPHOLOGY
MIC	MISC - CIRCULATORY	N	30000	M00010	CARDIOVASC. SYSTEM * UNKNOWN MORPHOLOGY
MID	MISC - DIGESTIVE	N	50000	M00010	DIGESTIVE SYSTEM * UNKNOWN MORPHOLOGY
MIG	MISC - URO-GENITAL	N	70000	M00010	GENITO-URINARY SYST. * UNKNOWN MORPHOLOGY
MIL	MISC - LUNG	N	28000	M00010	LUNG * UNKNOWN MORPHOLOGY
MIR	MISC - RENAL (URINARY TRACT)	N	70100	M00010	URINARY TRACT * UNKNOWN MORPHOLOGY
MIS	OTHERS - GENERAL	N	00003	M00010	- NOT ASSIGNED - * UNKNOWN MORPHOLOGY
MKY	MILKY	N	00003	M36340	- NOT ASSIGNED - * CHYLOUS EFFUSION (MILKY)
MSC	MILKY ASCITES	N	Y4500	M36340	PERITONEAL CAVITY * CHYLOUS EFFUSION (MILKY)
MYO	MYOCARDIUM	N	33010	M00010	MYOCARDIUM * UNKNOWN MORPHOLOGY
NEC	NECROSIS	N	00003	M54000	- NOT ASSIGNED - * NECROSIS
OBE	OBESE	N	00010	M71800	TOTAL BODY * OBESITY
OBS	OBSTRUCTION	N	00003	M34000	- NOT ASSIGNED - * OBSTRUCTION
OVE	OVARY	N	87000	M00010	OVARY * UNKNOWN MORPHOLOGY
PAN	PANCREATITIS	N	59000	M40000	PANCREAS * INFLAMMATION
PAR	PARALYSIS	N	00003	F80840	- NOT ASSIGNED - * PARALYSIS
PCD	PERICARDIUM	N	31000	M00010	PERICARDIUM * UNKNOWN MORPHOLOGY
PCK	POLYCYSTIC KIDNEY	N	71000	M26730	KIDNEY * POLYCYSTIC KIDNEY DISEASE, ADULT TYPE
PEN	PENIS	N	76000	M00010	PENIS * UNKNOWN MORPHOLOGY
PER	PERITONITIS	N	Y4400	M40000	PERITONEUM * INFLAMMATION
PGL	PREPUTIAL GLAND	N	76350	M00010	PREPUTIAL GLAND * UNKNOWN MORPHOLOGY
PIT	PITUITARY	N	91000	M00010	PITUITARY * UNKNOWN MORPHOLOGY
PNC	PNEUMONITIS	N	28000	M36100	LUNG * CONGESTION
PNU	PNEUMONIA	N	28000	M40000	LUNG * INFLAMMATION
PRF	PERFORATION	N	00003	M39800	- NOT ASSIGNED - * PERFORATION

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JANUS Code	JANUS Description	PSN	Topography	Morphology	SNOMED Description
PRO	PROLAPSE	N	00003	M31050	- NOT ASSIGNED - * PROLAPSE
PST	PROSTATE	N	77100	M00010	PROSTATE * UNKNOWN MORPHOLOGY
SEM	SEMINAL VESICLE	N	77500	M00010	SEMINAL VESICLE * UNKNOWN MORPHOLOGY
SGL	SALIVARY GLAND	N	55000	M00010	SALIVARY GLAND * UNKNOWN MORPHOLOGY
SPL	SPLEEN	N	07000	M00010	SPLEEN * UNKNOWN MORPHOLOGY
STO	STOMACH	N	63000	M00010	STOMACH * UNKNOWN MORPHOLOGY
TEP	TESTIS & EPIDIDYMIS	N	78910	M00010	TESTIS & EPIDIDYMIS * UNKNOWN MORPHOLOGY
TGE	TONGUE	N	53000	M00010	TONGUE * UNKNOWN MORPHOLOGY
THR	THROMBUS	N	30000	M35100	CARDIOVASC. SYSTEM * THROMBUS
TRD	THYROID	N	96000	M00010	THYROID * UNKNOWN MORPHOLOGY
TWI	TWISTER	N	00010	DX580	TOTAL BODY * VESTIBULAR DISEASE OR SYNDROME
TYP	TYPHILITIS	N	67100	M41000	CECUM * ACUTE INFLAMMATION
ULC	ULCER	N	00003	M38000	- NOT ASSIGNED - * ULCERATION
UTE	UTERUS	N	82000	M00010	UTERUS * UNKNOWN MORPHOLOGY
VAG	VAGINA	N	81000	M00010	VAGINA * UNKNOWN MORPHOLOGY
VOL	VOLVULUS	N	50500	M34220	INTESTINE * VOLVULUS
NTYG	NON-THYMIC LYMPHOMA - GENERALIZED	P	00020	MYY933	MULT. TOPOG. SITES * MALIGNANT LYMPHOMA - B CELL TYPE
NTYL	NON-THYMIC LYMPHOMA - LOCALIZED	P	00003	MYY933	- NOT ASSIGNED - * MALIGNANT LYMPHOMA - B CELL TYPE
TADN	LUNG	P	28000	M80001	LUNG * NEOPLASM
TADP	ADIPOSE	P	1X010	M80001	ADIPOSE TISSUE * NEOPLASM
TADR	ADRENAL	P	93000	M80001	ADRENAL GLAND * NEOPLASM
TBLA	BLADDER (URINARY)	P	74000	M80001	URINARY BLADDER * NEOPLASM
TBON	BONE	P	1X500	M80001	BONE * NEOPLASM
TBRN	BRAIN	P	X2000	M80001	BRAIN * NEOPLASM
TCEC	CAECUM	P	67100	M80001	CECUM * NEOPLASM
TCGL	COWPER'S GLAND	P	75170	M80001	COWPER'S GLAND * NEOPLASM
TCNS	CENTRAL NERVOUS SYSTEM	P	X0090	M80001	CENTRAL NERVOUS SYS. * NEOPLASM
TCOL	COLON	P	67000	M80001	COLON * NEOPLASM
TCON	CONNECTIVE TISSUE	P	1X200	M80001	CONNECTIVE TISSUE * NEOPLASM
TDUO	DUODENUM	P	64300	M80001	DUODENUM * NEOPLASM
TEPI	EPIDIDYMIS	P	79100	M80001	EPIDIDYMIS * NEOPLASM
TESO	ESOPHAGUS	P	62000	M80001	ESOPHAGUS * NEOPLASM
TGBL	GALL BLADDER	P	57000	M80001	GALL BLADDER * NEOPLASM
THGL	HARDERIAN GLAND	P	XX836	M80001	HARDERIAN GLAND * NEOPLASM
THIB	HIBERNATING GLAND	P	1X040	M80001	BROWN FAT * NEOPLASM
THRT	HEART	P	32000	M80001	HEART * NEOPLASM
TILE	ILEUM	P	65200	M80001	ILEUM * NEOPLASM
TISO	ISOGRAFT (SPLEEN)	P	07000	M80001	SPLEEN * NEOPLASM
TJEJ	JEJUNUM	P	65100	M80001	JEJUNUM * NEOPLASM
TKID	KIDNEY	P	71000	M80001	KIDNEY * NEOPLASM
TLIV	LIVER	P	56000	M80001	LIVER * NEOPLASM
TMGL	MAMMARY GLAND	P	04000	M80001	MAMMARY GLAND * NEOPLASM
TMIC	MISC. CONNECTIVE TISSUE	P	1X005	M80001	SOFT TISSUE & CONN. * NEOPLASM

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JANUS Code	JANUS Description	P S N	Topography	Morphology	SNOMED Description
TMID	MISC. DIGESTIVE SYSTEM	P	50000	M80001	DIGESTIVE SYSTEM * NEOPLASM
TMIE	MISC. ENDOCRINE	P	90000	M80001	ENDOCRINE SYSTEM * NEOPLASM
TMIG	MISC. GLANDULAR	P	00003	M80001	- NOT ASSIGNED - * NEOPLASM
TMIL	MISC. LUNG (RESPIRATORY SYSTEM)	P	20000	M80001	RESPIRATORY TRACT * NEOPLASM
TMIN	MISC. NERVOUS SYSTEM	P	X0000	M80001	NERVOUS SYSTEM * NEOPLASM
TMIR	MISC. RETICULAR SYSTEM	P	1X250	M80001	RETICULAR TISSUE * NEOPLASM
TMIS	MISC. MISC.	P	00003	M80001	- NOT ASSIGNED - * NEOPLASM
TMUG	MISC. URO-GENITAL	P	70000	M80001	GENITO-URINARY SYST. * NEOPLASM
TMUS	MUSCLE	P	13001	M80001	MUSCLE * NEOPLASM
TOVE	OVARY	P	87000	M80001	OVARY * NEOPLASM
TPAN	PANCREAS	P	59000	M80001	PANCREAS * NEOPLASM
TPIT	PITUITARY	P	91000	M80001	PITUITARY * NEOPLASM
TPNS	PERIPHERAL NERVOUS SYSTEM	P	X0100	M80001	PERIPH. NERVOUS SYS. * NEOPLASM
TPPT	PREPUTIAL GLAND	P	76350	M80001	PREPUTIAL GLAND * NEOPLASM
TPST	PROSTATE	P	77100	M80001	PROSTATE * NEOPLASM
TPYL	PYLORUS	P	63700	M80001	GASTRIC PYLORUS * NEOPLASM
TSEC	SECONDARY	S	00003	M80006	- NOT ASSIGNED - * METASTATIC TUMOR
TSGL	SALIVARY GLAND	P	55000	M80001	SALIVARY GLAND * NEOPLASM
TSKN	SKIN	P	01000	M80001	SKIN * NEOPLASM
TSMV	SEMINAL VESICLE	P	77500	M80001	SEMINAL VESICLE * NEOPLASM
TSPL	SPLEEN	P	07000	M80001	SPLEEN * NEOPLASM
TSTO	STOMACH	P	63000	M80001	STOMACH * NEOPLASM
TTGE	TONGUE	P	53000	M80001	TONGUE * NEOPLASM
TTRD	THYROID	P	96000	M80001	THYROID * NEOPLASM
TTST	TESTIS	P	78000	M80001	TESTIS * NEOPLASM
TTYG	THYMIC LYMPHOMA - GENERALIZED	P	00020	MYY953	MULT. TOPOG. SITES * MALIGNANT LYMPHOMA - T CELL TYPE
TTYL	THYMIC LYMPHOMA - LOCALIZED	P	00003	MYY953	- NOT ASSIGNED - * MALIGNANT LYMPHOMA - T CELL TYPE
TUTE	UTERUS	P	82000	M80001	UTERUS * NEOPLASM
TVAG	VAGINA	P	81000	M80001	VAGINA * NEOPLASM
TVAS	VASCULAR	P	40000	M80001	BLOOD VESSEL * NEOPLASM

159 rows selected.

APPENDIX F:

PROCEDURE FOR COLLECTION OF TISSUES FOR HISTOPATHOLOGY

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PROCEDURE FOR COLLECTION OF TISSUES FOR HISTOPATHOLOGY

1. Necropsies are to be performed as outlined in Appendix D.

   a. When a mouse is partially cannibalized, the remaining tissues should be taken as defined below.

   b. When autolysis is borderline, tissues should be taken.

2. The following tissues are to be collected for histopathologic processing.

   a. Lung: The entire lung should be taken with bronchus for fixation. If this is not possible, tumor(s) or lesions that appear grossly different from each other should be taken with adjacent uninvolved lung. When a primary typical lung tumor is the apparent cause of death and no other tumor(s) or gross lesions are found, no tissue should be saved from the mouse.

   b. Liver: If no tumors or lesions are present, the median lobe with the gallbladder should be taken. Tumor(s) or gross lesions are to be collected with a sample of adjacent uninvolved liver.

   c. Spleen: The entire spleen should be taken if possible. If not, tumor(s) that appear grossly different are to be taken with adjacent uninvolved spleen.

   d. Kidney: One kidney with attached adrenal gland is to be taken routinely when no lesions are grossly apparent. When one kidney is abnormal, except in the case of hydronephrosis, then both should be taken. Tumor(s) or lesions that appear grossly different are to be collected with adjacent normal tissue.

   e. Heart: The entire heart is to be fixed separated from the lungs.

   f. When the diagnosis is a generalized or localized lymphoma, the cervical nodes should be taken with the salivary gland, the pararenal node should be taken with the kidney, the parathymic nodes and thymus with the heart, and the mesenteric node with a piece of gut. Only one peripheral node need be collected. Other nodes should be taken only when involved with a different tumor or lesion. If the mouse is partially autolyzed, the freshest node is to be taken.

3. In addition to the above standard organs, other tissues are to be collected when any gross lesions (i.e., tumors, degenerative or inflammatory processes) are present. The

following organs and organ systems are examples of such other tissues and are to be examined and sampled:

- Mammary gland
- Harderian gland with eye
- Gut
- Ovaries or testes
- Brain and pituitary
- Any tissue or organ suspected of having a vascular tumor
- Bone

While other tissues that appear normal may have relevance in the cause of death, the practical problem of completing the tissue processing makes it imperative to limit the numbers of specimens collected. For example, without a terminal radiograph, the incidence of bone tumors cannot be determined; therefore, the number of bone tumors observed during necropsy is not conclusive. Other rare sites for tumors and lesions should not be collected unless, in the opinion of the prosector, the additional tissues will define the cause or contributing factors of death and not just add incidental or coincidental data on tumors.

APPENDIX G:

HISTOLOGY PROCEDURE

APPENDIX G:

HISTOLOGY PROCEDURE

1. Tissues are fixed in 70% AFA (20 parts 70% ethanol, 2 parts neutral formaldehyde [37–40%], 1 part glacial acetic acid).

2. The tissues are processed in the following manner.

   The tissue is trimmed to a 2- to 5-mm thickness to present a face to be studied. The trimming is done by using the necropsy report as a guide. The trimmed tissues are grouped into tissue cassettes according to how they will be blocked for cutting. The cassettes are kept in 70% ethanol until processed. Processing is done in an Autotechnicon by dehydration through a series of increasing grades of ethanol and cleared in isoamyl acetate. After clearing, the tissues are put through several changes of paraffin-embedding medium (melting point, 56–58 °C).

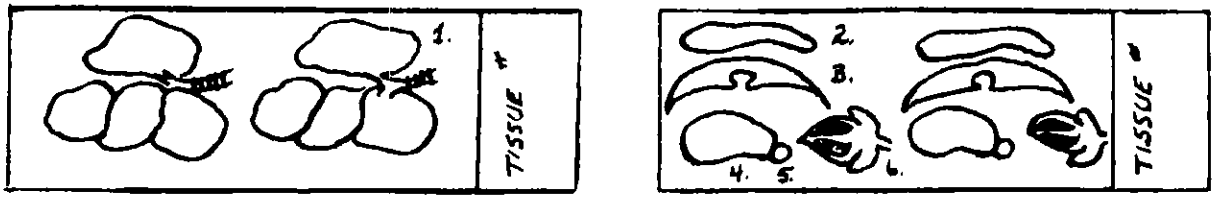
   The tissues are completely infiltrated with fresh paraffin in a vacuum oven. The tissues are embedded in paraffin in the arrangement for the slide. (See the slide chart, Fig. G.1, for one possible positioning. Any additional tissues are mounted on other slides.)

3. Sections are to be cut to a thickness of 4–5 μm, mounted on slides, and dried.

4. An automatic stainer (Gam Rad) is used to stain with hematoxylin-eosin.

5. The stained slides are coverslipped, dried, boxed, and sent with the necropsy sheets to the pathologist.

6. When the diagnosis is completed, the slides are returned for filing, and the necropsy report is returned for MICRO data entry.



Legend: 1) lung, 2) spleen, 3) liver, 4) kidney, 5) adrenal gland, 6) heart

FIGURE G.1 Slide Chart of Standard Tissues Taken

APPENDIX H:

JANUS MICRO DICTIONARY

JANUS MICRO DICTIONARY - SNOMED/SNOVET CONVERT Ordered by MOUSCODE July 11, 1994 bjw

JANUS Code	JANUS Description	PSN	Topog. Site.	Morph.	Topog.	Met.	Origin	SNOMED Description	Metastatic Origin
DH1	EYE MISSING	N	XX000	FY4480				EYE * MISSING BODY PARTS	
DH2	2 EYES MISSING	N	XX180	FY4480				EYES * MISSING BODY PARTS	
DHE	HEAD, NECK MISSING	N	Y0000	FY4480				HEAD AND NECK * MISSING BODY PARTS	
DHG	HARDERIAN GLAND MISSING	N	XX836	FY4480				HARDERIAN GLAND * MISSING BODY PARTS	
DLU	LUNG MISSING	N	28000	FY4480				LUNG * MISSING BODY PARTS	
DMG	MAMMARY GLAND (TUMOR) MISSING	N	04000	FY4480				MAMMARY GLAND * MISSING BODY PARTS	
DTR	TRUNK MISSING	N	Y1000	FY4480				TRUNK * MISSING BODY PARTS	
DTS	THYMUS MISSING	N	98000	FY4480				THYMUS * MISSING BODY PARTS	
DTX	THORAX MISSING	N	Y2100	FY4480				THORAX * MISSING BODY PARTS	
MABA	CEROID OR BROWN ATROPHY OF ADRENAL	N	93100	M58000				ADRENAL CORTEX * ATROPHY	
MACN	COAGULATION NECROSIS ADRENAL; (ZONE) SITE SPEC. IN COMM.	N	93000	M54060				ADRENAL GLAND * COAGULATIVE NECROSIS	
MADM	MESENTERIC LN, OR MESENTERIC DISEASE	N	08510	D0802				MESENTERIC L. NODE * ACUTE MESENTERIC LYMPHADENITIS	
MADS	SUBMAXILLARY (CERVICAL) ADENITIS	N	08190	M40000				SUBMAXILLARY L. NODE * INFLAMMATION	
MATA	AMYLOIDOSIS, ONE OR MORE ORGANS INVOLVED	N	00020	M55100				MULT. TOPOG. SITES * AMYLOIDOSIS	
MAZG	METAPLASIA ZONA GLOMERULOSA ADRENAL	N	93110	M73000				ADR.GL,ZONA GLOMER. * METAPLASIA	
MAZX	FIBROSIS OF RETICULAR ZONE ('X-ZONE') ADRENAL CORTEX	N	93100	M49000				ADRENAL CORTEX * FIBROSIS	
MBMZ	APLASTIC BONE MARROW (ATROPHIC)	N	06000	M75400				BONE MARROW * APLASIA	
MCDU	CAUSE OF DEATH UNDETERMINED	N	00010	FY3500				TOTAL BODY * UNDETERMINED MANNER OF DEATH	
MCIG	SEPTICEMIA GENERAL CONDITION	N	00010	D00800				TOTAL BODY * SEPTICEMIA	
MCLC	COLITIS, CHRONIC	N	67000	M43000				COLON * CHRONIC INFLAMMATION	
MCMZ	PARASITE, METAZOAN; COLON	N	67000	E4302				COLON * METAZOAN PARASITE	
MCRD	CHRONIC RENAL DISEASE	N	71000	M43000				KIDNEY * CHRONIC INFLAMMATION	
MECA	ACUTE ENDOCARDITIS	N	34000	M41000				ENDOCARDIUM * ACUTE INFLAMMATION	
MECC	CHRONIC ENDOCARDITIS (VALVULAR)	N	34000	M43000				ENDOCARDIUM * CHRONIC INFLAMMATION	
MEIC	OESOPHAGITIS, CHRONIC	N	62000	M43000				ESOPHAGUS * CHRONIC INFLAMMATION	
MGAA	ACUTE INFLAMMATION, HARDERIAN GLAND	N	XX836	M41000				HARDERIAN GLAND * ACUTE INFLAMMATION	
MGAC	CHRONIC INFLAMMATION, HARDERIAN GLAND	N	XX836	M43000				HARDERIAN GLAND * CHRONIC INFLAMMATION	
MGGF	FIBROSIS, HARDERIAN GLAND	N	XX836	M49000				HARDERIAN GLAND * FIBROSIS	
MHCN	HEPATITIS, COAGULATIVE - FOCAL	N	56000	M40060				LIVER * COAGULATIVE INFLAMMATION	
MHCY	HEPATIC CYST	N	56000	M33400				LIVER * CYST	
MHUD	HEPATIC, HYDROPIC DEGENERATION	N	56000	M50070				LIVER * HYDROPIC DEGENERATION	
MHIA	HEPATITIS, ACUTE	N	56000	M41000				LIVER * ACUTE INFLAMMATION	
MHIC	HEPATITIS, CHRONIC	N	56000	M43000				LIVER * CHRONIC INFLAMMATION	
MHIT	HEPATITIS, TOXIC	N	56000	M40050				LIVER * TOXIC INFLAMMATION	
MHLD	FATTY METAMORPHOSIS-FATTY CHANGES LIVER (LIPIDOSIS)	N	56000	M50080				LIVER * FATTY CHANGE	

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JANUS Code	JANUS Description	P S M	Topog.	Morph.	Topog.	Morph.	SNOMED Description	Metastatic Origin
MICY	CYST INTESTINE; SITE SPECIFIED IN COMMENT	M	50500	M33400			INTESTINE * CYST	
MIFC	FATTY CHANGE INTESTINE; SITE SPECIFIED IN COMMENT	M	50500	M50080			INTESTINE * FATTY CHANGE	
MIIA	ENTERITIS, ACUTE; SITE SPECIFIED IN COMMENT	M	50500	M41000			INTESTINE * ACUTE INFLAMMATION	
MIIC	ENTERITIS, CHRONIC; SITE SPECIFIED IN COMMENT	M	50500	M43000			INTESTINE * CHRONIC INFLAMMATION	
MINA	INTERSTITIAL NEPHRITIS, ACUTE	M	71040	M41000			INTERST.TISS.OF KIDN * ACUTE INFLAMMATION	
MINC	INTERSTITIAL NEPHRITIS, CHRONIC	M	71040	M43000			INTERST.TISS.OF KIDN * CHRONIC INFLAMMATION	
MMCA	ACUTE MYOCARDITIS	M	33010	M41000			MYOCARDIUM * ACUTE INFLAMMATION	
MMCC	CHRONIC MYOCARDITIS	M	33010	M43000			MYOCARDIUM * CHRONIC INFLAMMATION	
MMCH	UTERINE CYSTIC HYPERPLASIA	M	82000	M72060			UTERUS * CYSTIC HYPERPLASIA	
MMDE	MAMMARY DUCTAL ECTASIA (GALACTOCOELE)	M	04000	M32100			MAMMARY GLAND * DILATATION	
MMEI	VESTIBULAR DISEASE; MIDDLE EAR INFECTION, ACUTE	M	XY300	DX580			MIDDLE EAR * VESTIBULAR DISEASE OR SYNDROME	
MMMA	ACUTE INFLAMMATION (MASTITIS) MAMMARY GLAND	M	04000	M41000			MAMMARY GLAND * ACUTE INFLAMMATION	
MMMC	CHRONIC INFLAMMATION (INCLUDING SUBACUTE) MAMMARY GLAND	M	04000	M43000			MAMMARY GLAND * CHRONIC INFLAMMATION	
MMTA	METRITIS, ACUTE	M	82000	M41000			UTERUS * ACUTE INFLAMMATION	
MMTC	METRITIS, CHRONIC	M	82000	M43000			UTERUS * CHRONIC INFLAMMATION	
MNIA	INFECTION, ACUTE; NERVOUS SYSTEM; SITE SPECIFIED IN COMMENT	M	X0000	M41000			NERVOUS SYSTEM * ACUTE INFLAMMATION	
MOAT	OVARIAN OR TESTICULAR ATROPHY (GONAD)	M	70205	M58000			GONAD * ATROPHY	
MOCY	OVARY OR TESTIS CYSTIC (GONAD)	M	70205	M33400			GONAD * CYST	
MOIA	ACUTE INFECTION; OVARY OR TESTIS (GONAD)	M	70205	M41000			GONAD * ACUTE INFLAMMATION	
MPAN	PAN / POLYARTERITIS NODOSA	M	40000	D7321			BLOOD VESSEL * POLYARTERITIS NODOSA	
MPCA	ACUTE PERICARDITIS	M	31000	M41000			PERICARDIUM * ACUTE INFLAMMATION	
MPCC	CHRONIC PERICARDITIS	M	31000	M43000			PERICARDIUM * CHRONIC INFLAMMATION	
MPNA	PANCREATITIS, ACUTE	M	59000	M41000			PANCREAS * ACUTE INFLAMMATION	
MPNC	LUNG CONGESTION	M	28000	M36100			LUNG * CONGESTION	
MPNE	PYELONEPHRITIS, ACUTE	M	71000	M41000			KIDNEY * ACUTE INFLAMMATION	
MPNI	PNEUMONITIS (INTERSTITIAL - ACUTE / CHRONIC)	M	28000	M40000			LUNG * INFLAMMATION	

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JANUS Code	JANUS Description	P S N	Topog.	SMorph.	TopogMod.	Origin	SNOMED Description	Metastatic Origin
MPNP	PYONEPHRITIS (PYELONEPHRITIS)	N	71000	M41400			KIDNEY * SUPPURATIVE INFLAMMATION	
MPNU	PNEUMONIA, ACUTE AND SUBACUTE	N	20000	M41000			RESPIRATORY TRACT * ACUTE INFLAMMATION	
MPRA	PROSTATITIS, ACUTE	N	77100	M41000			PROSTATE * ACUTE INFLAMMATION	
MPRH	PROSTATIC HYPERPLASIA	N	77100	M72000			PROSTATE * HYPERPLASIA	
MPRS	STASIS PROSTATE	N	77100	M33000			PROSTATE * STASIS	
MPTH	HYPERPLASIA OF PARATHYROID GLAND (HYPERTROPHY)	N	97800	M72000			PARATHYROID GLAND * HYPERPLASIA	
MRMP	MURINE PNEUMONIA	N	20000	D03442			RESPIRATORY TRACT * MURINE PNEUMONIA	
MROD	RENAL OSTEODYSTROPHY	N	1X500	D6561			BONE * RENAL OSTEODYSTROPHY	
MRPU	PLEURITIS, LOCAL OR GENERALIZED	N	29000	M40000			PLEURA * INFLAMMATION	
MSAA	SIALADENITIS, ACUTE	N	55000	M41000			SALIVARY GLAND * ACUTE INFLAMMATION	
MSAC	SIALADENITIS, CHRONIC	N	55000	M43000			SALIVARY GLAND * CHRONIC INFLAMMATION	
MSCN	COAGULATION NECROSIS SPLEEN	N	07000	M54060			SPLEEN * COAGULATIVE NECROSIS	
MSDA	DERMATITIS, ACUTE	N	01000	M41000			SKIN * ACUTE INFLAMMATION	
MSDC	DERMATITIS, CHRONIC	N	01000	M43000			SKIN * CHRONIC INFLAMMATION	
MSGF	FIBROSIS SALIVARY GLAND	N	55000	M49000			SALIVARY GLAND * FIBROSIS	
MSKA	ACANTHOSIS; SKIN	N	01000	M72710			SKIN * ACANTHOSIS	
MSLC	LYMPHOID HYPERPLASIA SPLEEN	N	07000	M72200			SPLEEN * LYMPHOID HYPERPLASIA	
MSPZ	APLASTIC SPLEEN (ATROPHIC)	N	07000	M75400			SPLEEN * APLASIA	
MSTA	THYROIDITIS, ACUTE	N	96000	M41000			THYROID * ACUTE INFLAMMATION	
MSTH	HYPERPLASIA THYROID	N	96000	M72000			THYROID * HYPERPLASIA	
MSVA	SEMINAL VESICLE, ACUTE INFLAMMATION	N	77500	M41000			SEMINAL VESICLE * ACUTE INFLAMMATION	
MSVH	SEMINAL VESICLE HYPERPLASIA	N	77500	M72000			SEMINAL VESICLE * HYPERPLASIA	
MSVS	STASIS SEMINAL VESICLE	N	77500	M33000			SEMINAL VESICLE * STASIS	
MTHR	THROMBOSIS, AURICULAR	N	32000	M35100			HEART * THROMBUS	
MUCA	CYSTITIS, ACUTE	N	74000	M41000			URINARY BLADDER * ACUTE INFLAMMATION	
MUCC	CYSTITIS, CHRONIC	N	74000	M43000			URINARY BLADDER * CHRONIC INFLAMMATION	
MURA	URETERITIS, ACUTE	N	73000	M41000			URETER * ACUTE INFLAMMATION	
MURC	URETERITIS, CHRONIC	N	73000	M43000			URETER * CHRONIC INFLAMMATION	
MURH	URETERAL EPITHELIAL HYPERPLASIA	N	73000	M72000			URETER * HYPERPLASIA	
MXWI	PERITONITIS, LOCAL OR GENERALIZED	N	Y4400	M40000			PERITONEUM * INFLAMMATION	
TACC	CORTICAL CARCINOMA ADRENAL	P	93100	M80103			ADRENAL CORTEX * CARCINOMA	
TACO	CORTICAL ADENOMA ADRENAL CORTEX	P	93100	M81400			ADRENAL CORTEX * ADENOMA	
TANS	MEDULLARY NEUROBLASTOMA (GANGLIONEUROMA) ADRENAL	P	93200	M95003			ADRENAL MEDULLA * NEUROBLASTOMA	

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JANUS Code	JANUS Description	PSN	Topog.	Morph.	Topog.	SNOMED Description	Metastatic Origin
TAPS	MEDULLARY PHEOCHROMOCYTOMA ADRENAL	P	93200	M87000		ADRENAL MEDULLA * PHEOCHROMOCYTOMA	
TAUO	TUMOR(UNDETERMINED CELL TYPE) ADRENAL	P	93000	M80001		ADRENAL GLAND * NEOPLASM	
TAVO	VASCULAR TUMOR ADRENAL (HEMANGIOMA)	P	93000	M91200		ADRENAL GLAND * HEMANGIOMA	
TAWI	GI TRACT ORIGIN IN COMMENT; MET. TO ADRENAL	S	93000		50100	ADRENAL GLAND *	GI TRACT
TAWK	KIDNEY ORIGIN; MET. TO ADRENAL	S	93000		71000	ADRENAL GLAND *	KIDNEY
TAWM	MUSCLE ORIGIN IN COMMENT; MET. TO ADRENAL	S	93000		13001	ADRENAL GLAND *	MUSCLE
TAWO	OVARY ORIGIN; MET. TO ADRENAL	S	93000		87000	ADRENAL GLAND *	OVARY
TAWR	RESPIRATORY SYSTEM ORIGIN; MET. TO ADRENAL	S	93000		20000	ADRENAL GLAND *	RESPIRATORY TRACT
TAWS	SKIN ORIGIN IN COMMENT; MET. TO ADRENAL	S	93000		01000	ADRENAL GLAND *	SKIN
TAWU	UTERUS ORIGIN; MET. TO ADRENAL	S	93000		82000	ADRENAL GLAND *	UTERUS
TAWZ	THYROID ORIGIN; MET. TO ADRENAL	S	93000		96000	ADRENAL GLAND *	THYROID
TBCS	CHONDROSARCOMA BONE SITE SPECIFIED IN COMMENT	P	1X500	M92203		BONE * CHONDROSARCOMA	
TBFS	FIBROSARCOMA BONE SITE SPECIFIED IN COMMENT	P	1X500	M88103		BONE * FIBROSARCOMA	
TBOO	OSTEOMA BONE SITE SPEC. IN COMMENT	P	1X500	M91800		BONE * OSTEOMA	
TBOS	OSTEOSARCOMA BONE SITE SPECIFIED IN COMMENT	P	1X500	M91803		BONE * OSTEOSARCOMA	
TBUS	ODONTOGENIC SARCOMA BONE SITE SPECIFIED IN COMMENT	P	1X500	M92703		BONE * ODONTOGENIC SARCOMA	
TBVO	STERNAL MARROW VASCULAR TUMOR (HEMANGIOMA)	P	06000	M91200		BONE MARROW * HEMANGIOMA	
TBVS	VASCULAR TUMOR (ANGIOSARCOMA) BONE SITE SPEC. IN COMMENT	P	1X500	M91203		BONE * ANGIOSARCOMA	
TBWG	HARDERIAN GLAND ORIGIN; BONE MET. SITE SPEC. IN COMMENT	S	1X500		XX836	BONE *	HARDERIAN GLAND
TBWM	MUSCLE ORIGIN IN COMMENT; BONE MET. SITE SPEC. IN COMMENT	S	1X500		13001	BONE *	MUSCLE
TBWN	NERVOUS SYSTEM ORIGIN IN COMMENT;BONE MET. SITE SPEC. IN COT	S	1X500		X0000	BONE *	NERVOUS SYSTEM

JANUS Code	JANUS Description	P S N	T o p o g .	S i t e	M o r p h .	T o p o g .	O M e t .	O r i g i n	SNOMED Description	Metastatic Origin
TBWR	RESPIRATORY SYSTEM ORIGIN; BONE MET. SITE SPEC. IN COMMENT	S	1X500			20000			BONE *	RESPIRATORY TRACT
TBWS	SKIN ORIGIN IN COMMENT; BONE MET. SITE SPEC. IN COMMENT	S	1X500			01000			BONE *	SKIN
TBWX	TISSUE OF ORIGIN IN COMMENT; BONE MET. SITE SPEC. IN COMM.	S	1X500			00003			BONE *	- NOT ASSIGNED -
TCFO	FIBROMA CONN. TISS. SITE SPEC. IN COMMENT	P	1X200		M88100				CONNECTIVE TISSUE * FIBROMA	
TCFS	FIBROSARCOMA CONN. TISS. SITE SPECIFIED IN COMMENT	P	1X200		M88103				CONNECTIVE TISSUE * FIBROSARCOMA	
TCMS	MAST CELL TUMOR CONNECTIVE TISSUE SITE SPECIFIED IN COMMENT	P	1X200		M97401				CONNECTIVE TISSUE * MASTOCYTOMA	
TCOO	OSTEOMA CONN. TISSUE SITE SPECIFIED IN COMMENT	P	1X200		M91800				CONNECTIVE TISSUE * OSTEOMA	
TCSS	UNDIFFERENTIATED CONNECTIVE TISSUE SARCOMA SITE SPEC. IN CO.	P	1X200		M88053				CONNECTIVE TISSUE * UNDIFFERENTIATED SARCOMA	
TCVO	HEMANGIOMA, BENIGN; CONN. TISS. SITE SPECIFIED IN COMMENT	P	1X200		M91200				CONNECTIVE TISSUE * HEMANGIOMA	
TCVS	HEMANGIOENDOTHELIOMA(ANGIOSARCOMA) MALIG CONN TISS SITE SPEC	P	1X200		M91203				CONNECTIVE TISSUE * ANGIOSARCOMA	
TCWA	ADRENAL ORIGIN; CONN. TISS. MET. SITE SPECIFIED IN COMMENT	S	1X200			93000			CONNECTIVE TISSUE *	ADRENAL GLAND
TCWB	BONE ORIGIN IN COMM.; CONN.TISS. MET. SITE SPEC. IN COMM.	S	1X200			1X500			CONNECTIVE TISSUE *	BONE
TCWD	URINARY BLADDER ORIGIN; CONN.TISS. MET. SITE SPEC. IN COMM.	S	1X200			74000			CONNECTIVE TISSUE *	URINARY BLADDER
TCWG	HARDERIAN GLAND ORIGIN; CONN. TISS. MET. SITE SPEC. IN COMMT	S	1X200			XX836			CONNECTIVE TISSUE *	HARDERIAN GLAND
TCWH	LIVER ORIGIN; CONN TISS. MET. SITE SPEC. IN COMMENT	S	1X200			56000			CONNECTIVE TISSUE *	LIVER

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JANUS Code	JANUS Description	PSN	Topog.	Morph.	Topog.	MeOtg	Origin	SNOMED Description	Metastatic Origin
TCWI	GI TRACT ORIGIN IN COMMENT; CONN.TISS. MET. SITE SPEC. IN C.	S	1X200		50100			CONNECTIVE TISSUE *	GI TRACT
TCWK	KIDNEY ORIGIN; CONN. TISS. MET. SITE SPEC. IN COMMENT	S	1X200		71000			CONNECTIVE TISSUE *	KIDNEY
TCWN	NERVOUS SYSTEM ORIGIN IN COMMENT; CONN.TISS. MET. SITE SPEC.	S	1X200		X0000			CONNECTIVE TISSUE *	NERVOUS SYSTEM
TCWO	OVARY ORIGIN; CONN. TISS. MET. SITE SPEC. IN COMMENT	S	1X200		87000			CONNECTIVE TISSUE *	OVARY
TCWP	PITUITARY ORIGIN; CONN.TISS. MET. SITE SPEC. IN COMMENT	S	1X200		91000			CONNECTIVE TISSUE *	PITUITARY
TCWR	RESPIRATORY SYSTEM ORIGIN; CONN. TISS. MET. SITE SPEC. IN CT	S	1X200		20000			CONNECTIVE TISSUE *	RESPIRATORY TRACT
TCWS	SKIN ORIGIN IN COMMENT; CONN. TISS. MET. SITE SPEC. IN COMM.	S	1X200		01000			CONNECTIVE TISSUE *	SKIN
TCWZ	THYROID ORIGIN; CONN. TISS. MET. SITE SPEC. IN COMMENT	S	1X200		96000			CONNECTIVE TISSUE *	THYROID
TDEC	SQUAMOUS CELL CARCINOMA URINARY BLADDER	P	74000	M80703				URINARY BLADDER * SQUAMOUS CARCINOMA	
TDFS	FIBROSARCOMA URINARY BLADDER	P	74000	M88103				URINARY BLADDER * FIBROSARCOMA	
TDLS	LEIOMYOSARCOMA URINARY BLADDER	P	74000	M88903				URINARY BLADDER * LEIOMYOSARCOMA	
TDTC	TRANSITIONAL CELL CARCINOMA URINARY BLADDER	P	74000	M81203				URINARY BLADDER * TRANSITIONAL CARCINOMA	
TDVO	VASCULAR TUMOR URINARY BLADDER (HEMANGIOMA)	P	74000	M91200				URINARY BLADDER * HEMANGIOMA	
TDVS	VASCULAR TUMOR, ANGIOSARCOMA URINARY BLADDER	P	74000	M91203				URINARY BLADDER * ANGIOSARCOMA	
TDWX	TISS. OF ORIGIN IN COMMENT; MET. TO URINARY BLADDER	S	74000		00003			URINARY BLADDER *	- NOT ASSIGNED -
TEFS	FIBROSARCOMA OF SPLEEN	P	07000	M88103				SPLEEN * FIBROSARCOMA	
TEVO	VASCULAR TUMOR OF SPLEEN, BENIGN (HEMANGIOMA)	P	07000	M91200				SPLEEN * HEMANGIOMA	

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JANUS Code	JANUS Description	PSN	Topog.	Morph.	TopogMod.	OrigSite	SNOMED Description	Metastatic Origin
TEVS	VASCULAR TUMOR OF SPLEEN, MALIGNANT(ANGIOSARCOMA)	P	07000	M91203			SPLEEN * ANGIOSARCOMA	
TEWB	BONE ORIGIN IN COMMENT; MET. TO SPLEEN	S	07000		1X500		SPLEEN *	BONE
TEWC	CONNECTIVE TISSUE ORIGIN IN COMMENT; MET. TO SPLEEN	S	07000		1X200		SPLEEN *	CONNECTIVE TISSUE
TEWD	URINARY BLADDER ORIGIN; MET. TO SPLEEN	S	07000		74000		SPLEEN *	URINARY BLADDER
TEWH	LIVER ORIGIN; MET. TO SPLEEN	S	07000		56000		SPLEEN *	LIVER
TEWK	KIDNEY ORIGIN; MET. TO SPLEEN	S	07000		71000		SPLEEN *	KIDNEY
TEWM	MUSCLE ORIGIN IN COMMENT; MET. TO SPLEEN	S	07000		13001		SPLEEN *	MUSCLE
TEWS	SKIN ORIGIN IN COMMENT; MET. TO SPLEEN	S	07000		01000		SPLEEN *	SKIN
TEWT	TESTIS ORIGIN; MET. TO SPLEEN	S	07000		78000		SPLEEN *	TESTIS
TEWU	UTERUS ORIGIN; MET. TO SPLEEN	S	07000		82000		SPLEEN *	UTERUS
TGAC	ADENOCARCINOMA HARDERIAN GLAND	P	XX836	M81403			HARDERIAN GLAND * ADENOCARCINOMA	
TGAO	PAPILLARY CYSTADENOMA HARDERIAN GLAND	P	XX836	M84500			HARDERIAN GLAND * PAP. CYSTADENOMA	
TGSC	UNDIFFERENTIATED TUMOR HARDERIAN GLAND	P	XX836	M80001			HARDERIAN GLAND * NEOPLASM	
TGWC	CONNECTIVE TISSUE ORIGIN IN COMMENT; MET. TO HARDERIAN GLAND	S	XX836		1X200		HARDERIAN GLAND *	CONNECTIVE TISSUE
TGWS	SKIN ORIGIN IN COMMENT; MET. TO HARDERIAN GLAND	S	XX836		01000		HARDERIAN GLAND *	SKIN
THAA	ADENOMA (HEPATOMA)	P	56000	M81700			LIVER * HEPATOMA-HEPATOC.ADEN.	
THAC	HEPATOCARCINOMA	P	56000	M81703			LIVER * HEPATOCELLULAR CARC.	
THAO	HYPERPLASTIC NODULE LIVER ('PRE'-NEOPLASTIC NODULE)	P	56000	M72030			LIVER * NODULAR HYPERPLASIA	
THCC	CHOLANGIOCARCINOMA LIVER	P	56000	M81603			LIVER * CHOLANGIOCARCINOMA (BILE DUCT CARCINOMA)	
THCO	CHOLANGIOMA (CHOLANGIOMATOSIS) LIVER	P	56000	M81600			LIVER * BILE DUCT ADENOMA	
THFO	FIBROMA LIVER	P	56000	M88100			LIVER * FIBROMA	
THVO	HEMANGIOMA LIVER	P	56000	M91200			LIVER * HEMANGIOMA	
THVS	HEMANGIOENDOTHELIOMA (ANGIOSARCOMA) LIVER	P	56000	M91203			LIVER * ANGIOSARCOMA	
THWA	ADRENAL ORIGIN; MET. TO LIVER	S	56000		93000		LIVER *	ADRENAL GLAND
THWB	BONE ORIGIN IN COMM.; MET. TO LIVER	S	56000		1X500		LIVER *	BONE
THWC	CONNECTIVE TISSUE ORIGIN IN COMMENT; MET. TO LIVER	S	56000		1X200		LIVER *	CONNECTIVE TISSUE
THWD	URINARY BLADDER ORIGIN; MET. TO LIVER	S	56000		74000		LIVER *	URINARY BLADDER
THWG	HARDERIAN GLAND ORIGIN; MET. TO LIVER	S	56000		XX836		LIVER *	HARDERIAN GLAND

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JANUS Code	JANUS Description	PSN	T Site	S Morph	T Topog	O M Morph.	SNOMED Description	Metastatic Origin
THWI	GI TRACT ORIGIN IN COMMENT; MET. TO LIVER	S	56000		50100		LIVER *	GI TRACT
THWK	KIDNEY ORIGIN; MET. TO LIVER	S	56000		71000		LIVER *	KIDNEY
THWM	MUSCLE ORIGIN IN COMMENT; MET. TO LIVER	S	56000		13001		LIVER *	MUSCLE
THWN	NERVOUS SYSTEM ORIGIN IN COMMENT; MET. TO LIVER	S	56000		X0000		LIVER *	NERVOUS SYSTEM
THWO	OVARY ORIGIN; MET. TO LIVER	S	56000		87000		LIVER *	OVARY
THWP	PITUITARY ORIGIN; MET. TO LIVER	S	56000		91000		LIVER *	PITUITARY
THWR	RESPIRATORY SYSTEM ORIGIN; MET. TO LIVER	S	56000		20000		LIVER *	RESPIRATORY TRACT
THWS	SKIN ORIGIN IN COMMENT; MET. TO LIVER	S	56000		01000		LIVER *	SKIN
THWU	UTERUS ORIGIN; MET. TO LIVER	S	56000		82000		LIVER *	UTERUS
THWV	SEMINAL VESICLE ORIGIN; MET. TO LIVER	S	56000		77500		LIVER *	SEMINAL VESICLE
THWX	TISSUE OF ORIGIN IN COMMENT; MET. TO LIVER	S	56000		00003		LIVER *	- NOT ASSIGNED -
THWY	HEART ORIGIN; MET TO LIVER	S	56000		32000		LIVER *	HEART
THWZ	THYROID ORIGIN; MET. TO LIVER	S	56000		96000		LIVER *	THYROID
TIAC	ADENOCARCINOMA GI TRACT; SITE SPECIFIED IN COMMENT	P	50100	M81403			GI TRACT * ADENOCARCINOMA	
TIAO	ADENOMA GI TRACT SITE SPEC. IN COMMENT	P	50100	M81400			GI TRACT * ADENOMA	
TIEC	SQUAMOUS CELL CARCINOMA GI TRACT; SITE SPECIFIED IN COMMENT	P	50100	M80703			GI TRACT * SQUAMOUS CARCINOMA	
TIFO	FIBROMA GI TRACT SITE SPEC. IN COMMENT	P	50100	M88100			GI TRACT * FIBROMA	
TIFS	FIBROSARCOMA GI TRACT SITE SPECIFIED IN COMMENT	P	50100	M88103			GI TRACT * FIBROSARCOMA	
TINO	NEURILEMMOMA GI TRACT SITE SPECIFIED IN COMMENT	P	50100	M95600			GI TRACT * SCHWANNOMA	
TIPL	PLAQUE (PYLORIC REGION; POLYP) GI TRACT	P	50100	M72040			GI TRACT * POLYPOID HYPERPLASIA	
TIPO	POLYPS GI TRACT SITE SPECIFIED IN COMMENT	P	50100	M76800			GI TRACT * POLYP	
TISC	UNDIFFERENTIATED CARCINOMA GI TRACT; SITE SPEC. IN COMMENT	P	50100	M80203			GI TRACT * UNDIFF. CARCINOMA	
TISO	LEIOMYOMA GI TRACT SITE SPECIFIED IN COMMENT	P	50100	M88900			GI TRACT * LEIOMYOMA	
TISS	LEIOMYOSARCOMA GI TRACT SITE SPEC. IN COMMENT	P	50100	M88903			GI TRACT * LEIOMYOSARCOMA	

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JANUS Code	JANUS Description	PSN	Topog.	Morph.	Topog.	SNOMED Description	Metastatic Origin
TIVO	HEMANGIOMA, BENIGN; GI TRACT SITE SPECIFIED IN COMMENT	P	50100	M91200		GI TRACT * HEMANGIOMA	
TIVS	HEMANGIOENDO.(ANGIOSARCOMA) MALIG. GI TRACT SITE SPEC IN COM	P	50100	M91203		GI TRACT * ANGIOSARCOMA	
TIWB	BONE ORIGIN IN COMM.; GI TRACT MET. SITE SPEC. IN COMMENT	S	50100		1X500	GI TRACT *	BONE
TIWM	MUSC OR MAMM GL ORIG IN COMMENT; GI TRACT MET. SITE SPEC INC	S	50100		00003	GI TRACT *	- NOT ASSIGNED -
TIWO	OVARY ORIGIN; GI TRACT MET. SITE SPEC. IN COMMENT	S	50100		87000	GI TRACT *	OVARY
TIWT	TESTIS ORIGIN; GI TRACT MET. SITE SPEC. IN COMMENT	S	50100		78000	GI TRACT *	TESTIS
TIWU	UTERUS ORIGIN; GI TRACT MET. SITE SPECIFIED IN COMMENT	S	50100		82000	GI TRACT *	UTERUS
TIWZ	THYROID ORIGIN; GI TRACT MET. SITE SPEC. IN COMMENT	S	50100		96000	GI TRACT *	THYROID
TKAA	RENAL ADENOMA	P	71000	M81400		KIDNEY * ADENOMA	
TKAC	RENAL TUBULAR TUMOR; ADENOCARCINOMA	P	71000	M81403		KIDNEY * ADENOCARCINOMA	
TKCA	CYSTADENOMA KIDNEY	P	71000	M84400		KIDNEY * CYSTADENOMA	
TKFS	FIBROSARCOMA KIDNEY	P	71000	M88103		KIDNEY * FIBROSARCOMA	
TKPA	RENAL PAPILLARY CYSTADENOMA	P	71000	M84500		KIDNEY * PAP. CYSTADENOMA	
TKTC	RENAL PELVIC TRANSITIONAL-CELL CARCINOMA	P	72000	M81203		PELVIS OF KIDNEY * TRANSITIONAL CARCINOMA	
TKVS	HEMANGIOENDOTHELIOMA (ANGIOSARCOMA) KIDNEY	P	71000	M91203		KIDNEY * ANGIOSARCOMA	
TKWA	ADRENAL ORIGIN; MET. TO KIDNEY	S	71000		93000	KIDNEY *	ADRENAL GLAND
TKWB	BONE ORIGIN IN COMM.; MET. TO KIDNEY	S	71000		1X500	KIDNEY *	BONE
TKWC	CONNECTIVE TISSUE ORIGIN IN COMMENT; MET. TO KIDNEY	S	71000		1X200	KIDNEY *	CONNECTIVE TISSUE
TKWG	HARDERIAN GLAND ORIGIN; MET. TO KIDNEY	S	71000		XX836	KIDNEY *	HARDERIAN GLAND
TKWH	LIVER ORIGIN; MET. TO KIDNEY	S	71000		56000	KIDNEY *	LIVER
TKWI	GI TRACT ORIGIN IN COMMENT; MET. TO KIDNEY	S	71000		50100	KIDNEY *	GI TRACT
TKWM	MUSCLE OR MAMMARY GLAND ORIGIN IN COMMENT; MET. TO KIDNEY	S	71000		00003	KIDNEY *	- NOT ASSIGNED -

JANUS Code	JANUS Description	PSN	Topog.	Morph.	Topog.	OMorig.	SNOMED Description	Metastatic Origin
TKWN	NERVOUS SYSTEM ORIGIN IN COMMENT; MET. TO KIDNEY	S	71000		X0000		KIDNEY *	NERVOUS SYSTEM
TKWO	OVARY ORIGIN; MET. TO KIDNEY	S	71000		87000		KIDNEY *	OVARY
TKWP	PITUITARY ORIGIN; MET. TO KIDNEY	S	71000		91000		KIDNEY *	PITUITARY
TKWR	RESPIRATORY SYSTEM ORIGIN; MET. TO KIDNEY	S	71000		20000		KIDNEY *	RESPIRATORY TRACT
TKWS	SKIN ORIGIN IN COMMENT; MET. TO KIDNEY	S	71000		01000		KIDNEY *	SKIN
TKWU	UTERUS ORIGIN; MET. TO KIDNEY	S	71000		82000		KIDNEY *	UTERUS
TKWX	TISSUE OF ORIGIN IN COMMENT; MET. TO KIDNEY	S	71000		00003		KIDNEY *	- NOT ASSIGNED -
TKWZ	THYROID ORIGIN; MET. TO KIDNEY	S	71000		96000		KIDNEY *	THYROID
TLFS	FIBROSARCOMA LYMPH NODE SITE SPECIFIED IN COMMENT	P	08000	M88103			LYMPH NODE * FIBROSARCOMA	
TLHL	HISTIOCYTIC LEUKEMIA LYMPHORETICULAR TISSUE	P	05000	M98903			R/E & HEMATOP. SYST. * MONOCYTIC LEUKEMIA	
TLHS	HISTIOCYTIC LYMPHOMA (RCT TYPE A) LYMPHORET. TISSUE	P	05000	M96403			R/E & HEMATOP. SYST. * HISTIOCYT.LYMPHOSARC.	
TLLL	LYMPHOCYTIC / LYMPHOBLASTIC LEUKEMIA; LYMPHORETICULAR TISSUE	P	05000	M98263			R/E & HEMATOP. SYST. * LYMPHOCYT.LYMPHOBLAST.LEUK.(RCT TYPE A)	
TLLS	LYMPHOCYTIC / LYMPHOBLASTIC LYMPHOMA LYMPHORETICULAR TISS.	P	05000	M96993			R/E & HEMATOP. SYST. * LYMPHOCYTIC LYMPHOBLASTIC LYMPHOMA	
TLML	MYELOGENOUS LEUKEMIA ; LYMPHORETICULAR TISSUE	P	05000	M98603			R/E & HEMATOP. SYST. * MYELOGENOUS LEUKEMIA	
TLPS	PLASMA CELL TUMOR LYMPHORETICULAR TISSUE	P	05000	M97311			R/E & HEMATOP. SYST. * PLASMACYTOMA	
TLSL	UNDIFFERENTIATED LEUKEMIA; LYMPHORETICULAR TISSUE	P	05000	M98013			R/E & HEMATOP. SYST. * UNDIFF.LEUKEMIA	
TLSS	UNDIFFERENTIATED LYMPHOMA LYMPHORETICULAR TISSUE	P	05000	M96003			R/E & HEMATOP. SYST. * UNDIFFERENTIATED LYMPHOMA	
TLUS	UNCLASSIFIED LYMPHOMA LYMPHORETICULAR TISSUE	P	05000	M95903			R/E & HEMATOP. SYST. * MALIGNANT LYMPHOMA	
TLVO	VASCULAR TUMOR, BENIGN(HEMANGIOMA); LYMPHO.TISS. SITE SPEC..	P	05000	M91200			R/E & HEMATOP. SYST. * HEMANGIOMA	

JANUS Code	JANUS Description	PSN	Topog.	Morph.	Topog.	TopMeti	Orign	SNOMED Description	Metastatic Origin
TLVS	LN, VASCULAR TUMOR (ANGIOSARCOMA) LYMPHORET. TISS SITE SPEC.	P	08000	M91203				LYMPH NODE * ANGIOSARCOMA	
TLWA	ADRENAL ORIGIN; LYMPHORET. TISS. MET. SITE SPECIFIED IN COMT	S	05000		93000			R/E & HEMATOP. SYST. *	ADRENAL GLAND
TLWB	BONE ORIGIN IN COMM.; LYMPHORET.TISS. MET. SITE SPEC IN COMM	S	05000		1X500			R/E & HEMATOP. SYST. *	BONE
TLWC	CONN. TISS. ORIG IN COMMENT; LYMPHORET TISS MET SITE SPEC IN	S	05000		1X200			R/E & HEMATOP. SYST. *	CONNECTIVE TISSUE
TLWG	HARDERIAN GLAND ORIGIN; LYMPHORET. MET. SITE SPEC. IN COMM.	S	05000		XX836			R/E & HEMATOP. SYST. *	HARDERIAN GLAND
TLWH	LIVER ORIGIN; LYMPHORET. TISS. MET. SITE SPEC. IN COMMENT	S	05000		56000			R/E & HEMATOP. SYST. *	LIVER
TLWI	GI TRACT ORIGIN IN COMM.;LYMPHORET.TISS. MET. SITE SPEC. IN.	S	05000		50100			R/E & HEMATOP. SYST. *	GI TRACT
TLWK	KIDNEY ORIGIN; LYMPHORET. TISS. MET. SITE SPEC. IN COMMENT	S	05000		71000			R/E & HEMATOP. SYST. *	KIDNEY
TLWM	MUSCLE ORIGIN IN COMMENT; LYMPHORET. TISS. MET. SITE SPEC.	S	05000		13001			R/E & HEMATOP. SYST. *	MUSCLE
TLWN	NERV SYS ORIG IN COMM.;LYMPHORET.TISS. MET. SITE SPEC IN CO	S	05000		X0000			R/E & HEMATOP. SYST. *	NERVOUS SYSTEM
TLWO	OVARY ORIGIN; LYMPHORET. TISS. MET. SITE SPEC. IN COMMENT	S	05000		87000			R/E & HEMATOP. SYST. *	OVARY
TLWP	PITUITARY ORIGIN; LYMPHORET. TISS. MET. SITE SPEC. IN COMMET	S	05000		91000			R/E & HEMATOP. SYST. *	PITUITARY
TLWR	RESPIRATORY SYSTEM ORIGIN; LYMPHORET. TISS. MET. SITE SPEC..	S	05000		20000			R/E & HEMATOP. SYST. *	RESPIRATORY TRACT
TLWS	SKIN ORIGIN IN COMM.; LYMPHORET.TISS. MET. SITE SPEC. IN CO.	S	05000		01000			R/E & HEMATOP. SYST. *	SKIN
TLWT	TESTIS ORIGIN; LYMPHORET. TISS. MET. SITE SPEC. IN COMMENT	S	05000		78000			R/E & HEMATOP. SYST. *	TESTIS

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JANUS Code	JANUS Description	PSN	Topog.	Siteo	Morph.	Topog.	MOrpho.	SNOMED Description	Metastatic Origin
TLWU	UTERUS ORIGIN; LYMPHORET. TISS. MET. SITE SPEC. IN COMMENT	S	05000			82000		R/E & HEMATOP. SYST. *	UTERUS
TLWX	TISS OF ORIG IN COMMENT; LYMPHORET.TISS. MET. SITE SPEC IN C	S	05000			00003		R/E & HEMATOP. SYST. *	- NOT ASSIGNED -
TLWY	HEART ORIGIN; LYMPHORET. TISS. MET. SITE SPEC. IN COMMENT	S	05000			32000		R/E & HEMATOP. SYST. *	HEART
TLWZ	THYROID ORIGIN; LYMPHORET. TISS. MET. SITE SPEC. IN COMMENT	S	05000			96000		R/E & HEMATOP. SYST. *	THYROID
TLXL	MIXED HISTIOCYTIC LYMPHOCYTIC LEUKEMIA; LYMPHORET. TISSUE	P	05000		M98273			R/E & HEMATOP. SYST. * MIXED HISTIOCYTIC LYMPHOCYTIC LEUKEMIA	
TLXS	MIXED HISTIOCYTIC LYMPHOCYTIC LYMPHOMA (RCT TYPE B)	P	05000		M96133			R/E & HEMATOP. SYST. * MIXED HISTIOCYTIC LYMPHOCYTIC LYMPHOMA	
TMAA	ADENOCARCINOMA A (ALVEOLAR) MAMMARY GLAND	P	04000		M82513			MAMMARY GLAND * ALVEOLAR ADENOCARCINOMA	
TMAB	ADENOCARCINOMA B (DUCTAL, PREDOMINANTLY) MAMMARY GLAND	P	04000		M85003			MAMMARY GLAND * DUCTAL ADENOCARCINOMA	
TMAC	ADENOCARCINOMA C (FIBROSARCOMA) MAMMARY GLAND	P	04000		M88103			MAMMARY GLAND * FIBROSARCOMA	
TMAT	ADENOACANTHOMA MAMMARY GLAND	P	04000		M85703			MAMMARY GLAND * ADENOACANTHOMA	
TMFS	FIBROSARCOMA MUSCLE SITE SPECIFIED IN COMMENT	P	13001		M88103			MUSCLE * FIBROSARCOMA	
TMLS	LEIOMYOSARCOMA MUSCLE SITE SPECIFIED IN COMMENT	P	13001		M88903			MUSCLE * LEIOMYOSARCOMA	
TMRO	RHABDOMYOMA MUSCLE SITE SPECIFIED IN COMMENT	P	13001		M89000			MUSCLE * RHABDOMYOMA	
TMRS	RHABDOMYOSARCOMA MUSCLE SITE SPECIFIED IN COMMENT	P	13001		M89003			MUSCLE * RHABDOMYOSARCOMA	
TMSO	LEIOMYOMA MUSCLE SITE SPECIFIED IN COMMENT	P	13001		M88900			MUSCLE * LEIOMYOMA	
TMSS	UNDIFFERENTIATED SARCOMA MUSCLE SITE SPECIFIED IN COMMENT	P	13001		M88053			MUSCLE * UNDIFFERENTIATED SARCOMA	

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JANUS Code	JANUS Description	PSN	Topog.	Morph.	Topog.	OMeit	SNOMED Description	Metastatic Origin
TMUO	MAMMARY GLAND TUMOR (UNDETERMINED TYPE)	P	04000	M80001			MAMMARY GLAND * NEOPLASM	
TMVO	HEMANGIOMA MUSCLE SITE SPECIFIED IN COMMENT	P	13001	M91200			MUSCLE * HEMANGIOMA	
TMVS	HEMANGIOENDO. (ANGIOSARCOMA), MALIG MUSCLE SITE SPEC IN COMM	P	13001	M91203			MUSCLE * ANGIOSARCOMA	
TMWA	ADRENAL ORIGIN; MUSCLE MET. SITE SPEC. IN COMMENT	S	13001		93000		MUSCLE *	ADRENAL GLAND
TMWB	BONE ORIGIN IN COMMENT; MUSCLE MET. SITE SPEC. IN COMMENT	S	13001		1X500		MUSCLE *	BONE
TMWC	CONN TISS ORIGIN IN COMM.;MUSCLE MET. SITE SPEC. IN COMMENT	S	13001		1X200		MUSCLE *	CONNECTIVE TISSUE
TMWD	URINARY BLADDER ORIGIN; MUSCLE MET. SITE SPECIFIED IN COMMET	S	13001		74000		MUSCLE *	URINARY BLADDER
TMWG	HARDERIAN GLAND ORIGIN; MUSCLE MET. SITE SPECIFIED IN COMM.	S	13001		XX836		MUSCLE *	HARDERIAN GLAND
TMWH	LIVER ORIGIN; MUSCLE MET. SITE SPEC. IN COMMENT	S	13001		56000		MUSCLE *	LIVER
TMWK	KIDNEY ORIGIN; MUSCLE MET. SITE SPECIFIED IN COMMENT	S	13001		71000		MUSCLE *	KIDNEY
TMWM	MAMMARY GLAND ORIGIN; MUSCLE MET. SITE SPEC. IN COMMENT	S	13001		04000		MUSCLE *	MAMMARY GLAND
TMWN	NERVOUS SYSTEM ORIGIN IN COMM.; MUSCLE MET. SITE SPEC. IN C.	S	13001		X0000		MUSCLE *	NERVOUS SYSTEM
TMWR	RESPIRATORY SYSTEM ORIGIN; MUSCLE MET. SITE SPEC. IN COMMENT	S	13001		20000		MUSCLE *	RESPIRATORY TRACT
TMWS	SKIN ORIGIN IN COMMENT; MUSCLE MET. SITE SPEC. IN COMMENT	S	13001		01000		MUSCLE *	SKIN
TMWT	TESTIS ORIGIN; MUSCLE MET. SITE SPECIFIED IN COMMENT	S	13001		78000		MUSCLE *	TESTIS
TMWX	TISSUE OF ORIGIN IN COMMENT; MUSCLE MET. SITE SPEC. IN COMM.	S	13001		00003		MUSCLE *	- NOT ASSIGNED -

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JANUS Code	JANUS Description	PSN	Topog.	Sitet.	Morph.	Topog.	MeOt.	Orign.	SNOMED Description	Metastatic Origin
TMNZ	THYROID ORIGIN; MUSCLE MET. SITE SPECIFIED IN COMMENT	S	13001			96000			MUSCLE *	THYROID
TNAS	ASTROCYTOMA NERVOUS SYS. SITE SPECIFIED IN COMMENT	P	X0000		M94003				NERVOUS SYSTEM * ASTROCYTOMA	
TNFO	FIBROMA NERVOUS SYSTEM SITE SPEC. IN COMMENT	P	X0000		M88100				NERVOUS SYSTEM * FIBROMA	
TNMS	MENINGEAL SARCOMA NERVOUS SYSTEM	P	X1110		M88003				MENINGES * SARCOMA	
TNNB	EPENDYMOMA	P	X1610		M93913				EPENDYMA * EPENDYMOMA	
TNNO	NEUROFIBROMA (PERIPHERAL NERVE NEURILEMMOMA) SITE SPEC. IN .	P	X0500		M95400				PERIPHERAL NERVE * NEUROFIBROMA	
TNNS	PERIPHERAL NERVE NEUROFIBROSARCOMA NERVOUS SYS. SITE SPEC. .	P	X0500		M95403				PERIPHERAL NERVE * NEUROFIBROSARCOMA	
TNOS	OLIGODENDROGLIOMA NERVOUS SYSTEM	P	X0000		M94503				NERVOUS SYSTEM * OLIGODENDROGLIOMA	
TNPO	PAPILLOMA, CHOROID PLEXUS NERVOUS SYS.	P	X1900		M80500				CHOROID PLEXUS * PAPILLOMA	
TNUS	UNDIFFERENTIATED TUMOR NERVOUS SYSTEM SITE SPEC. IN COMMENT	P	X0000		M80001				NERVOUS SYSTEM * NEOPLASM	
TNVS	VASCULAR TUMOR (ANGIOSARCOMA) NERVOUS SYSTEM SITE SPEC. IN .	P	X0000		M91203				NERVOUS SYSTEM * ANGIOSARCOMA	
TNWB	BONE ORIGIN IN COMM.; NERVOUS SYS. MET. SITE SPEC. IN COMM.	S	X0000			1X500			NERVOUS SYSTEM *	BONE
TNWC	CONN TISS ORIG IN COMMENT; NERV. SYS. MET. SITE SPEC IN COMM	S	X0000			1X200			NERVOUS SYSTEM *	CONNECTIVE TISSUE
TNWG	HARDERIAN GLAND ORIGIN; NERV. SYS. MET. SITE SPEC. IN COMM.	S	X0000			XX836			NERVOUS SYSTEM *	HARDERIAN GLAND
TNWK	KIDNEY ORIGIN; NERVOUS SYS. MET. SITE SPEC. IN COMMENT	S	X0000			71000			NERVOUS SYSTEM *	KIDNEY
TNWM	MUSCLE ORIGIN IN COMMENT; NERVOUS SYS. MET. SITE SPEC. IN CT	S	X0000			13001			NERVOUS SYSTEM *	MUSCLE
TNWO	OVARY ORIGIN; NERV. SYSTEM MET. SITE SPEC. IN COMMENT	S	X0000			87000			NERVOUS SYSTEM *	OVARY
TNWP	PITUITARY ORIGIN; NERV. SYS. MET. SITE SPEC. IN COMMENT	S	X0000			91000			NERVOUS SYSTEM *	PITUITARY

JANUS Code	JANUS Description	PSN	Topog Site	Morph.	Topog. Met. Origin	SNOMED Description	Metastatic Origin
TNWR	RESPIRATORY SYSTEM ORIGIN; NERV. SYS. MET. SITE SPEC. IN CO.	S	X0000		20000	NERVOUS SYSTEM *	RESPIRATORY TRACT
TNWS	SKIN ORIGIN IN COMMENT; NERV. SYS. MET. SITE SPEC. IN COMMET	S	X0000		01000	NERVOUS SYSTEM *	SKIN
TNWX	TISSUE OF ORIGIN IN COMMENT; NERV. SYS. MET. SITE SPEC. IN .	S	X0000		00003	NERVOUS SYSTEM *	- NOT ASSIGNED -
TNXS	GLIOMA, MIXED, NERVOUS SYSTEM	P	X0000	M93823		NERVOUS SYSTEM * MIXED GLIOMA	
TOAC	ADENOCARCINOMA OVARY	P	87000	M81403		OVARY * ADENOCARCINOMA	
TOAO	ADENOMA OVARY	P	87000	M81400		OVARY * ADENOMA	
TOCO	CYSTADENOMA OVARY	P	87000	M84400		OVARY * CYSTADENOMA	
TOGC	GRANULOSA CELL TUMOR OVARY	P	87000	M86201		OVARY * GRANULOSA CELL TUMOR	
TOPA	PAPILLARY ADENOMA OVARY	P	87000	M82600		OVARY * PAPILLARY ADENOMA	
TOSC	UNDIFFERENTIATED CARCINOMA OVARY	P	87000	M80203		OVARY * UNDIFF. CARCINOMA	
TOTA	TUBULAR ADENOMA OVARY	P	87000	M82110		OVARY * TUBULAR ADENOMA	
TOTO	LUTEOMA (THECOMA) OVARY	P	87000	M86100		OVARY * LUTEOMA	
TOVO	HEMANGIOMA OVARY	P	87000	M91200		OVARY * HEMANGIOMA	
TOVS	HEMANGIOENDOTHELIOMA (ANGIOSARCOMA) OVARY	P	87000	M91203		OVARY * ANGIOSARCOMA	
TOWB	BONE ORIGIN IN COMM.; MET. TO OVARY	S	87000		1X500	OVARY *	BONE
TOWU	UTERUS ORIGIN; MET. TO OVARY	S	87000		82000	OVARY *	UTERUS
TOWX	TISSUE OF ORIGIN IN COMMENT; MET. TO OVARY	S	87000		00003	OVARY *	- NOT ASSIGNED -
TPAA	ACIDOPHILIC ADENOMA PITUITARY	P	91000	M82800		PITUITARY * ACIDOPHILIC ADENOMA	
TPAC	CARCINOMA PITUITARY	P	91000	M80103		PITUITARY * CARCINOMA	
TPAO	ADENOMA PITUITARY	P	91000	M81400		PITUITARY * ADENOMA	
TPVS	ANGIOSARCOMA PITUITARY	P	91000	M91203		PITUITARY * ANGIOSARCOMA	
TRAA	ALVEOLOGENIC TUMOR, BENIGN (ADENOMA)	P	28000	M81400		LUNG * ADENOMA	
TRAC	ALVEOLOGENIC TUMOR, MALIGNANT (ADENOCARCINOMA)	P	28000	M81403		LUNG * ADENOCARCINOMA	
TRCO	CYSTADENOMA LUNG	P	28000	M84400		LUNG * CYSTADENOMA	
TRVS	VASCULAR TUMOR (ANGIOSARCOMA) LUNG	P	28000	M91203		LUNG * ANGIOSARCOMA	
TRWA	ADRENAL ORIGIN; MET. TO LUNG	S	28000		93000	LUNG *	ADRENAL GLAND
TRWB	BONE ORIGIN IN COMM.; MET. TO LUNG	S	28000		1X500	LUNG *	BONE
TRWC	CONNECTIVE TISSUE ORIGIN IN COMMENT; MET. TO LUNG	S	28000		1X200	LUNG *	CONNECTIVE TISSUE
TRWG	HARDERIAN GLAND ORIGIN; MET. TO LUNG	S	28000		XX836	LUNG *	HARDERIAN GLAND
TRWH	LIVER ORIGIN; MET. TO LUNG	S	28000		56000	LUNG *	LIVER
TRWI	GI TRACT ORIGIN IN COMMENT; MET. TO LUNG	S	28000		50100	LUNG *	GI TRACT

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JANUS Code	JANUS Description	PSN	Topog.	Morph.	Topog.	TMorg.	OMorig.	SNOMED Description	Metastatic Origin
TRWK	KIDNEY ORIGIN; MET. TO LUNG	S	28000		71000			LUNG *	KIDNEY
TRWM	MUSCLE OR MAMMARY GLAND ORIGIN IN COMMENT; MET. TO LUNG	S	28000		00003			LUNG *	- NOT ASSIGNED -
TRWN	NERVOUS SYSTEM ORIGIN IN COMMENT; MET. TO LUNG	S	28000		X0000			LUNG *	NERVOUS SYSTEM
TRWO	OVARY ORIGIN; MET. TO LUNG	S	28000		87000			LUNG *	OVARY
TRWP	PITUITARY ORIGIN; MET. TO LUNG	S	28000		91000			LUNG *	PITUITARY
TRWS	SKIN ORIGIN IN COMMENT; MET. TO LUNG	S	28000		01000			LUNG *	SKIN
TRWT	TESTIS ORIGIN; MET. TO LUNG	S	28000		78000			LUNG *	TESTIS
TRWU	UTERUS ORIGIN; MET. TO LUNG	S	28000		82000			LUNG *	UTERUS
TRWV	SEMINAL VESICLE ORIGIN; MET. TO LUNG	S	28000		77500			LUNG *	SEMINAL VESICLE
TRWX	TISSUE OF ORIGIN IN COMMENT; MET. TO LUNG	S	28000		00003			LUNG *	- NOT ASSIGNED -
TRWY	HEART ORIGIN; MET. TO LUNG	S	28000		32000			LUNG *	HEART
TRWZ	THYROID ORIGIN; MET. TO LUNG	S	28000		96000			LUNG *	THYROID
TSAO	ADENOMA SKIN SITE SPEC. IN COMMENT	P	01000	M81400				SKIN * ADENOMA	
TSBC	BASAL CELL CARCINOMA(HAIR FOLLICLE TUMOR) SITE SPEC. IN COMM	P	01414	M80903				HAIR FOLLICLE * BASAL CARCINOMA	
TSDO	SEBACEOUS (GLAND) ADENOMA SKIN SITE SPEC. IN COMMENT	P	01310	M84100				SEBACEOUS GLAND * SEBACEOUS ADENOMA	
TSEC	SQUAMOUS CELL CARCINOMA SKIN; SITE SPECIFIED IN COMMENT	P	01000	M80703				SKIN * SQUAMOUS CARCINOMA	
TSFS	FIBROSARCOMA SKIN SITE SPECIFIED IN COMMENT	P	01000	M88103				SKIN * FIBROSARCOMA	
TSPO	PAPILLOMA SKIN SITE SPECIFIED IN COMMENT	P	01000	M80500				SKIN * PAPILLOMA	
TSSS	UNDIFFERENTIATED SARCOMA SKIN SITE SPECIFIED IN COMMENT	P	01000	M88053				SKIN * UNDIFFERENTIATED SARCOMA	
TSVS	VASCULAR TUMOR (ANGIOSARCOMA) SKIN SITE SPEC. IN COMMENT	P	01000	M91203				SKIN * ANGIOSARCOMA	
TSWB	BONE ORIGIN IN COMM.; SKIN MET. SITE SPECIFIED IN COMMENT	S	01000		1X500			SKIN *	BONE
TSWC	CONNECTIVE TISSUE ORIGIN IN COMM.; SKIN MET. SITE SPEC.IN C.	S	01000		1X200			SKIN *	CONNECTIVE TISSUE

JANUS Code	JANUS Description	PSN	Topog.	Morph.	Topog.	MeTing.	SNOMED Description	Metastatic Origin
TSWN	NERVOUS SYSTEM ORIGIN IN COMMENT; SKIN MET. SITE SPEC. IN C.	S	01000		X0000		SKIN *	NERVOUS SYSTEM
TTAC	CARCINOMA TESTIS	P	78000	M80103			TESTIS * CARCINOMA	
TTFA	FIBROMA TESTIS	P	78000	M88100			TESTIS * FIBROMA	
TTFS	FIBROSARCOMA TESTIS	P	78000	M88103			TESTIS * FIBROSARCOMA	
TTGC	SEMINOMA TESTIS	P	78000	M90613			TESTIS * SEMINOMA	
TTIO	INTERSTITIAL CELL TUMOR (LEYDIG) TESTIS	P	78000	M86500			TESTIS * LEYDIG CELL TUMOR	
TTKC	SERTOLI CELL TUMOR TESTIS	P	78000	M86400			TESTIS * SERTOLI CELL TUMOR	
TTQC	EMBRYONAL CARCINOMA TESTIS	P	78000	M90703			TESTIS * EMBRYONAL CARCINOMA	
TTVO	HEMANGIOMA, BENIGN TESTIS	P	78000	M91200			TESTIS * HEMANGIOMA	
TTVS	HEMANGIOENDOTHELIOMA (ANGIOSARCOMA), MALIGNANT TESTIS	P	78000	M91203			TESTIS * ANGIOSARCOMA	
TTYC	TERATOMA TESTIS	P	78000	M90801			TESTIS * TERATOMA	
TUAC	ADENOCARCINOMA UTERUS	P	82000	M81403			UTERUS * ADENOCARCINOMA	
TUAO	ADENOMA (INCLUDING PAPILLARY TYPE) UTERUS	P	82000	M81400			UTERUS * ADENOMA	
TUEC	SQUAMOUS CELL CARCINOMA UTERUS	P	82000	M80703			UTERUS * SQUAMOUS CARCINOMA	
TUFO	FIBROMA UTERUS	P	82000	M88100			UTERUS * FIBROMA	
TULO	LEIOMYOMA UTERUS	P	82000	M88900			UTERUS * LEIOMYOMA	
TULS	LEIOMYOSARCOMA UTERUS	P	82000	M88903			UTERUS * LEIOMYOSARCOMA	
TUNO	NEURILEMMOMA UTERUS	P	82000	M95600			UTERUS * SCHWANNOMA	
TUUO	DECIDUOMATOSIS, UTERUS (DECIDUOMA)	P	82000	M76570			UTERUS * DECIDUOMATOSIS	
TUUS	SARCOMA, UNDETERMINED TYPE, UTERUS	P	82000	M88003			UTERUS * SARCOMA	
TUVO	HEMANGIOMA, BENIGN UTERUS	P	82000	M91200			UTERUS * HEMANGIOMA	
TUVS	HEMANGIOENDOTHELIOMA (ANGIOSARCOMA), MALIGNANT UTERUS	P	82000	M91203			UTERUS * ANGIOSARCOMA	
TUWO	OVARY ORIGIN; MET. TO UTERUS	S	82000		87000		UTERUS *	OVARY
TVAO	ADENOMA SEMINAL VESICLE	P	77500	M81400			SEMINAL VESICLE * ADENOMA	
TVFO	FIBROMA SEMINAL VESICLE	P	77500	M88100			SEMINAL VESICLE * FIBROMA	
TVFS	FIBROSARCOMA SEMINAL VESICLE	P	77500	M88103			SEMINAL VESICLE * FIBROSARCOMA	
TVSS	UNDIFFERENTIATED SARCOMA SEMINAL VESICLE	P	77500	M88053			SEMINAL VESICLE * UNDIFFERENTIATED SARCOMA	
TVUO	TUMOR (UNDETERMINED CELL TYPE) SEMINAL VESICLE	P	77500	M80001			SEMINAL VESICLE * NEOPLASM	
TVVS	HEMANGIOENDOTHELIOMA (ANGIOSARCOMA),MALIGNANT SEMINAL VESIC.	P	77500	M91203			SEMINAL VESICLE * ANGIOSARCOMA	
TVWD	URINARY BLADDER ORIGIN; MET. TO SEMINAL VESICLE	S	77500		74000		SEMINAL VESICLE *	URINARY BLADDER

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JANUS Code	JANUS Description	PSN	Topog. Site	Morph.	Topog. Met. Origin	SNOMED Description	Metastatic Origin
TVWX	TISSUE OF ORIGIN IN COMMENT; MET. TO SEMINAL VESICLE	S	77500		00003	SEMINAL VESICLE *	- NOT ASSIGNED -
TXAC	ADENOCARCINOMA RARE TISSUE WITH TUMOR SITE SPEC. IN COMMENT	P	00003	M81403		- NOT ASSIGNED - * ADENOCARCINOMA	
TXAO	ADENOMA RARE TISS. WITH TUMOR SITE SPEC. IN COMMENT	P	00003	M81400		- NOT ASSIGNED - * ADENOMA	
TXEC	SQUAMOUS CELL CARCINOMA RARE TISS. WITH TUMOR; SITE SPEC. I.	P	00003	M80703		- NOT ASSIGNED - * SQUAMOUS CARCINOMA	
TXFA	FIBROADENOMA; RARE TISSUE WITH TUMOR; SITE SPECIFIED IN COMT	P	00003	M90100		- NOT ASSIGNED - * FIBROADENOMA	
TXFS	FIBROSARCOMA RARE TISS. SITE SPECIFIED IN COMMENT	P	00003	M88103		- NOT ASSIGNED - * FIBROSARCOMA	
TXLS	LEIOMYOSARCOMA RARE TISSUE SITE SPECIFIED IN COMMENT	P	00003	M88903		- NOT ASSIGNED - * LEIOMYOSARCOMA	
TXUO	ALL INFO CODED IN COMMENT; UNIDENT. TUMOR SITE SPEC. IN COMM	P	00003	M80001		- NOT ASSIGNED - * NEOPLASM	
TXUS	UNDIFFERENTIATED SARCOMA RARE TISSUE SITE SPEC. IN COMMENT	P	00003	M88053		- NOT ASSIGNED - * UNDIFFERENTIATED SARCOMA	
TXVS	HEMANGIOENDO. (ANGIOSARCOMA), MALIG RARE TISS SITE SPEC IN C	P	00003	M91203		- NOT ASSIGNED - * ANGIOSARCOMA	
TXWB	BONE ORIGIN IN COMM.; RARE TISS. MET. SITE SPEC. IN COMM.	S	00003		1X500	- NOT ASSIGNED - *	BONE
TXWC	CONNECTIVE TISSUE ORIGIN IN COMM.;RARE TISS. MET. SITE SPEC.	S	00003		1X200	- NOT ASSIGNED - *	CONNECTIVE TISSUE
TXWG	HARDERIAN GLAND ORIGIN; RARE TISS. MET. SITE SPEC. IN COMM.	S	00003		XX836	- NOT ASSIGNED - *	HARDERIAN GLAND
TXWI	GI TRACT ORIGIN IN COMM.; RARE TISS. MET. SITE SPEC. IN COM.	S	00003		50100	- NOT ASSIGNED - *	GI TRACT

JANUS MICRO DICTIONARY - SNOMED/SNOVET CONVERT Ordered by MOUSCODE July 11, 1994 bjw

JANUS Code	JANUS Description	PSN	Topog.	Morph.	Topog.	SNOMED Description	Metastatic Origin
TXWK	KIDNEY ORIGIN; RARE TISS. MET. SITE SPEC. IN COMMENT	S	00003		71000	- NOT ASSIGNED - *	KIDNEY
TXWM	MUSCLE ORIGIN IN COMMENT; RARE TISS. MET. SITE SPEC. IN COM.	S	00003		13001	- NOT ASSIGNED - *	MUSCLE
TXWO	OVARY ORIGIN; RARE TISS. MET. SITE SPEC. IN COMMENT	S	00003		87000	- NOT ASSIGNED - *	OVARY
TXWP	PITUITARY ORIGIN; RARE TISS. MET. SITE SPEC. IN COMMENT	S	00003		91000	- NOT ASSIGNED - *	PITUITARY
TXWR	RESPIRATORY SYSTEM ORIGIN; RARE TISS. MET. SITE SPEC. IN CO.	S	00003		20000	- NOT ASSIGNED - *	RESPIRATORY TRACT
TXWS	SKIN ORIGIN IN COMMENT; RARE TISS. MET. SITE SPEC. IN COMMET	S	00003		01000	- NOT ASSIGNED - *	SKIN
TXWU	UTERUS ORIGIN; RARE TISS. MET. SITE SPEC. IN COMMENT	S	00003		82000	- NOT ASSIGNED - *	UTERUS
TXWV	SEMINAL VESICLE ORIGIN; RARE TISS. MET. SITE SPEC. IN COMM.	S	00003		77500	- NOT ASSIGNED - *	SEMINAL VESICLE
TYCS	CHONDROSARCOMA HEART	P	32000	M92203		HEART * CHONDROSARCOMA	
TYFS	FIBROSARCOMA HEART	P	32000	M88103		HEART * FIBROSARCOMA	
TYRO	RHABDOMYOMA HEART	P	32000	M89000		HEART * RHABDOMYOMA	
TYRS	RHABDOMYOSARCOMA HEART	P	32000	M89003		HEART * RHABDOMYOSARCOMA	
TYVS	ANGIOSARCOMA HEART	P	32000	M91203		HEART * ANGIOSARCOMA	
TYWA	ADRENAL ORIGIN; MET. TO HEART	S	32000		93000	HEART *	ADRENAL GLAND
TYWB	BONE ORIGIN IN COMM.; MET. TO HEART	S	32000		1X500	HEART *	BONE
TYWC	CONNECTIVE TISSUE ORIGIN IN COMMENT; MET. TO HEART	S	32000		1X200	HEART *	CONNECTIVE TISSUE
TYWG	HARDERIAN GLAND ORIGIN; MET. TO HEART	S	32000		XX836	HEART *	HARDERIAN GLAND
TYWH	LIVER ORIGIN; MET. TO HEART	S	32000		56000	HEART *	LIVER
TYWK	KIDNEY ORIGIN; MET. TO HEART	S	32000		71000	HEART *	KIDNEY
TYWM	MUSCLE ORIGIN IN COMMENT; MET. TO HEART	S	32000		13001	HEART *	MUSCLE
TYWO	OVARY ORIGIN; MET. TO HEART	S	32000		87000	HEART *	OVARY
TYWR	RESPIRATORY SYSTEM ORIGIN; MET. TO HEART	S	32000		20000	HEART *	RESPIRATORY TRACT
TYWS	SKIN ORIGIN IN COMMENT; MET. TO HEART	S	32000		01000	HEART *	SKIN
TYWT	TESTIS ORIGIN; MET. TO HEART	S	32000		78000	HEART *	TESTIS

JANUS MICRO DICTIONARY - SNOMED/SNOVET CONVERT Ordered by MOUSCODE July 11, 1994 bjw

JANUS Code	JANUS Description	PSN	Topog.	Morph.	Topog.	MeOrg.	SNOMED Description	Metastatic Origin
TYWU	UTERUS ORIGIN; MET. TO HEART	S	32000		82000		HEART *	UTERUS
TYWX	TISSUE OF ORIGIN IN COMMENT; MET. TO HEART	S	32000		00003		HEART *	- NOT ASSIGNED -
TZAC	ADENOCARCINOMA THYROID	P	96000	M81403			THYROID * ADENOCARCINOMA	
TZAO	ADENOMA THYROID	P	96000	M81400			THYROID * ADENOMA	

430 rows selected.

APPENDIX I:

JANUS ORACLE TABLES

JANUS ORACLE TABLES

GENERAL
HISTORY
EXIT
FRACTIONS
MACBASE
MACFIND
MICBASE
MICFIND
NEXT_NUMID
ROOMDEF
ROOMOCC
FILE_SEQNOS

The tables described in this appendix contain all the information necessary to initiate new experiments, to enter experimental data, or to be used in data analysis. The first eight tables contain all of the data for the experiments. The tables are arranged in the order in which the data are obtained. Table GENERAL and the last four tables contain all the information necessary to initiate experiments.

For each table described, the table headings and a sample line from the actual table are shown. Variable names in the headings are sometimes truncated to the number of spaces available for the data. The first line of each "Table Columns Description" gives the variable name (e.g., "EXPT"), the type and number of column positions, and a note if the variable must be present in the table ("NOT NULL"); this line is followed by an explanation of the variable.

Table GENERAL

This table contains the identification of a cage of mice and assigns the NUMID that is used to relate all the Tables.

EXPT	R	S	TM	RE	CA	NUMID	STRAIN	BIRTH	BEGIN	END
4	G	M	K1	02	05	6603	8	16-JUN-74	24-SEP-74	04-MAR-75

Table Columns Description

EXPT NUMBER(2) NOT NULL

Experiment number that is appended to "JM-."

RADN CHAR(1) NOT NULL

Type of radiation: C = Control, G = Gamma ray, or N = Neutron.

SEX CHAR(1) NOT NULL

Sex code: M = Male, F = Female.

TMT CHAR(2) NOT NULL

Treatment coded by the experimenter (usually a dose code). Alphanumeric values allowed.

REP CHAR(2) NOT NULL

Replicate number is determined by "ease of treatment" and total number of animals on hand. By "ease of treatment" is meant the ability to handle a certain number of animals within the time frame and protocol of the experimental design.

CAGE CHAR(2) NOT NULL

Cage number (1 to n) within a replicate.

NUMID NUMBER(5) NOT NULL

Archival number generated by the computer for each cage. This value is the link to all the other JANUS ORACLE Tables, which contain added information about the animals described by this Table record.

Table GENERAL (continued)

STRAIN NUMBER(2) NOT NULL

Animal strain code. In most JM experiments this is strain 08, the B6CF1 mouse. In JM-10, Peromyscus leucopus was used and is designated strain 83.

BIRTH DATE

Date of birth of the animals using a "weekly date."

BEGIN DATE

Date of first irradiation.

END DATE

Date of last irradiation.

Table HISTORY

This table contains information about the location of a cage in the room and the number of animals in the cage; it also records the sequence of events for the cage. Several sample lines are shown for this table to show the progression of the data.

NUMID	SEQ	NUM	ROOM	S	POSN	TRANS
6603	1	5	E118	N	13	15-SEP-74
6603	2	5	E112	Q	20	14-MAR-75
6603	3	5	T204	Q	14	13-MAR-76
6603	4	4	T204	Q	14	10-JUN-76

Table Columns Description

NUMID NUMBER(5) NOT NULL

Originates in Table GENERAL and is the archival number generated by the computer for each cage in the system. NUMID is the link to all other records in the system of ORACLE tables for a specific cage.

SEQ NUMBER(2) NOT NULL

Sequence number (range of 1 to n). Each time a HISTORY record with the same NUMID is created, the sequence number is incremented by one. All previous HISTORY records are maintained in the database. This gives an ordered trail of cage movement.

NUM NUMBER(1) NOT NULL

Number of animals in the cage. This number will decrease as animals are exited.

ROOM CHAR(4) NOT NULL

Room number (alphanumeric).

SHELF CHAR(1) NOT NULL

Shelf letter (range A to Z).

POSN NUMBER(2) NOT NULL

Position number on the shelf (range 1 to 21).

TRANS DATE

Transaction date. Date on which the cage first occupied the above ROOM-SHELF-POSN or the date on which the number of animals in the cage decreased.

Table EXIT

This table contains the information from the JANUS Death Tag (see Appendix A), which is filled out at the death of the mouse or its removal from the experiment.

NUMID	I	CODE	A	TRANS	AUTNUM
6603	1	2	A	10-JUN-76	16987

Table Columns Description

NUMID NUMBER(5) NOT NULL

NUMID originates in Table GENERAL and is the archival number generated by the computer for each cage in the system. NUMID is the link to all other records in the system of ORACLE tables for a specific cage.

INDIV CHAR(1) NOT NULL

Individual animal in the cage ranging from 1 to 5. Number 1 is the first recorded and number 5 is the last. The animals are not preidentified; numbering is based on the order of death.

CODE NUMBER(3,1) NOT NULL

Exit code (see Appendix B) assigned by prosector at the time of necropsy.

AUTOP CHAR(1) NOT NULL

Autopsy code (see Appendix B) assigned by the prosector at the time of necropsy.

TRANS DATE NOT NULL

Date of death or removal from cage.

AUTNUM NUMBER(7)

Autopsy number is obtained from the number on the JANUS Death Tag (see Appendix A).

Table FRACTIONS

This table records the actual number of fractions administered to the individual mouse.

NUMID	I	NFRACT
6603	1	24

Table Columns Description

NUMID NUMBER(5) NOT NULL

Originates in Table GENERAL and is the archival number generated by the computer for each cage in the system. NUMID is the link to all other records in the system of ORACLE tables for a specific cage.

INDIV CHAR(1) NOT NULL

Individual animal in the cage (range 1 to 5), as described for Table EXIT.

NFRAC NUMBER(4)

The actual number of fractions delivered for the treatment.

Table MACBASE

This table contains the individual identification information found on the first and the carbon second page of the necropsy report (see Appendix C).

NUMID	I	TRANS	PR	TNUM	T
6603	1	10-JUN-76	KA	C00735	T

Table Columns Description

NUMID NUMBER(5) NOT NULL

Originates in Table GENERAL and is the archival number generated by the computer for each cage in the system. NUMID is the link to all other records in the system of ORACLE tables for a specific cage.

INDIV CHAR(1) NOT NULL

Individual animal in the cage (range 1 to 5), as described for Table EXIT.

TRANS DATE NOT NULL

Date of necropsy.

PRO CHAR(2) NOT NULL

Two initials of the prosector.

TNUM CHAR(6)

Tissue number (alphanumeric as a letter assigned to a particular JM experiment and a sequential number obtained at the time of necropsy; e.g., JM-13 tissue numbers are S00001 to Snnnnn).

TUMOR CHAR(1)

Presence of a tumor designated by the letter "T"; absence of a tumor designated by the letter "N."

Table MACFIND

This table contains the MACRO diagnoses coded at the time of the necropsy. The COMMENT column is on a separate line because of the number of characters allowed for a comment; this column may be null.

NUMID	I	L	CODE	TOPO	MORPH
CMT					
6603	1	N	NTYG	00020	MYY933

Table Column Description

NUMID NUMBER(5) NOT NULL

Originates in Table GENERAL and is the archival number generated by the computer for each cage in the system. NUMID is the link to all other records in the system of ORACLE tables for a specific cage.

INDIV CHAR(1) NOT NULL

Individual animal in the cage (range 1 to 5), as described for Table EXIT.

LTH CHAR(1) NOT NULL

A letter "L" is in this field if the MACFIND.CODE is the cause of death (lethal) as determined by the prosector; a letter "N" if nonlethal.

CODE CHAR(4) NOT NULL

Four-letter JANUS mouse tumor MACRO code or three-letter JANUS mouse nontumor MACRO code assigned by prosector.

TOPO CHAR(5)

Topography of lesion; five-character SNOMED code (numeric). The SNOMED code is entered by the computer when the letter code for the lesion is entered.

MORPH CHAR(6)

Morphology of lesion; six-character SNOMED code (alphanumeric). The SNOMED code is entered by the computer when the letter code for the lesion is entered.

CMT CHAR(240)

Comment; contains additional information regarding the lesion.

Table MICBASE

This table contains the individual identification information found on the third page of the necropsy report (see Appendix C).

NUMID	I	TRANS	PR	T
6603	1	23-AUG-79	LL	T

Table Columns Description

NUMID NUMBER(5) NOT NULL

Originates in Table GENERAL and is the archival number generated by the computer for each cage in the system. NUMID is the link to all other records in the system of ORACLE tables for a specific cage.

INDIV CHAR(1) NOT NULL

Individual animal in the cage (range 1 to 5), as described for Table EXIT.

TRANS DATE NOT NULL

Date slides were read or pathologist's report was dated; official closing date.

PRO CHAR(2) NOT NULL

Two initials of the pathologist who read the slides.

TDEATH CHAR(1) NOT NULL

Letter "T" designates that the cause of death was a tumor; letter "N" designates a that the cause of death was a nontumor.

Table MICFIND

This table contains the histopathological diagnoses coded on the third page of the necropsy report (see Appendix C). The COMMENT and METORIG columns are on separate lines because of the number of characters allowed for the COMMENT; these columns may be null.

```
 NUMID I L CODE TOPO  MORPH  H
--------- - - ---- ----- ------ -
CMT
-------------------------------------------------------------------------------
METOR
-----
  6603 1 L TLLS 05000 M96993 H
```

Table Columns Description

NUMID NUMBER(5) NOT NULL

Originates in Table GENERAL and is the archival number generated by the computer for each cage in the system. NUMID is the link to all other records in the system of ORACLE tables for a specific cage.

INDIV CHAR(1) NOT NULL

Individual animal in the cage (range 1 to 5), as described for Table EXIT.

LTH CHAR(1)

Code indicating lethality of the lesion:

L	Lethal
C	Contributory
N	Noncontributory
Blank	For missing part codes used in MICRO findings

CODE CHAR(4) NOT NULL

Four-letter JANUS mouse MICRO code assigned by pathologist.

TOPO CHAR(5)

Topography of lesion; five-character SNOMED code (numeric). The code is entered by the computer when the letter code for the lesion is entered.

MORPH CHAR(6)

Morphology of lesion; six-character SNOMED code (alphanumeric). The code is entered by the computer when the letter code for the lesion is entered.

HIST CHAR(1)

Letter "H" if a histological examination of tissue was done.

Table MICFIND (continued)

CMT CHAR(240)

Comment; additional information regarding the lesion.

METORIG CHAR(5)

Topography of the metastatic origin; five-character SNOMED code (numeric). The code is entered by the computer when the letter code for the metastatic lesion is entered.

Table NEXT_NUMID

This table contains the sequential numbers assigned to GENERAL.NUMID.

NUMVAL
16000

Table Columns Description

NUMVAL NUMBER(5)
Number assigned to GENERAL.NUMID when a new cage of animals enters the database system. This number is incremented by one with each new cage.

Table ROOMDEF

This table describes the animal rooms.

ROOM	S	B	E	NOPOSN
E129	L	A	G	21

Table Columns Description

ROOM CHAR(4) NOT NULL

Room number (e.g., E129).

SUBSEC CHAR(1) NOT NULL

Section of the room: L = Left side, R = Right side.

BEGLET CHAR(1) NOT NULL

Beginning letter of a contiguous set of shelves that will have the same number of positions (ROOMDEF.NOPOSN) on each shelf.

ENDLET CHAR(1) NOT NULL

End letter of a contiguous set of shelves that will have the same number of positions (ROOMDEF.NOPOSN) on each shelf.

NOPOSN NUMBER(2) NOT NULL

Number of positions on the shelves defined by the range ROOMDEF.BEGLET and ROOMDEF.ENDLET.

Table ROOMOCC

This table contains the identification of the animals located in certain positions in the animal rooms. This table only contains records when experiments are being conducted and as long as a cage occupies the space; there are no experiments in progress at this time.

NUMID	SEQ	NUM	ROOM	S	POSN	TRANS	R

No rows selected

Table Column Description

NUMID NUMBER(5) NOT NULL

Originates in Table GENERAL and is the archival number generated by the computer for each cage in the system. NUMID is the link to all other records in the system of ORACLE tables for a specific cage.

SEQ NUMBER(2) NOT NULL

Sequence number (range of 1 to n). Each time a HISTORY record with the same NUMID is created, the sequence number is incremented by one. All previous HISTORY records are maintained in the database. This gives an ordered trail of cage movement.

NUM NUMBER(1) NOT NULL

Number of animals in the cage.

ROOM CHAR(4) NOT NULL

Room number (e.g., E129).

SHELF CHAR(1) NOT NULL

Shelf letter (range A to Z).

POSN NUMBER(2) NOT NULL

Position number on the shelf.

TRANS DATE

Transaction date. This date first signifies when the cage occupies the above ROOM-SHELF-POSN and later is modified as each animal exits the cage.

RELOC CHAR(1)

Flag to indicate whether the cage is in the process of being relocated. If RELOC contains the letter "R," then the cage is under relocation; otherwise, RELOC will be null.

Table FILE_SEQNOS

This table contains information used in setting up new experiments and the room assignments for these animals.

ASSMNT	RELOCATE	LABELS
8	3	10

Table Columns Description

ASSMNT NUMBER(5)

Sequence number ASSMNT is used to identify a particular assignment file created by program JNRMMNG (JANUS ANIMAL ROOM MANAGEMENT). The file is called JNRMMNG_ASSIGN_xxxxx.OUT, where xxxxx is the ASSMNT value. ASSMNT is incremented accordingly by program JNRMMNG.

RELOCATE NUMBER(5)

Sequence number RELOCATE is used to identify a particular relocation file created by program JNRMMNG (JANUS ANIMAL ROOM MANAGEMENT). The file is called JNRMMNG_RELOCATE_yyyyy.OUT, where yyyyy is the RELOCATE value. RELOCATE is incremented accordingly by program JNRMMNG.

LABELS NUMBER(5)

Sequence number LABELS is used to identify a particular labels file created by program JNRMMNG (JANUS ANIMAL ROOM MANAGEMENT). The file is called JNRMMNG_LABELS_zzzzz.OUT, where zzzzz is the LABEL value. LABEL is incremented accordingly by program JNRMMNG.

APPENDIX J:

JANUS RADIATION PROTOCOL

APPENDIX J:

JANUS RADIATION PROTOCOL

Expt. No. (JM-)	Treatment Code	Radiation Quality[a]	cGy (total)	Time (min)	Fractions	Fraction/ Unit Time[b]	No. of Repeats	Comments
2	AC	C	0	15	72	3/w		
2	DC	C	0	45	24	1/w		
2	EC	C	0	360	24	1/w		
2	HC	C	0	180	6	1/m		
2	S0	C	0	20	1			
2	AI	G	855	15	72	3/w		
2	BI	G	855	45	24	1/w		
2	DI	G	1110	45	24	1/w		
2	EI	G	855	360	24	1/w		
2	HI	G	855	180	6	1/m		
2	S1	G	90	20	1			
2	S2	G	268	20	1			
2	S3	G	788	20	1			
2	Y2	G	268	20	1			Age 194 d
2	Y3	G	788	20	1			Age 194 d
2	Z2	G	268	20	1			Age 287 d
2	Z3	G	788	20	1			Age 287 d
2	AI	N	240	15	72	3/w		
2	BI	N	240	45	24	1/w		
2	DI	N	80	45	24	1/w		
2	EI	N	240	360	24	1/w		
2	HI	N	240	180	6	1/m		
2	S1	N	20	20	1			
2	S2	N	80	20	1			
2	S3	N	240	20	1			
2	Y2	N	80	20	1			Age 194 d
2	Y3	N	240	20	1			Age 194 d
2	Z2	N	80	20	1			Age 287 d
2	Z3	N	240	20	1			Age 287 d
3	S0	C	0	20	1			
3	S4	G	90	20	1			
3	S5	G	143	20	1			Females discarded
3	S6	G	206	20	1			Females discarded
3	S7	G	417	20	1			
3	S8	G	569	20	1			Some females discarded
3	S4	N	20	20	1			
3	S5	N	40	20	1			Females discarded
3	S6	N	60	20	1			Females discarded
3	S7	N	120	20	1			Females discarded
3	S8	N	160	20	1			
3	SL	N	240	480	1			Males; no MICROS
3	SH	N	240	20	1			Males; no MICROS
4	K0	C	0	45	24	1/w		
4	K1	G	206	45	24	1/w		Females reassigned
4	K2	G	417	45	24	1/w		
4	K3	G	959	45	24	1/w		Females reassigned
4	K4	G	1919	45	24	1/w		Most females reassigned
4	K5	G	3820	45	24	1/w		Males & a few females; no MICROS
4	K6	G	5111	45	24	1/w		No MICROS
4	K1	N	20	45	24	1/w		
4	K2	N	40	45	24	1/w		Females reassigned

Expt. No. (JM-)	Treatment Code	Radiation Quality[a]	cGy (total)	Time (min)	Fractions	Fraction/ Unit Time[b]	No. of Repeats	Comments
4	K3	N	60	45	24	1/w		Females reassigned
4	K4	N	120	45	24	1/w		Females reassigned
4	K5	N	168	45	24	1/w		
4	K6	N	320	45	24	1/w		Females reassigned
4	L0	C	0	1320	5	5/w	23	Males
4	LC	C	0	1320	5	5/w	59	Males
4	L1	G	206	1320	5	5/w	23	Males
4	L2	G	417	1320	5	5/w	23	Males
4	L3	G	959	1320	5	5/w	23	Males
4	L4	G	1918	1320	5	5/w	23	Males
4	L5	G	529	1320	5	5/w	59	Males
4	L6	G	1070	1320	5	5/w	59	Males
4	L7	G	2460	1320	5	5/w	59	Males
4	W0	C	0	45	24	1/w		Females; no MICROS
4	W1	G	807	45	24	1/w		Females; no MICROS
4	W2	G	2690	45	24	1/w		Females; no MICROS
4	W1	N	80	45	24	1/w		Females; no MICROS
4	W2	N	240	45	24	1/w		Females; no MICROS
7	00	C	0	20	0			
7	Q1	G	417	45	60	1/w		MICROS of males only
7	Q2	G	1918	45	60	1/w		MICROS of males only
7	Q1	N	40	45	60	1/w		MICROS of males only
7	Q2	N	160	45	60	1/w		MICROS of males only
7	R1	G	206	20	1			Age at start 515 d
7	R2	G	569	20	1			Age at start 515 d
7	R1	N	40	20	1			Age at start 515 d
7	R2	N	160	20	1			Age at start 515 d
8	U0	C	0	45	999	1/w		MICROS of males and females
8	U1	G	6.95	45	999	1/w		MICROS of males only
8	U2	G	17.38	45	999	1/w		MICROS of males only
8	U3	G	31.9	45	999	1/w		Males & a few females; no MICROS
8	U1	N	0.667	45	999	1/w		MICROS of males and females
8	U2	N	1.67	45	999	1/w		Males & a few females; no MICROS
8	U3	N	2.67	45	999	1/w		Males & a few females; no MICROS
9	XC	C	0	20	1			Females
9	X0	C	0	45	1			No MICROS
9	XX	C	0	45	24	1/w		Females; no MICROS
9	X1	G	22.5	20	1			Females
9	X2	G	45	20	1			Females
9	X3	G	90	20	1			Females
9	XX	N	10	45	24	1/w		Females; no MICROS
9	X2	N	5	5	1			Females; no MICROS
9	X3	N	10	10	1			No MICROS
9	X4	N	1	20	1			Females
9	X5	N	2.5	20	1			Females
9	X6	N	5	20	1			Females
9	X7	N	10	20	1			Females
9	X8	N	20	20	1			Females
9	X9	N	40	20	1			Females
10	V0	C	0	45	24	1/w		*P. leucopus* males; no MICROS

Expt. No. (JM-)	Treatment Code	Radiation Quality[a]	cGy (total)	Time (min)	Fractions	Fraction/ Unit Time[b]	No. of Repeats	Comments
10	W0	C	0	20	1			*P. leucopus* males; no MICROS
10	V1	G	90	20	1			*P. leucopus* males; no MICROS
10	V2	G	143	20	1			*P. leucopus* males; no MICROS
10	V3	G	206	20	1			*P. leucopus* males; no MICROS
10	V4	G	417	20	1			*P. leucopus* males; no MICROS
10	VV	N	40	45	24	1/w		*P. leucopus* males; no MICROS
10	V1	N	20	20	1			*P. leucopus* males; no MICROS
10	V2	N	40	20	1			*P. leucopus* males; no MICROS
10	V3	N	80	20	1			*P. leucopus* males; no MICROS
10	V4	N	160	20	1			*P. leucopus* males; no MICROS
10	VW	N	160	45	24	1/w		*P. leucopus* males; no MICROS
12	J0	C	0		0			Males; no MICROS
12	J1	N	240	20	1	1/w		Males; no MICROS
12	J2	N	240	20	2	1/w		Males; no MICROS
12	J4	N	240	20	4	1/w		Males; no MICROS
12	J6	N	240	20	6	1/w		Males; no MICROS
13	0A	C	0	20	60	1/w		
13	0B	C	0	20	60	1/w		
13	0C	C	0	20	60	1/w		
13	0X[c]	C	0	20	60	1/w		
13	1A	G	100	20	60	1/w		
13	1B	G	100	20	60	1/w		
13	1C	G	100	20	60	1/w		
13	1X[c]	G	100	20	60	1/w		
13	2A	G	200	20	60	1/w		
13	2X[c]	G	200	20	60	1/w		
13	3A	G	300	20	60	1/w		
13	3X[c]	G	300	20	60	1/w		
13	4A	G	450	20	60	1/w		
13	4X[c]	G	450	20	60	1/w		
13	5A	G	600	20	60	1/w		
13	5X[c]	G	600	20	60	1/w		
13	1A	N	2	20	60	1/w		
13	1B	N	2	20	60	1/w		
13	1C	N	2	20	60	1/w		
13	1X[c]	N	2	20	60	1/w		
13	2A	N	7.5	20	60	1/w		
13	2X[c]	N	7.5	20	60	1/w		
13	3A	N	13.5	20	60	1/w		
13	3X[c]	N	13.5	20	60	1/w		
13	4A	N	21	20	60	1/w		
13	4X[c]	N	21	20	60	1/w		
13	5A	N	30	20	60	1/w		
13	5X[c]	N	30	20	60	1/w		
13	6A	N	40	20	60	1/w		
13	6X[c]	N	40	20	60	1/w		

Expt. No. (JM-)	Treatment Code	Radiation Quality[a]	cGy (total)	Time (min)	Fractions	Fraction/ Unit Time[b]	No. of Repeats	Comments
14	0P	C	0	20	1			WR-2721
14	0S	C	0	20	1			Saline
14	C0	G	206	20	1			No Injection
14	CP	G	206	20	1			WR-2721
14	DP	G	417	20	1			WR-2721
14	A0	N	10	20	1			No Injection
14	AP	N	10	20	1			WR-2721
14	AR	N	10	20	1			WR-151327
14	BP	N	40	20	1			WR-2721
14	BR	N	40	20	1			WR-151327

[a] C = control; G = γ ray; N = neutron.

[b] w = week; m = month.

[c] In experiment JM-13, an _X code designates the total number of records of all the parts (A + B + C, or only A) of the numbered treatment set.

APPENDIX K:

COMBINED PATHOLOGY DATABASE <E>: MACRO AND MICRO GLOSSARIES

Combined Pathology Database <E>

MACRO Glossary

Group 1 <CDU> Cause of death undetermined

CDU	Cause of death undetermined

Tumor Codes

Group 2 <LR_T> Lymphoreticular tumors

NTYG	Non-thymic lymphoma, generalized
NTYL	Non-thymic lymphoma, localized
TTYG	Thymic lymphoma, generalized
TTYL	Thymic lymphoma, localized

Group 3 <TVAS> Vascular tumors

TVAS	Vascular

Group 4 <TCON> Connective tissue tumors other than lymphoreticular and vascular tumors

TBON	Bone
TBRN	Brain
TCNS	Central nervous system
TCON	Connective tissue (fibrosarcoma)
THRT	Heart
TMIC	Miscellaneous connective tissue
TMIN	Miscellaneous nervous system
TMUS	Muscle
TPNS	Peripheral nervous system
TSPL	Spleen

Group 5 <TADN> Respiratory system tumors

TADN	Lung
TMIL	Miscellaneous lung

Group 6 <TGA_> Harderian gland tumors

THGL	Harderian gland

<E> MACRO Glossary (Cont.)

Group 7 <TLIV> Liver and gallbladder tumors

TGBL	Gallbladder
TLIV	Liver

Group 8 <TKID> Kidney and urinary bladder tumors

TBLA	Urinary bladder
TKID	Kidney
TMUG	Miscellaneous urogenital

Group 9 <TGI_> Gastrointestinal tract tumors

TCEC	Caecum
TCOL	Colon
TDUO	Duodenum
TESO	Esophagus
TILE	Ileum
TJEJ	Jejunum
TMID	Miscellaneous digestive system
TPAN	Pancreas
TPYL	Pylorus
TSGL	Salivary gland
TSTO	Stomach
TTGE	Tongue

Group 10 <TADR> Adrenal gland tumors

TADR	Adrenal

Group 11 <TPIT> Pituitary gland tumors

TPIT	Pituitary

Group 12 <TTHY> Thyroid gland tumors

TTRD	Thyroid

Group 13 <TTA_> Testis and seminal vesicle tumors

TSMV	Seminal vesicle
TTST	Testis
TCGL	Cowper's gland
TEPI	Epididymis

<E> MACRO Glossary (Cont.)

Group 14 <TMAM> Mammary gland tumors

TMGL Mammary gland

Group 15 <TUTE> Uterine tumors

TUTE Uterus

Group 16 <TOVE> Ovarian tumors

TOVE Ovary

Group 17 <TEPO> Skin and other epithelial tumors

THIB Hibernating gland
TMIE Miscellaneous endocrine
TMIG Miscellaneous glandular
TPPT Preputial gland
TPST Prostate
TSKN Skin
TVAG Vagina

Group 18 <TWCN> Secondary tumors, any site, origin connective tissue

TSEC Secondary

Group 19 <T_WG> Secondary tumors, any site, origin Harderian gland

TSEC Secondary

Group 20 <T_WR> Secondary tumors, any site, origin lung

TSEC Secondary

Group 21 <TWEP> All other secondary tumors, any site of origin

TSEC Secondary

Nontumor Codes

Group 22 <MHEP> Liver diseases

CHO Cholecystitis
CIR Cirrhosis
HEP Hepatitis

<E> MACRO Glossary (Cont.)

Group 23 <MPNU> Pulmonary diseases

EMP	Emphysema
LOB	Lobar pneumonia
MIL	Miscellaneous lung
PNC	Pneumonitis
PNU	Pneumonia

Group 24 <MCVD> Cardiovascular diseases

MYO	Myocardium
PCD	Pericardium
THR	Thrombus

Group 25 <MCRD> Renal diseases

CRD	Chronic renal disease
HNP	Hydronephrosis
MIR	Miscellaneous renal
PCK	Polycystic kidney

Group 26 <MOCY> Ovarian cyst

CYS	Cyst

Group 27 <MAMY> Amyloidosis

AMY	Amyloid

Group 28 <O_NT> All other nontumor diseases

ABS	Abscess
ACI	Acute infection
ADH	Adhesion
ADR	Adrenal
ANE	Anemia
ANU	Aneurysm
ASC	Ascites
BAC	Bacteremia
BDY	Bloody - HTX or ASC
BLA	Urinary bladder
BON	Bone
BRN	Brain
BSC	Bloody ascites
CAE	Caecum
CAL	Calcification

<E> MACRO Glossary (Cont.)

CAT	Cataract
CGL	Cowper's gland
CLI	Calculi
CLR	Clear HTX or ASC
CNS	Central nervous system
COL	Colon
DER	Dermatitis
DHY	Dehydration
DIV	Diverticulum
DUO	Duodenum
EDA	Edema
EMB	Embolus
ENT	Enteritis
EPL	Epilation
ESO	Esophagus
FIT	Fighting
GBL	Gallbladder
GEN	External genitalia
GON	Gonad
GRY	Grayness
HEM	Hematoma
HGL	Harderian gland
HRG	Hemorrhage
HRT	Heart
HTX	Hydrothorax
ILE	Ileum
INF	Inflammation
INT	Intussusception
ISO	Isograft
JAU	Jaundice
JEJ	Jejunum
KID	Kidney
LIV	Liver
MAL	Malocclusion
MET	Metritis
MGC	Megacolon
MGL	Mammary gland
MIC	Miscellaneous circulatory
MID	Miscellaneous digestive
MIG	Miscellaneous urogenital
MIS	Others, general
MKY	Milky
MSC	Milky ascites
NEC	Necrosis
OBE	Obese
OBS	Obstruction

<E> MACRO Glossary (Cont.)

OVE	Ovary
PAN	Pancreatitis
PAR	Paralysis
PEN	Penis
PER	Peritonitis
PGL	Preputial gland
PIT	Pituitary
PRF	Perforation
PRO	Prolapse
PST	Prostate
SEM	Seminal vesicle
SGL	Salivary gland
SPL	Spleen
STO	Stomach
TEP	Testis and epididymis
TGE	Tongue
TRD	Thyroid
TWI	Twister
TYP	Typhlitis
ULC	Ulcer
UTE	Uterus
VAG	Vagina
VOL	Volvulus

Combined Pathology Database <E>

MICRO Glossary

Group 1 <CDU> Cause of death undetermined

MCDU Cause of death undetermined

Tumor Codes

Group 2 <LR_T> Lymphoreticular tumors

TLHL	Histiocytic leukemia
TLHS	Histiocytic lymphoma (reticulum cell tumor, type A)
TLLL	Lymphocytic-lymphoblastic leukemia
TLLS	Lymphocytic-lymphoblastic lymphoma
TLML	Myelogenous leukemia
TLPS	Plasma cell tumor
TLSL	Undifferentiated leukemia
TLSS	Undifferentiated lymphoma
TLUS	Unclassified lymphoma
TLXL	Mixed histiocytic-lymphocytic leukemia
TLXS	Mixed histiocytic-lymphocytic lymphoma (RCT, type B)

Group 3 <TVAS> Vascular tumors

TEVO	Hemangioma, spleen
TLVO	Hemangioma, lymphoreticular tissue
TOVO	Hemangioma, ovary
THVO	Hemangioma, liver
TCVO	Hemangioma, connective tissue
TMVO	Hemangioma, muscle
TBVO	Hemangioma, sternal marrow
TIVO	Hemangioma, gastrointestinal tract
TDVO	Hemangioma, urinary bladder
TUVO	Hemangioma, uterus
TAVO	Hemangioma, adrenal
TTVO	Hemangioma, testis
TEVS	Angiosarcoma, spleen
TLVS	Angiosarcoma, lymph node
TRVS	Angiosarcoma, lung
TOVS	Angiosarcoma, ovary
TKVS	Angiosarcoma, kidney
THVS	Angiosarcoma, liver
TCVS	Angiosarcoma, connective tissue
TMVS	Angiosarcoma, muscle
TBVS	Angiosarcoma, bone
TSVS	Angiosarcoma, skin

<E> MICRO Glossary (Cont.)

TIVS	Angiosarcoma, gastrointestinal tract
TDVS	Angiosarcoma, urinary bladder
TUVS	Angiosarcoma, uterus
TPVS	Angiosarcoma, pituitary
TTVS	Angiosarcoma, testis
TVVS	Angiosarcoma, seminal vesicle
TNVS	Angiosarcoma, nervous system
TYVS	Angiosarcoma, heart
TXVS	Angiosarcoma, site specified in comment

Group 4 <TCON> Connective tissue tumors other than lymphoreticular and vascular tumors

TEFS	Fibrosarcoma, spleen
TKFS	Fibrosarcoma, kidney
TLFS	Fibrosarcoma, lymph node, site specified in comment
THFO	Fibroma, liver
TCFO	Fibroma, connective tissue
TCFS	Fibrosarcoma, connective tissue
TCSS	Undifferentiated connective tissue sarcoma
TMFS	Fibrosarcoma, muscle
TMSS	Undifferentiated sarcoma, muscle
TBFS	Fibrosarcoma, bone
TSFS	Fibrosarcoma, skin
TSSS	Undifferentiated sarcoma, skin
TIFO	Fibroma, gastrointestinal tract
TIFS	Fibrosarcoma, gastrointestinal tract
TDFS	Fibrosarcoma, urinary bladder
TUFO	Fibroma, uterus
TUUS	Sarcoma, uterus, undetermined type
TTFA	Fibroma, testis
TTFS	Fibrosarcoma, testis
TVFO	Fibroma, seminal vesicle
TVFS	Fibrosarcoma, seminal vesicle
TVSS	Undifferentiated sarcoma, seminal vesicle
TNFO	Fibroma, nervous system
TNMS	Meningeal sarcoma, nervous system
TYFS	Fibrosarcoma, heart
TXFS	Fibrosarcoma, site specified in comment
TXUS	Undifferentiated sarcoma, site specified in comment
TCMS	Mast cell tumor, connective tissue
TCOO	Osteoma, connective tissue
TMLS	Leiomyosarcoma, muscle
TMRO	Rhabdomyoma, muscle
TMRS	Rhabdomyosarcoma, muscle
TMSO	Leiomyoma, muscle

<E> MICRO Glossary (Cont.)

TBCS	Chondrosarcoma, bone
TBOO	Osteoma, bone
TBOS	Osteosarcoma, bone
TBUS	Odontogenic sarcoma, bone
TINO	Neurilemmoma, gastrointestinal tract
TISO	Leiomyoma, gastrointestinal tract
TISS	Leiomyosarcoma, gastrointestinal tract
TDLS	Leiomyosarcoma, urinary bladder
TULO	Leiomyoma, uterus
TULS	Leiomyosarcoma, uterus
TUNO	Neurilemmoma, uterus
TNAS	Astyrocytoma, nervous system
TNNB	Ependymoma, nervous system
TNNO	Peripheral nerve neurilemmoma (neurofibroma), nervous system
TNNS	Peripheral nerve neurofibrosarcoma, nervous system
TNOS	Oligodendroglioma, nervous system
TNPO	Papilloma, choroid plexus, nervous system
TNUS	Undifferentiated tumor, nervous system
TNXS	Glioma, mixed, nervous system
TYCS	Chondrosarcoma, heart
TYRO	Rhabdomyoma, heart
TYRS	Rhabdomyosarcoma, heart
TXFA	Fibroadenoma, site specified in comment
TXLS	Leiomyosarcoma, site specified in comment

Group 5 <TADN> Respiratory system tumors

TRAA	Alveologenic adenoma
TRAC	Alveologenic adenocarcinoma
TRCO	Cystadenoma

Group 6 <TGA> Harderian gland tumors

TGAC	Adenocarcinoma
TGAO	Papillary cystadenoma
TGSC	Undifferentiated tumor

Group 7 <TLIV> Liver and gallbladder tumors

THAA	Adenoma (hepatoma)
THAC	Hepatocarcinoma
THAO	Hyperplastic nodule (pre-neoplastic nodule)
THCC	Cholangiocarcinoma
THCO	Cholangioma (cholangiomatosis)

<E> MICRO Glossary (Cont.)

Group 8 <TKID> Kidney and urinary bladder tumors

Kidney

TKAA	Renal adenoma
TKAC	Renal tubular tumor (adenocarcinoma)
TKCA	Cystadenoma
TKPA	Renal adenoma (papillary)
TKTC	Renal pelvic transitional cell tumor

Urinary bladder

TDEC	Squamous cell carcinoma
TDTC	Transitional cell carcinoma

Group 9 <TGI_> Gastrointestinal tract tumors

TIAC	Adenocarcinoma
TIAO	Adenoma
TIEC	Squamous cell carcinoma
TIPL	Polyp (plaque), pyloric region
TIPO	Polyps
TISC	Undifferentiated carcinoma

Group 10 <TADR> Adrenal gland tumors

TACC	Cortical carcinoma
TACO	Cortical adenoma
TAUO	Tumor (undetermined cell type)
TANS	Medullary neuroblastoma/ganglioneuroma
TAPS	Medullary pheochromocytoma

Group 11 <TPIT> Pituitary gland tumors

TPAA	Acidophilic adenoma
TPAC	Carcinoma
TPAO	Adenoma

Group 12 <TTHY> Thyroid gland tumors

TZAC	Adenocarcinoma
TZAO	Adenoma

Group 13 <TTA_> Testis and seminal vesicle tumors

Testis

TTAC	Carcinoma
TTGC	Seminoma

<E> MICRO Glossary (Cont.)

TTIO	Interstitial cell tumor (Leydig)
TTKC	Sertoli cell tumor
TTQC	Embryonal carcinoma

Seminal vesicle

TVAO	Adenoma
TVUO	Tumor (undetermined cell type)

Group 14 <TMAM> Mammary gland tumors

TMAA	Adenocarcinoma A (alveolar)
TMAB	Adenocarcinoma B (ductal, predominantly)
TMAC	Adenocarcinoma C (fibrosarcoma)
TMAT	Adenoacanthoma
TMUO	Mammary gland tumor (undetermined type)

Group 15 <TUTE> Uterine tumors

TUAC	Adenocarcinoma
TUAO	Adenoma (including papillary type)
TUEC	Squamous cell carcinoma

Group 16 <TOVE> Ovarian tumors

TOAC	Adenocarcinoma
TOAO	Adenoma (also papillary adenoma)
TOCO	Cystadenoma
TOGC	Granulosa cell tumor
TOPA	Papillary adenoma
TOSC	Undifferentiated carcinoma
TOTA	Tubular adenoma
TOTO	Luteoma (thecoma)

Group 17 <TEPO> Skin and other epithelial tumors

Skin

TSAO	Adenoma
TSBC	Basal cell carcinoma (hair follicle tumor)
TSDO	Sebaceous gland adenoma
TSEC	Squamous cell carcinoma
TSPO	Papilloma

Rare tissues with tumors

TXAC	Adenocarcinoma
TXAO	Adenoma, site specified in comment
TXEC	Squamous cell carcinoma, site specified in comment

<E> MICRO Glossary (Cont.)

Group 18 <TWCN> Secondary tumors, any site, origin connective tissue tumor

Lymphoreticular tissue
- TLWB Origin, bone
- TLWC Origin, connective tissue
- TLWM Origin, muscle
- TLWN Origin, nervous system
- TLWY Origin, heart

Lung
- TRWB Origin, bone
- TRWC Origin, connective tissue
- TRWN Origin, nervous system
- TRWY Origin, heart

Ovary
- TOWB Origin, bone

Kidney
- TKWB Origin, bone
- TKWC Origin, connective tissue
- TKWN Origin, nervous system

Liver
- THWB Origin, bone
- THWC Origin, connective tissue
- THWM Origin, muscle
- THWN Origin, nervous system
- THWY Origin, heart

Connective tissue
- TCWB Origin, bone
- TCWN Origin, nervous tissue

Muscle
- TMWB Origin, bone
- TMWC Origin, connective tissue
- TMWN Origin, nervous system

Bone
- TBWM Origin, muscle
- TBWN Origin, nervous tissue

<E> MICRO Glossary (Cont.)

Skin
- TSWB Origin, bone
- TSWC Origin, connective tissue
- TSWN Origin, nervous system

Gastrointestinal tract
- TIWB Origin, bone

Adrenal
- TAWM Origin, muscle

Harderian gland
- TGWC Origin, connective tissue

Nervous system
- TNWB Origin, bone
- TNWC Origin, connective tissue
- TNWM Origin, muscle

Heart
- TYWB Origin, bone
- TYWM Origin, muscle
- TYWC Origin, connective tissue

Rare tissues with tumors
- TXWB Origin, bone
- TXWC Origin, connective tissue
- TXWM Origin, muscle

Spleen
- TEWB Origin, bone
- TEWC Origin, connective tissue
- TEWM Origin, muscle

Group 19 <T_WG> Secondary tumors, any site, origin Harderian gland

- TLWG Lymphoreticular tissue
- TRWG Lung
- TKWG Kidney
- THWG Liver
- TCWG Connective tissue
- TMWG Muscle
- TBWG Bone
- TNWG Nervous system
- TXWG Rare tissues
- TYWG Heart

<E> MICRO Glossary (Cont.)

Group 20 <T_WR> Secondary tumors, any site, origin lung

TLWR	Lymphoreticular tissue
TKWR	Kidney
THWR	Liver
TCWR	Connective tissue
TMWR	Muscle
TBWR	Bone
TAWR	Adrenal
TNWR	Nervous system
TYWR	Heart
TXWR	Rare tissues

Group 21 <TWEP> All other secondary tumors, any site

Spleen

TEWD	Origin, urinary bladder
TEWH	Origin, liver
TEWK	Origin, kidney
TEWS	Origin, skin
TEWT	Origin, testis
TEWU	Origin, uterus

Lymphoreticular tissue

TLWA	Origin, adrenal
TLWH	Origin, liver
TLWI	Origin, intestinal tract
TLWK	Origin, kidney
TLWO	Origin, ovary
TLWP	Origin, pituitary
TLWS	Origin, skin
TLWT	Origin, testis
TLWU	Origin, uterus
TLWZ	Origin, thyroid

Lung

TRWA	Origin, adrenal
TRWH	Origin, liver
TRWI	Origin, intestinal tract
TRWK	Origin, kidney
TRWO	Origin, ovary
TRWP	Origin, pituitary
TRWS	Origin, skin
TRWT	Origin, testis
TRWU	Origin, uterus

<E> MICRO Glossary (Cont.)

TRWV	Origin, seminal vesicle
TRWZ	Origin, thyroid

Kidney

TKWA	Origin, adrenal
TKWH	Origin, liver
TKWI	Origin, intestinal tract
TKWO	Origin, ovary
TKWP	Origin, pituitary
TKWS	Origin, skin
TKWU	Origin, uterus
TKWZ	Origin, thyroid

Liver

THWA	Origin, adrenal
THWD	Origin, urinary bladder
THWI	Origin, intestinal tract
THWK	Origin, kidney
THWO	Origin, ovary
THWP	Origin, pituitary
THWS	Origin, skin
THWU	Origin, uterus
THWV	Origin, seminal vesicle
THWZ	Origin, thyroid

Connective tissue

TCWA	Origin, adrenal
TCWD	Origin, urinary bladder
TCWH	Origin, liver
TCWI	Origin, intestinal tract
TCWK	Origin, kidney
TCWO	Origin, ovary
TCWP	Origin, pituitary
TCWS	Origin, skin
TCWZ	Origin, thyroid

Muscle

TMWA	Origin, adrenal
TMWD	Origin, urinary bladder
TMWH	Origin, liver
TMWK	Origin, kidney
TMWM	Origin, mammary gland
TMWS	Origin, skin
TMWT	Origin, testis
TMWZ	Origin, thyroid

<E> MICRO Glossary (Cont.)

Bone
- TBWS Origin, skin

Gastrointestinal tract
- TIWO Origin, ovary
- TIWT Origin, testis
- TIWU Origin, uterus
- TIWZ Origin, thyroid

Uterus
- TUWO Origin, ovary

Adrenal
- TAWI Origin, intestine
- TAWK Origin, kidney
- TAWO Origin, ovary
- TAWS Origin, skin
- TAWU Origin, uterus
- TAWZ Origin, thyroid

Heart
- TYWA Origin, adrenal
- TYWH Origin, liver
- TYWK Origin, kidney
- TYWO Origin, ovary
- TYWS Origin, skin
- TYWT Origin, testis
- TYWU Origin, uterus

Rare tissues with tumors
- TXWU Origin, uterus
- TXWV Origin, seminal vesicle

Seminal vesicle
- TVWD Origin, urinary bladder

Harderian gland
- TGWS Origin, skin

Nervous system
- TNWK Origin, kidney
- TNWO Origin, ovary
- TNWS Origin, skin
- TNWP Origin, pituitary

<E> MICRO Glossary (Cont.)

Rare tissues with tumors

TXWI	Origin, gastrointestinal tract
TXWK	Origin, kidney
TXWO	Origin, ovary
TXWP	Origin, pituitary
TXWS	Origin, skin

Nontumor Codes

Group 22 <MHEP> Liver diseases

MHCN	Hepatitis, coagulative - focal
MHCY	Hepatic cyst
MHHD	Hepatic, hydropic degeneration
MHIA	Hepatitis, acute
MHIC	Hepatitis, chronic
MHIT	Hepatitis, toxic
MHLD	Lipidosis (fatty metamorphosis)

Group 23 <MPNU> Pulmonary diseases

MPNC	Lung congestion
MPNI	Pneumonitis (interstitial), acute and chronic
MPNU	Pneumonia, acute and subacute
MRMP	Murine pneumonia

Group 24 <MCVD> Cardiovascular diseases

MECA	Acute endocarditis
MECC	Chronic endocarditis (valvular)
MMCA	Acute myocarditis
MMCC	Chronic myocarditis
MPAN	Pan/polyarteritis nodosa
MPCA	Acute pericarditis
MPCC	Chronic pericarditis
MTHR	Thrombosis, auricular

Group 25 <MCRD> Renal diseases

MCRD	Chronic renal disease, unspecified
MINA	Interstitial nephritis, acute
MINC	Interstitial nephritis, chronic
MPNE	Pyelonephritis, acute
MPNP	Pyelonephritis (pyonephritis)

<E> MICRO Glossary (Cont.)

Group 26 <MOCY> Ovarian cyst

MOCY	Ovary or testicle, cystic

Group 27 <MAMY> Amyloidosis

MATA	Amyloidosis, one or more organs involved

Group 28 <O_NT> Other nontumor diseases

Skin

MSDA	Dermatitis, acute
MSDC	Dermatitis, chronic
MSKA	Acanthosis

Digestive

MEIC	Oesophagitis, chronic

Jejunum_/Ileum_/Duodenum_/Colon_/Caecum

MICY	Cyst, site specified in comment
MIFC	Fatty change, site specified in comment
MIIA	Enteritis, acute, site specified in comment
MIIC	Enteritis, chronic, site specified in comment

Colon

MCLC	Colitis, chronic
MCMZ	Parasite, metazoan

Salivary glands

MSAA	Sialadenitis, acute
MSAC	Sialadenitis, chronic
MSGF	Fibrosis

Harderian gland

MGAA	Acute inflammation
MGAC	Chronic inflammation
MGGF	Fibrosis

Pancreas

MPNA	Pancreatitis, acute

Ureter

MURA	Ureteritis, acute
MURC	Ureteritis, chronic
MURH	Ureteral epithelial hyperplasia

<E> MICRO Glossary (Cont.)

Urinary bladder
- MUCA Urinary cystitis, acute
- MUCC Urinary cystitis, chronic

Prostate
- MPRA Prostatitis, acute
- MPRH Prostatic hyperplasia
- MPRS Prostatic stasis

Seminal vesicles
- MSVA Acute inflammation
- MSVH Hyperplasia
- MSVS Stasis

Testis/ovary
- MOAT Ovarian or testicular atrophy
- MOIA Acute infection

Uterus
- MMCH Uterine cystic hyperplasia
- MMTA Metritis, acute
- MMTC Metritis, chronic

Mammary glands
- MMDE Mammary, ductal ectasia (galactocoele)
- MMMA Acute inflammation (mastitis)
- MMMC Chronic inflammation (including subacute)

Adrenal cortex
- MABA Ceroid, or brown, atrophy
- MACN Coagulation necrosis, zone specified in comment
- MAZG Metaplasia, zona glomerulosa
- MAZX Fibrosis, reticular zone ("X-zone")

Parathyroid
- MPTH Hypertrophy, hyperplasia

Thyroid
- MSTA Thyroiditis, acute
- MSTH Hyperplasia

Bone marrow
- MBMZ Atrophic or aplastic

<E> MICRO Glossary (Cont.)

Spleen
- MSCN Coagulation necrosis
- MSLC Lymphoid hyperplasia
- MSPZ Atrophic or aplastic

Lymph nodes
- MADM Mesenteric lymph node, or mesenteric disease
- MADS Submaxillary (cervical) adenitis

Nervous system
- MNIA Infection, acute, site specified in comment

General diseases or conditions
- MCIG Septicemia, subacute or acute
- MMEI Middle ear infection (vestibular disease), acute
- MROD Renal osteodystrophy
- MXWI Peritonitis, general or local
- MRPU Pleuritis, general or local

APPENDIX L:

COMBINED PATHOLOGY DATABASE <F>: MACRO AND MICRO GLOSSARIES

Combined Pathology Database <F>

MACRO Glossary

Group 1 <PR_T> Primary tumors

NTYG	Non-thymic lymphoma, generalized
NTYL	Non-thymic lymphoma, localized
TTYG	Thymic lymphoma, generalized
TTYL	Thymic lymphoma, localized
TVAS	Vascular
TBON	Bone
TBRN	Brain
TCNS	Central nervous system
TCON	Connective tissue (fibrosarcoma)
THRT	Heart
TMIC	Miscellaneous connective tissue
TMIN	Miscellaneous nervous system
TMUS	Muscle
TPNS	Peripheral nervous system
TSPL	Spleen
TADN	Lung
TMIL	Miscellaneous lung
TOVE	Ovary
TGBL	Gallbladder
TLIV	Liver
TBLA	Urinary bladder
TKID	Kidney
TMUG	Miscellaneous urogenital
TCEC	Caecum
TCOL	Colon
TDUO	Duodenum
TESO	Esophagus
TILE	Ileum
TJEJ	Jejunum
TMID	Miscellaneous digestive system
TPAN	Pancreas
TPYL	Pylorus
TSGL	Salivary gland
TSTO	Stomach
TTGE	Tongue
THIB	Hibernating gland
TMIE	Miscellaneous endocrine
TMIG	Miscellaneous glandular
TPPT	Preputial gland
TPST	Prostate
TSKN	Skin
TVAG	Vagina

<F> MACRO Glossary (Cont.)

THGL	Harderian gland
TPIT	Pituitary
TTRD	Thyroid
TSMV	Seminal vesicle
TTST	Testis
TCGL	Cowper's gland
TEPI	Epididymis
TMGL	Mammary gland
TUTE	Uterus
TADR	Adrenal

Group 2 <CT_T> Primary connective tissue tumors

NTYG	Non-thymic lymphoma, generalized
NTYL	Non-thymic lymphoma, localized
TTYG	Thymic lymphoma, generalized
TTYL	Thymic lymphoma, localized
TVAS	Vascular
TBON	Bone
TBRN	Brain
TCNS	Central nervous system
TCON	Connective tissue (fibrosarcoma)
THRT	Heart
TMIC	Miscellaneous connective tissue
TMIN	Miscellaneous nervous system
TMUS	Muscle
TPNS	Peripheral nervous system
TSPL	Spleen

Group 3 <EP_T> Primary epithelial tumors excluding ovarian tumors

TADN	Lung
TMIL	Miscellaneous lung
TGBL	Gallbladder
TLIV	Liver
TBLA	Urinary bladder
TKID	Kidney
TMUG	Miscellaneous urogenital
TCEC	Caecum
TCOL	Colon
TDUO	Duodenum
TESO	Esophagus
TILE	Ileum
TJEJ	Jejunum
TMID	Miscellaneous digestive system
TPAN	Pancreas

<F> MACRO Glossary (Cont.)

TPYL	Pylorus
TSGL	Salivary gland
TSTO	Stomach
TTGE	Tongue
THIB	Hibernating gland
TMIE	Miscellaneous endocrine
TMIG	Miscellaneous glandular
TPPT	Preputial gland
TPST	Prostate
TSKN	Skin
TVAG	Vagina
THGL	Harderian gland
TPIT	Pituitary
TTRD	Thyroid
TSMV	Seminal vesicle
TTST	Testis
TCGL	Cowper's gland
TEPI	Epididymis
TMGL	Mammary gland
TUTE	Uterus
TADR	Adrenal

Group 4 <LR_T> Lymphoreticular tumors

NTYG	Non-thymic lymphoma, generalized
NTYL	Non-thymic lymphoma, localized
TTYG	Thymic lymphoma, generalized
TTYL	Thymic lymphoma, localized

Group 5 <TLHS> Histiocytic lymphoma

Null table Codes in <MICRO> only

Group 6 <TLLL> Lymphocytic-lymphoblastic leukemia

Null table Codes in <MICRO> only

Group 7 <TLLS> Lymphocytic-lymphoblastic lymphoma

Null table Codes in <MICRO> only

Group 8 <TLUS> Unclassified lymphoma

Null table Codes in <MICRO> only

<F> MACRO Glossary (Cont.)

Group 9 <TLXS> Mixed histiocytic-lymphocytic lymphoma

Null table Codes in <MICRO> only

Group 10 <TLOT> All other lymphoreticular tumors

Null table Codes in <MICRO> only

Group 11 <T_VO> Hemangioma, any site

Null table Codes in <MICRO> only

Group 12 <T_VS> Angiosarcoma, any site

Null table Codes in <MICRO> only

Group 13 <TVAS> Vascular tumors

TVAS Vascular

Group 14 (T_FS> Fibroma, fibrosarcoma, undifferentiated sarcoma, any site

Null table Codes in <MICRO> only

Group 15 <TCOT> All other primary connective tissue tumors

Null table Codes in <MICRO> only

Group 16 <TCON> Connective tissue tumors other than lymphoreticular and vascular tumors

TBON	Bone
TBRN	Brain
TCNS	Central nervous system
TCON	Connective tissue (fibrosarcoma)
THRT	Heart
TMIC	Miscellaneous connective tissue
TMIN	Miscellaneous nervous system
TMUS	Muscle
TPNS	Peripheral nervous system
TSPL	Spleen

Group 17 <THA_> Liver, hepatocellular tumors

Null table Codes in <MICRO> only

<F> MACRO Glossary (Cont.)

Group 18 <THC_> Liver, bile duct tumors

Null table Codes in <MICRO> only

Group 19 <TAC_> Adrenal cortical tumors

Null table Codes in <MICRO> only

Group 20 <TAM_> Adrenal medullary tumors

Null table Codes in <MICRO> only

Group 21 <TOVE> Ovarian tumors

TOVE Ovary

Group 22 <TOGC> Granulosa cell tumor, ovary

Null table Codes in <MICRO> only

Group 23 <TOTA> Tubular adenoma, ovary

Null table Codes in <MICRO> only

Group 24 <TOTO> Luteoma (thecoma), ovary

Null table Codes in <MICRO> only

Group 25 <TOOT> All other ovarian tumors

Null table Codes in <MICRO> only

Group 26 <KLOG> Kidney, liver, gastrointestinal system, and other tumors

TGBL	Gallbladder
TLIV	Liver
TBLA	Urinary bladder
TKID	Kidney
TMUG	Miscellaneous urogenital
TCEC	Caecum
TCOL	Colon
TDUO	Duodenum
TESO	Esophagus
TILE	Ileum
TJEJ	Jejunum
TMID	Miscellaneous digestive system

<F> MACRO Glossary (Cont.)

TPAN	Pancreas
TPYL	Pylorus
TSGL	Salivary gland
TSTO	Stomach
TTGE	Tongue
THIB	Hibernating gland
TMIE	Miscellaneous endocrine
TMIG	Miscellaneous glandular
TPPT	Preputial gland
TPST	Prostate
TSKN	Skin
TVAG	Vagina

Group 27 <MAPU> Mammary gland, adrenal gland, pituitary gland, thyroid gland, uterine, testicular, and seminal vesicle tumors

TPIT	Pituitary
TTRD	Thyroid
TSMV	Seminal vesicle
TTST	Testis
TCGL	Cowper's gland
TEPI	Epididymis
TMGL	Mammary gland
TUTE	Uterus
TADR	Adrenal

Group 28 <ENDO> Mammary gland, adrenal gland, pituitary gland, thyroid gland, uterine, testicular, seminal vesicle, and Harderian gland tumors

THGL	Harderian gland
TPIT	Pituitary
TTRD	Thyroid
TSMV	Seminal vesicle
TTST	Testis
TCGL	Cowper's gland
TEPI	Epididymis
TMGL	Mammary gland
TUTE	Uterus
TADR	Adrenal

Combined Pathology Database <F>

MICRO Glossary

Group 1 <PR_T> Primary tumors

TLFS	Fibrosarcoma, lymph node, site specified in comment
TLHL	Histiocytic leukemia
TLHS	Histiocytic lymphoma (reticulum cell tumor, type A)
TLLL	Lymphocytic-lymphoblastic leukemia
TLLS	Lymphocytic-lymphoblastic lymphoma
TLML	Myelogenous leukemia
TLPS	Plasma cell tumor
TLSL	Undifferentiated leukemia
TLSS	Undifferentiated lymphoma
TLUS	Unclassified lymphoma
TLXL	Mixed histiocytic-lymphocytic leukemia
TLXS	Mixed histiocytic-lymphocytic lymphoma (RCT, type B)
TEVO	Hemangioma, spleen
TLVO	Hemangioma, lymphoreticular tissue
TOVO	Hemangioma, ovary
THVO	Hemangioma, liver
TCVO	Hemangioma, connective tissue
TMVO	Hemangioma, muscle
TBVO	Hemangioma, sternal marrow
TIVO	Hemangioma, gastrointestinal tract
TDVO	Hemangioma, urinary bladder
TUVO	Hemangioma, uterus
TAVO	Hemangioma, adrenal
TTVO	Hemangioma, testis
TEVS	Angiosarcoma, spleen
TLVS	Angiosarcoma, lymph node
TRVS	Angiosarcoma, lung
TOVS	Angiosarcoma, ovary
TKVS	Angiosarcoma, kidney
THVS	Angiosarcoma, liver
TCVS	Angiosarcoma, connective tissue
TMVS	Angiosarcoma, muscle
TBVS	Angiosarcoma, bone
TSVS	Angiosarcoma, skin
TIVS	Angiosarcoma, gastrointestinal tract
TDVS	Angiosarcoma, urinary bladder
TUVS	Angiosarcoma, uterus
TPVS	Angiosarcoma, pituitary
TTVS	Angiosarcoma, testis
TVVS	Angiosarcoma, seminal vesicle
TNVS	Angiosarcoma, nervous system
TYVS	Angiosarcoma, heart

<F> MICRO Glossary (Cont.)

TXVS	Angiosarcoma, site specified in comment
TEFS	Fibrosarcoma, spleen
TKFS	Fibrosarcoma, kidney
THFO	Fibroma, liver
TCFO	Fibroma, connective tissue
TCFS	Fibrosarcoma, connective tissue
TCSS	Undifferentiated connective tissue sarcoma
TMFS	Fibrosarcoma, muscle
TMSS	Undifferentiated sarcoma, muscle
TBFS	Fibrosarcoma, bone
TSFS	Fibrosarcoma, skin
TSSS	Undifferentiated sarcoma, skin
TIFO	Fibroma, gastrointestinal tract
TIFS	Fibrosarcoma, gastrointestinal tract
TDFS	Fibrosarcoma, urinary bladder
TUFO	Fibroma, uterus
TUUS	Sarcoma, uterus, undetermined type
TTFA	Fibroma, testis
TTFS	Fibrosarcoma, testis
TVFO	Fibroma, seminal vesicle
TVFS	Fibrosarcoma, seminal vesicle
TVSS	Undifferentiated sarcoma, seminal vesicle
TNFO	Fibroma, nervous system
TNMS	Meningeal sarcoma, nervous system
TYFS	Fibrosarcoma, heart
TXFS	Fibrosarcoma, site specified in comment
TXUS	Undifferentiated sarcoma, site specified in comment
TCMS	Mast cell tumor, connective tissue
TCOO	Osteoma, connective tissue
TMLS	Leiomyosarcoma, muscle
TMRO	Rhabdomyoma, muscle
TMRS	Rhabdomyosarcoma, muscle
TMSO	Leiomyoma, muscle
TBCS	Chondrosarcoma, bone
TBOO	Osteoma, bone
TBOS	Osteosarcoma, bone
TBUS	Odontogenic sarcoma, bone
TINO	Neurilemmoma, gastrointestinal tract
TISO	Leiomyoma, gastrointestinal tract
TISS	Leiomyosarcoma, gastrointestinal tract
TDLS	Leiomyosarcoma, urinary bladder
TULO	Leiomyoma, uterus
TULS	Leiomyosarcoma, uterus
TUNO	Neurilemmoma, uterus
TNAS	Astrocytoma, nervous system
TNNB	Ependymoma, nervous system

<F> MICRO Glossary (Cont.)

TNNO	Peripheral nerve neurilemmoma (neurofibroma), nervous system
TNNS	Peripheral nerve neurofibrosarcoma, nervous system
TNOS	Oligodendroglioma, nervous system
TNPO	Papilloma, choroid plexus, nervous system
TNUS	Undifferentiated tumor, nervous system
TNXS	Glioma, mixed, nervous system
TYCS	Chondrosarcoma, heart
TYRO	Rhabdomyoma, heart
TYRS	Rhabdomyosarcoma, heart
TXFA	Fibroadenoma, site specified in comment
TXLS	Leiomyosarcoma, site specified in comment
TANS	Medullary neuroblastoma/ganglioneuroma, adrenal
TAPS	Medullary pheochromocytoma, adrenal

Respiratory system

TRAA	Alveologenic adenoma
TRAC	Alveologenic adenocarcinoma
TRCO	Cystadenoma

Mammary gland

TMAA	Adenocarcinoma A (alveolar)
TMAB	Adenocarcinoma B (ductal, predominantly)
TMAC	Adenocarcinoma C (fibrosarcoma)
TMAT	Adenoacanthoma
TMUO	Mammary gland tumor (undetermined type)

Adrenal cortical tumors

TACC	Cortical carcinoma
TACO	Cortical adenoma
TAUO	Tumor (undetermined cell type)

Pituitary

TPAA	Acidophilic adenoma
TPAC	Carcinoma
TPAO	Adenoma

Thyroid

TZAC	Adenocarcinoma
TZAO	Adenoma

Uterus

TUAC	Adenocarcinoma
TUAO	Adenoma (including papillary type)
TUEC	Squamous cell carcinoma

<F> MICRO Glossary (Cont.)

Testis
- TTAC Carcinoma
- TTGC Seminoma
- TTIO Interstitial cell tumor (Leydig)
- TTKC Sertoli cell tumor
- TTQC Embryonal carcinoma

Seminal vesicle
- TVAO Adenoma
- TVUO Tumor (undetermined cell type)

Harderian gland
- TGAC Adenocarcinoma
- TGAO Papillary cystadenoma
- TGSC Undifferentiated tumor

Kidney
- TKAA Renal adenoma
- TKAC Renal tubular tumor (adenocarcinoma)
- TKCA Cystadenoma
- TKPA Renal papillary cystadenoma
- TKTC Renal pelvic transitional cell tumor

Urinary bladder
- TDEC Squamous cell carcinoma
- TDTC Transitional cell carcinoma

Liver
- THAA Adenoma (hepatoma)
- THAC Hepatocarcinoma
- THAO Hyperplastic nodule (pre-neoplastic nodule)
- THCC Cholangiocarcinoma
- THCO Cholangioma (cholangiomatosis)

Gastrointestinal tract
- TIAC Adenocarcinoma
- TIAO Adenoma
- TIEC Squamous cell carcinoma
- TIPL Polyp (plaque), pyloric region
- TIPO Polyps
- TISC Undifferentiated carcinoma

Skin
- TSAO Adenoma
- TSBC Basal cell carcinoma (hair follicle tumor)
- TSDO Sebaceous gland adenoma

<F> MICRO Glossary (Cont.)

TSEC	Squamous cell carcinoma
TSPO	Papilloma

Rare tissues with tumors

TXAC	Adenocarcinoma, site specified in comment
TXAO	Adenoma, site specified in comment
TXEC	Squamous cell carcinoma, site specified in comment

Ovary

TOAC	Adenocarcinoma
TOAO	Adenoma (also papillary adenoma)
TOCO	Cystadenoma
TOGC	Granulosa cell tumor
TOPA	Papillary adenoma
TOSC	Undifferentiated carcinoma
TOTA	Tubular adenoma
TOTO	Luteoma (thecoma)

Group 2 <CT_T> Primary connective tissue tumors

TLFS	Fibrosarcoma, lymph node, site specified in comment
TLHL	Histiocytic leukemia
TLHS	Histiocytic lymphoma (reticulum cell tumor, type A)
TLLL	Lymphocytic-lymphoblastic leukemia
TLLS	Lymphocytic-lymphoblastic lymphoma
TLML	Myelogenous leukemia
TLPS	Plasma cell tumor
TLSL	Undifferentiated leukemia
TLSS	Undifferentiated lymphoma
TLUS	Unclassified lymphoma
TLXL	Mixed histiocytic-lymphocytic leukemia
TLXS	Mixed histiocytic-lymphocytic lymphoma (RCT, type B)
TEVO	Hemangioma, spleen
TLVO	Hemangioma, lymphoreticular tissue
TOVO	Hemangioma, ovary
THVO	Hemangioma, liver
TCVO	Hemangioma, connective tissue
TMVO	Hemangioma, muscle
TBVO	Hemangioma, sternal marrow
TIVO	Hemangioma, gastrointestinal tract
TDVO	Hemangioma, urinary bladder
TUVO	Hemangioma, uterus
TAVO	Hemangioma, adrenal
TTVO	Hemangioma, testis
TEVS	Angiosarcoma, spleen
TLVS	Angiosarcoma, lymph node

<F> MICRO Glossary (Cont.)

TRVS	Angiosarcoma, lung
TOVS	Angiosarcoma, ovary
TKVS	Angiosarcoma, kidney
THVS	Angiosarcoma, liver
TCVS	Angiosarcoma, connective tissue
TMVS	Angiosarcoma, muscle
TBVS	Angiosarcoma, bone
TSVS	Angiosarcoma, skin
TIVS	Angiosarcoma, gastrointestinal tract
TDVS	Angiosarcoma, urinary bladder
TUVS	Angiosarcoma, uterus
TPVS	Angiosarcoma, pituitary
TTVS	Angiosarcoma, testis
TVVS	Angiosarcoma, seminal vesicle
TNVS	Angiosarcoma, nervous system
TYVS	Angiosarcoma, heart
TXVS	Angiosarcoma, site specified in comment
TEFS	Fibrosarcoma, spleen
TKFS	Fibrosarcoma, kidney
THFO	Fibroma, liver
TCFO	Fibroma, connective tissue
TCFS	Fibrosarcoma, connective tissue
TCSS	Undifferentiated connective tissue sarcoma
TMFS	Fibrosarcoma, muscle
TMSS	Undifferentiated sarcoma, muscle
TBFS	Fibrosarcoma, bone
TSFS	Fibrosarcoma, skin
TSSS	Undifferentiated sarcoma, skin
TIFO	Fibroma, gastrointestinal tract
TIFS	Fibrosarcoma, gastrointestinal tract
TDFS	Fibrosarcoma, urinary bladder
TUFO	Fibroma, uterus
TUUS	Sarcoma, uterus, undetermined type
TTFA	Fibroma, testis
TTFS	Fibrosarcoma, testis
TVFO	Fibroma, seminal vesicle
TVFS	Fibrosarcoma, seminal vesicle
TVSS	Undifferentiated sarcoma, seminal vesicle
TNFO	Fibroma, nervous system
TNMS	Meningeal sarcoma, nervous system
TYFS	Fibrosarcoma, heart
TXFS	Fibrosarcoma, site specified in comment
TXUS	Undifferentiated sarcoma, site specified in comment
TCMS	Mast cell tumor, connective tissue
TCOO	Osteoma, connective tissue
TMLS	Leiomyosarcoma, muscle

<F> MICRO Glossary (Cont.)

TMRO	Rhabdomyoma, muscle
TMRS	Rhabdomyosarcoma, muscle
TMSO	Leiomyoma, muscle
TBCS	Chondrosarcoma, bone
TBOO	Osteoma, bone
TBOS	Osteosarcoma, bone
TBUS	Odontogenic sarcoma, bone
TINO	Neurilemmoma, gastrointestinal tract
TISO	Leiomyoma, gastrointestinal tract
TISS	Leiomyosarcoma, gastrointestinal tract
TDLS	Leiomyosarcoma, urinary bladder
TULO	Leiomyoma, uterus
TULS	Leiomyosarcoma, uterus
TUNO	Neurilemmoma, uterus
TNAS	Astrocytoma, nervous system
TNNB	Ependymoma, nervous system
TNNO	Peripheral nerve neurilemmoma (neurofibroma), nervous system
TNNS	Peripheral nerve neurofibrosarcoma, nervous system
TNOS	Oligodendroglioma, nervous system
TNPO	Papilloma, choroid plexus, nervous system
TNUS	Undifferentiated tumor, nervous system
TNXS	Glioma, mixed, nervous system
TYCS	Chrondrosarcoma, heart
TYRO	Rhabdomyoma, heart
TYRS	Rhabdomyosarcoma, heart
TXFA	Fibroadenoma, site specified in comment
TXLS	Leiomyosarcoma, site specified in comment
TANS	Medullary neuroblastoma/ganglioneuroma, adrenal
TAPS	Medullary pheochromocytoma, adrenal

Group 3 <EP_T> Primary epithelial tumors excluding ovarian tumors

Respiratory system

TRAA	Alveologenic adenoma
TRAC	Alveologenic adenocarcinoma
TRCO	Cystadenoma

Mammary gland

TMAA	Adenocarcinoma A (alveolar)
TMAB	Adenocarcinoma B (ductal, predominantly)
TMAC	Adenocarcinoma C (fibrosarcoma)
TMAT	Adenoacanthoma
TMUO	Mammary gland tumor (undetermined type)

<F> MICRO Glossary (Cont.)

Adrenal cortical tumors
- TACC Cortical carcinoma
- TACO Cortical adenoma
- TAUO Tumor (undetermined cell type)

Pituitary
- TPAA Acidophilic adenoma
- TPAC Carcinoma
- TPAO Adenoma

Thyroid
- TZAC Adenocarcinoma
- TZAO Adenoma

Uterus
- TUAC Adenocarcinoma
- TUAO Adenoma (including papillary type)
- TUEC Squamous cell carcinoma

Testis
- TTAC Carcinoma
- TTGC Seminoma
- TTIO Interstitial cell tumor (Leydig)
- TTKC Sertoli cell tumor
- TTQC Embryonal carcinoma

Seminal vesicle
- TVAO Adenoma
- TVUO Tumor (undetermined cell type)

Harderian gland
- TGAC Adenocarcinoma
- TGAO Papillary cystadenoma
- TGSC Undifferentiated tumor

Kidney
- TKAA Renal adenoma
- TKAC Renal tubular tumor (adenocarcinoma)
- TKCA Cystadenoma
- TKPA Renal papillary cystadenoma
- TKTC Renal pelvic transitional cell tumor

Urinary bladder
- TDEC Squamous cell carcinoma
- TDTC Transitional cell carcinoma

<F> MICRO Glossary (Cont.)

Liver

THAA	Adenoma (hepatoma)
THAC	Hepatocarcinoma
THAO	Hyperplastic nodule (pre-neoplastic nodule)
THCC	Cholangiocarcinoma
THCO	Cholangioma (cholangiomatosis)

Gastrointestinal tract

TIAC	Adenocarcinoma
TIAO	Adenoma
TIEC	Squamous cell carcinoma
TIPL	Polyp (plaque), pyloric region
TIPO	Polyps
TISC	Undifferentiated carcinoma

Skin

TSAO	Adenoma
TSBC	Basal cell carcinoma (hair follicle tumor)
TSDO	Sebaceous gland adenoma
TSEC	Squamous cell carcinoma
TSPO	Papilloma

Rare tissues with tumor

TXAC	Adenocarcinoma, site specified in comment
TXAO	Adenoma, site specified in comment
TXEC	Squamous cell carcinoma, site specified in comment

Group 4 <LR_T> Lymphoreticular tumors

TLHL	Histiocytic leukemia
TLHS	Histiocytic lymphoma (reticulum cell tumor, type A)
TLLL	Lymphocytic-lymphoblastic leukemia
TLLS	Lymphocytic-lymphoblastic lymphoma
TLML	Myelogenous leukemia
TLPS	Plasma cell tumor
TLSL	Undifferentiated leukemia
TLSS	Undifferentiated lymphoma
TLUS	Unclassified lymphoma
TLXL	Mixed histiocytic-lymphocytic leukemia
TLXS	Mixed histiocytic-lymphocytic lymphoma (RCT, type B)

Group 5 <TLHS> Histiocytic lymphoma

TLHS	Histiocytic lymphoma (reticulum cell tumor, type A)

<F> MICRO Glossary (Cont.)

Group 6 <TLLL> Lymphocytic-lymphoblastic leukemia

TLLL Lymphocytic-lymphoblastic leukemia

Group 7 <TLLS> Lymphocytic-lymphoblastic lymphoma

TLLS Lymphocytic-lymphoblastic lymphoma

Group 8 <TLUS> Unclassified lymphoma

TLUS Unclassified lymphoma

Group 9 <TLXS> Mixed histiocytic-lymphocytic lymphoma

TLXS Mixed histiocytic-lymphocytic lymphoma (RCT, type B)

Group 10 <TLOT> All other lymphoreticular tumors

TLHL Histiocytic leukemia
TLML Myelogenous leukemia
TLPS Plasma cell tumor
TLSL Undifferentiated leukemia
TLSS Undifferentiated lymphoma
TLXL Mixed histiocytic-lymphocytic leukemia

Group 11 <T_VO> Hemangioma, any site

TEVO Hemangioma, spleen
TLVO Hemangioma, lymphoreticular tissue
TOVO Hemangioma, ovary
THVO Hemangioma, liver
TCVO Hemangioma, connective tissue
TMVO Hemangioma, muscle
TBVO Hemangioma, sternal marrow
TIVO Hemangioma, gastrointestinal tract
TDVO Hemangioma, urinary bladder
TUVO Hemangioma, uterus
TAVO Hemangioma, adrenal
TTVO Hemangioma, testis

Group 12 <T_VS> Angiosarcoma, any site

TEVS Angiosarcoma, spleen
TLVS Angiosarcoma, lymph node
TRVS Angiosarcoma, lung
TOVS Angiosarcoma, ovary

<F> MICRO Glossary (Cont.)

TKVS	Angiosarcoma, kidney
THVS	Angiosarcoma, liver
TCVS	Angiosarcoma, connective tissue
TMVS	Angiosarcoma, muscle
TBVS	Angiosarcoma, bone
TSVS	Angiosarcoma, skin
TIVS	Angiosarcoma, gastrointestinal tract
TDVS	Angiosarcoma, urinary bladder
TUVS	Angiosarcoma, uterus
TPVS	Angiosarcoma, pituitary
TTVS	Angiosarcoma, testis
TVVS	Angiosarcoma, seminal vesicle
TNVS	Angiosarcoma, nervous system
TYVS	Angiosarcoma, heart
TXVS	Angiosarcoma, site specified in comment

Group 13 <TVAS> Vascular tumors

TEVO	Hemangioma, spleen
TLVO	Hemangioma, lymphoreticular tissue
TOVO	Hemangioma, ovary
THVO	Hemangioma, liver
TCVO	Hemangioma, connective tissue
TMVO	Hemangioma, muscle
TBVO	Hemangioma, sternal marrow
TIVO	Hemangioma, gastrointestinal tract
TDVO	Hemangioma, urinary bladder
TUVO	Hemangioma, uterus
TAVO	Hemangioma, adrenal
TTVO	Hemangioma, testis
TEVS	Angiosarcoma, spleen
TLVS	Angiosarcoma, lymph node
TRVS	Angiosarcoma, lung
TOVS	Angiosarcoma, ovary
TKVS	Angiosarcoma, kidney
THVS	Angiosarcoma, liver
TCVS	Angiosarcoma, connective tissue
TMVS	Angiosarcoma, muscle
TBVS	Angiosarcoma, bone
TSVS	Angiosarcoma, skin
TIVS	Angiosarcoma, gastrointestinal tract
TDVS	Angiosarcoma, urinary bladder
TUVS	Angiosarcoma, uterus
TPVS	Angiosarcoma, pituitary
TTVS	Angiosarcoma, testis
TVVS	Angiosarcoma, seminal vesicle

<F> MICRO Glossary (Cont.)

TNVS	Angiosarcoma, nervous system
TYVS	Angiosarcoma, heart
TXVS	Angiosarcoma, site specified in comment

Group 14 <T_FS> Fibroma, fibrosarcoma, undifferentiated sarcoma, any site

TEFS	Fibrosarcoma, spleen
TKFS	Fibrosarcoma, kidney
TLFS	Fibrosarcoma, lymph node, site specified in comment
THFO	Fibroma, liver
TCFO	Fibroma, connective tissue
TCFS	Fibrosarcoma, connective tissue
TCSS	Undifferentiated connective tissue sarcoma
TMFS	Fibrosarcoma, muscle
TMSS	Undifferentiated sarcoma, muscle
TBFS	Fibrosarcoma, bone
TSFS	Fibrosarcoma, skin
TSSS	Undifferentiated sarcoma, skin
TIFO	Fibroma, gastrointestinal tract
TIFS	Fibrosarcoma, gastrointestinal tract
TUFO	Fibroma, uterus
TUUS	Sarcoma, uterus, undetermined type
TTFA	Fibroma, testis
TTFS	Fibrosarcoma, testis
TVFO	Fibroma, seminal vesicle
TDFS	Fibrosarcoma, urinary bladder
TVFS	Fibrosarcoma, seminal vesicle
TVSS	Undifferentiated sarcoma, seminal vesicle
TNFO	Fibroma, nervous system
TNMS	Meningeal sarcoma, nervous system
TYFS	Fibrosarcoma, heart
TXFS	Fibrosarcoma, site specified in comment
TXUS	Undifferentiated sarcoma, site specified in comment

Group 15 <TCOT> All other primary connective tissue tumors

TCMS	Mast cell tumor, connective tissue
TCOO	Osteoma, connective tissue
TMLS	Leiomyosarcoma, muscle
TMRO	Rhabdomyoma, muscle
TMRS	Rhabdomyosarcoma, muscle
TMSO	Leiomyoma, muscle
TBCS	Chondrosarcoma, bone
TBOO	Osteoma, bone
TBOS	Osteosarcoma, bone
TBUS	Odontogenic sarcoma, bone

<F> MICRO Glossary (Cont.)

TINO	Neurilemmoma, gastrointestinal tract
TISO	Leiomyoma, gastrointestinal tract
TISS	Leiomyosarcoma, gastrointestinal tract
TDLS	Leiomyosarcoma, urinary bladder
TULO	Leiomyoma, uterus
TULS	Leiomyosarcoma, uterus
TUNO	Neurilemmoma, uterus
TNAS	Astrocytoma, nervous system
TNNB	Ependymoma, nervous system
TNNO	Peripheral nerve neurilemmoma (neurofibroma), nervous system
TNNS	Peripheral nerve neurofibrosarcoma, nervous system
TNOS	Oligodendroglioma, nervous system
TNPO	Papilloma, choroid plexus, nervous system
TNUS	Undifferentiated tumor, nervous system
TNXS	Glioma, mixed, nervous system
TYCS	Chondrosarcoma, heart
TYRO	Rhabdomyoma, heart
TYRS	Rhabdomyosarcoma, heart
TXFA	Fibroadenoma, site specified in comment
TXLS	Leiomyosarcoma, site specified in comment

Group 16 <TCON> Connective tissue tumors, other than lymphoreticular and vascular tumors

TEFS	Fibrosarcoma, spleen
TKFS	Fibrosarcoma, kidney
TLFS	Fibrosarcoma, lymph node, site specified in comment
THFO	Fibroma, liver
TCFO	Fibroma, connective tissue
TCFS	Fibrosarcoma, connective tissue
TCSS	Undifferentiated connective tissue sarcoma
TMFS	Fibrosarcoma, muscle
TMSS	Undifferentiated sarcoma, muscle
TBFS	Fibrosarcoma, bone
TSFS	Fibrosarcoma, skin
TSSS	Undifferentiated sarcoma, skin
TIFO	Fibroma, gastrointestinal tract
TIFS	Fibrosarcoma, gastrointestinal tract
TDFS	Fibrosarcoma, urinary bladder
TUFO	Fibroma, uterus
TUUS	Sarcoma, uterus, undetermined type
TTFA	Fibroma, testis
TTFS	Fibrosarcoma, testis
TVFO	Fibroma, seminal vesicle
TVFS	Fibrosarcoma, seminal vesicle
TVSS	Undifferentiated sarcoma, seminal vesicle

<F> MICRO Glossary (Cont.)

TNFO	Fibroma, nervous system
TNMS	Meningeal sarcoma, nervous system
TYFS	Fibrosarcoma, heart
TXFS	Fibrosarcoma, site specified in comment
TXUS	Undifferentiated sarcoma, site specified in comment
TCMS	Mast cell tumor, connective tissue
TCOO	Osteoma, connective tissue
TMLS	Leiomyosarcoma, muscle
TMRO	Rhabdomyoma, muscle
TMRS	Rhabdomyosarcoma, muscle
TMSO	Leiomyoma, muscle
TBCS	Chondrosarcoma, bone
TBOO	Osteoma, bone
TBOS	Osteosarcoma, bone
TBUS	Odontogenic sarcoma, bone
TINO	Neurilemmoma, gastrointestinal tract
TISO	Leiomyoma, gastrointestinal tract
TISS	Leiomyosarcoma, gastrointestinal tract
TDLS	Leiomyosarcoma, urinary bladder
TULO	Leiomyoma, uterus
TULS	Leiomyosarcoma, uterus
TUNO	Neurilemmoma, uterus
TNAS	Astrocytoma, nervous system
TNNB	Ependymoma, nervous system
TNNO	Peripheral nerve neurilemmoma (neurofibroma), nervous system
TNNS	Peripheral nerve neurofibrosarcoma, nervous system
TNOS	Oligodendroglioma, nervous system
TNPO	Papilloma, choroid plexus, nervous system
TNUS	Undifferentiated tumor, nervous system
TNXS	Glioma, mixed, nervous system
TYCS	Chondrosarcoma, heart
TYRO	Rhabdomyoma, heart
TYRS	Rhabdomyosarcoma, heart
TXFA	Fibroadenoma, site specified in comment
TXLS	Leiomyosarcoma, site specified in comment

Group 17 <THA_> Liver, hepatocellular tumors

THAA	Adenoma (hepatoma)
THAC	Hepatocarcinoma
THAO	Hyperplastic nodule (pre-neoplastic nodule)

Group 18 <THC_> Liver, bile duct tumors

THCC	Cholangiocarcinoma
THCO	Cholangioma (cholangiomatosis)

<F> MICRO Glossary (Cont.)

Group 19 <TAC_> Adrenal cortical tumors

TACC	Cortical carcinoma
TACO	Cortical adenoma
TAUO	Tumor (undetermined cell type)

Group 20 <TAM_> Adrenal medullary tumors

TANS	Medullary neuroblastoma/ganglioneuroma
TAPS	Medullary pheochromocytoma

Group 21 <TOVE> Ovarian tumors

TOAC	Adenocarcinoma
TOAO	Adenoma (also papillary adenoma)
TOCO	Cystadenoma
TOGC	Granulosa cell tumor
TOPA	Papillary adenoma
TOSC	Undifferentiated carcinoma
TOTA	Tubular adenoma
TOTO	Luteoma (thecoma)

Group 22 <TOGC> Granulosa cell tumor, ovary

TOGC	Granulosa cell tumor

Group 23 <TOTA> Tubular adenoma, ovary

TOTA	Tubular adenoma

Group 24 <TOTO> Luetoma (thecoma), ovary

TOTO	Luteoma (thecoma)

Group 25 <TOOT> All other ovarian tumors

TOAC	Adenocarcinoma
TOAO	Adenoma (also papillary adenoma)
TOCO	Cystadenoma
TOPA	Papillary adenoma
TOSC	Undifferentiated carcinoma

<F> MICRO Glossary (Cont.)

Group 26 <KLOG> Kidney, liver, gastrointestinal system, and other tumors

Kidney
- TKAA Renal adenoma
- TKAC Renal tubular tumor (adenocarcinoma)
- TKCA Cystadenoma
- TKPA Renal papillary adenoma
- TKTC Renal pelvic transitional cell tumor

Urinary bladder
- TDEC Squamous cell carcinoma
- TDTC Transitional cell carcinoma

Liver
- THAA Adenoma (hepatoma)
- THAC Hepatocarcinoma
- THAO Hyperplastic nodule (pre-neoplastic nodule)
- THCC Cholangiocarcinoma
- THCO Cholangioma (cholangiomatosis)

Gastrointestinal tract
- TIAC Adenocarcinoma
- TIAO Adenoma
- TIEC Squamous cell carcinoma
- TIPL Polyp (plaque), pyloric region
- TIPO Polyps
- TISC Undifferentiated carcinoma

Skin
- TSAO Adenoma
- TSBC Basal cell carcinoma (hair follicle tumor)
- TSDO Sebaceous gland adenoma
- TSEC Squamous cell carcinoma
- TSPO Papilloma

Rare tissues with tumors
- TXAC Adenocarcinoma, site specified in comment
- TXAO Adenoma, site specified in comment
- TXEC Squamous cell carcinoma, site specified in comment

Group 27 <MAPU> Mammary gland, adrenal gland, pituitary gland, thyroid gland, uterine, testicular, and seminal vesicle tumors

Mammary gland
- TMAA Adenocarcinoma A (alveolar)
- TMAB Adenocarcinoma B (ductal, predominantly)

<F> MICRO Glossary (Cont.)

TMAC Adenocarcinoma C (fibrosarcoma)
TMAT Adenoacanthoma
TMUO Mammary gland tumor (undetermined type)

Adrenal cortical tumors
TACC Cortical carcinoma
TACO Cortical adenoma
TAUO Tumor (undetermined cell type)

Adrenal medullary tumors
TANS Medullary neuroblastoma/ganglioneuroma
TAPS Medullary pheochromocytoma

Pituitary
TPAA Acidophilic adenoma
TPAC Carcinoma
TPAO Adenoma

Thyroid
TZAC Adenocarcinoma
TZAO Adenoma

Uterus
TUAC Adenocarcinoma
TUAO Adenoma (including papillary type)
TUEC Squamous cell carcinoma

Testis
TTAC Carcinoma
TTGC Seminoma
TTIO Interstitial cell tumor (Leydig)
TTKC Sertoli cell tumor
TTQC Embryonal carcinoma

Seminal vesicle
TVAO Adenoma
TVUO Tumor (undetermined cell type)

Group 28 <ENDO> Mammary gland, adrenal gland, pituitary gland, thyroid gland, uterine, testicular, seminal vesicle, and Harderian gland tumors

Mammary gland
TMAA Adenocarcinoma A (alveolar)
TMAB Adenocarcinoma B (ductal, predominantly)
TMAC Adenocarcinoma C (fibrosarcoma)

<F> MICRO Glossary (Cont.)

TMAT	Adenoacanthoma
TMUO	Mammary gland tumor (undetermined type)

Adrenal cortical tumors

TACC	Cortical carcinoma
TACO	Cortical adenoma
TAUO	Tumor (undetermined cell type)

Adrenal medullary tumors

TANS	Medullary neuroblastoma/ganglioneuroma
TAPS	Medullary pheochromocytoma

Pituitary

TPAA	Acidophilic adenoma
TPAC	Carcinoma
TPAO	Adenoma

Thyroid

TZAC	Adenocarcinoma
TZAO	Adenoma

Uterus

TUAC	Adenocarcinoma
TUAO	Adenoma (including papillary type)
TUEC	Squamous cell carcinoma

Testis

TTAC	Carcinoma
TTGC	Seminoma
TTIO	Interstitial cell tumor (Leydig)
TTKC	Sertoli cell tumor
TTQC	Embryonal carcinoma

Seminal vesicle

TVAO	Adenoma
TVUO	Tumor (undetermined cell type)

Harderian gland

TGAC	Adenocarcinoma
TGAO	Papillary cyst adenoma
TGSC	Undifferentiated tumor

APPENDIX M:

COMBINED PATHOLOGY DATABASE <H>: MACRO AND MICRO GLOSSARIES

Combined Pathology Database <H>

MACRO Glossary

Group 1 <PR_T> Primary tumors

NTYG	Non-thymic lymphoma, generalized
NTYL	Non-thymic lymphoma, localized
TTYG	Thymic lymphoma, generalized
TTYL	Thymic lymphoma, localized
TVAS	Vascular
TBON	Bone
TBRN	Brain
TCNS	Central nervous system
TCON	Connective tissue (fibrosarcoma)
THRT	Heart
TMIC	Miscellaneous connective tissue
TMIN	Miscellaneous nervous system
TMUS	Muscle
TPNS	Peripheral nervous system
TSPL	Spleen
TADN	Lung
TMIL	Miscellaneous lung (respiratory system)
TOVE	Ovary
TGBL	Gallbladder
TLIV	Liver
TBLA	Urinary bladder
TKID	Kidney
TMUG	Miscellaneous urogenital
TCEC	Caecum
TCOL	Colon
TDUO	Duodenum
TESO	Esophagus
TILE	Ileum
TJEJ	Jejunum
TMID	Miscellaneous digestive system
TPAN	Pancreas
TPYL	Pylorus
TSGL	Salivary gland
TSTO	Stomach
TTGE	Tongue
THIB	Hibernating gland
TMIE	Miscellaneous endocrine
TMIG	Miscellaneous glandular
TPPT	Preputial gland
TPST	Prostate
TSKN	Skin
TVAG	Vagina

<H> MACRO Glossary (Cont.)

THGL	Harderian gland
TPIT	Pituitary
TTRD	Thyroid
TSMV	Seminal vesicle
TTST	Testis
TCGL	Cowper's gland
TEPI	Epididymis
TMGL	Mammary gland
TUTE	Uterus
TADR	Adrenal

Group 2 <CT_T> Primary connective tissue tumors

NTYG	Non-thymic lymphoma, generalized
NTYL	Non-thymic lymphoma, localized
TTYG	Thymic lymphoma, generalized
TTYL	Thymic lymphoma, localized
TVAS	Vascular
TBON	Bone
TBRN	Brain
TCNS	Central nervous system
TCON	Connective tissue (fibrosarcoma)
THRT	Heart
TMIC	Miscellaneous connective tissue
TMIN	Miscellaneous nervous system
TMUS	Muscle
TPNS	Peripheral nervous system
TSPL	Spleen

Group 3 <EP_T> Primary epithelial tumors excluding ovarian tumors

TADN	Lung
TMIL	Miscellaneous lung (respiratory system)
TGBL	Gallbladder
TLIV	Liver
TBLA	Urinary bladder
TKID	Kidney
TMUG	Miscellaneous urogenital
TCEC	Caecum
TCOL	Colon
TDUO	Duodenum
TESO	Esophagus
TILE	Ileum
TJEJ	Jejunum
TMID	Miscellaneous digestive system
TPAN	Pancreas

<H> MACRO Glossary (Cont.)

TPYL	Pylorus
TSGL	Salivary gland
TSTO	Stomach
TTGE	Tongue
THIB	Hibernating gland
TMIE	Miscellaneous endocrine
TMIG	Miscellaneous glandular
TPPT	Preputial gland
TPST	Prostate
TSKN	Skin
TVAG	Vagina
THGL	Harderian gland
TPIT	Pituitary
TTRD	Thyroid
TSMV	Seminal vesicle
TTST	Testis
TCGL	Cowper's gland
TEPI	Epididymis
TMGL	Mammary gland
TUTE	Uterus
TADR	Adrenal

Group 4 <LR_T> Lymphoreticular tumors

NTYG	Non-thymic lymphoma, generalized
NTYL	Non-thymic lymphoma, localized
TTYG	Thymic lymphoma, generalized
TTYL	Thymic lymphoma, localized

Group 5 <TLSA> Lymphosarcoma

Null table Codes in <MICRO> only

Group 6 <TLRC> Reticulum cell sarcoma

Null table Codes in <MICRO> only

Group 7 <TLLE> Lymphocytic leukemia

Null table Codes in <MICRO> only

Group 8 <TCAR> All carcinomas

Null table Codes in <MICRO> only

<H> MACRO Glossary (Cont.)

Group 9 <TSAR> All sarcomas

Null table Codes in <MICRO> only

Group 10 <T_FO> All fibromas

Null table Codes in <MICRO> only

Group 11 <TFSA> All fibrosarcomas

Null table Codes in <MICRO> only

Group 12 <TRAA> Alveologenic adenoma

Null table Codes in <MICRO> only

Group 13 <TRAC> Alveologenic adenocarcinoma

Null table Codes in <MICRO> only

Group 14 <TADR> All adrenal tumors

TADR Adrenal

Group 15 <TAC_> Adrenal cortical tumors

Null table Codes in <MICRO> only

Group 16 <TAM_> Adrenal medullary tumors

Null table Codes in <MICRO> only

Group 17 <THA_> Liver hepatocellular tumors

Null table Codes in <MICRO> only

Group 18 <TK__> Kidney tumors

TKID Kidney

Group 19 <TMGL> Mammary gland tumors

TMGL Mammary gland

<H> MACRO Glossary (Cont.)

Group 20 <T_GI> Gastrointestinal tract tumors

TCEC	Caecum
TCOL	Colon
TDUO	Duodenum
TESO	Esophagus
TILE	Ileum
TJEJ	Jejunum
TMID	Miscellaneous digestive system
TPAN	Pancreas
TPYL	Pylorus
TSGL	Salivary gland
TSTO	Stomach
TTGE	Tongue

Group 21 <TBON> Bone tumors

TBON	Bone

Group 22 <T_WR> Metastases from lung tumor to any site

Null table	Codes in <MICRO> only

Group 23 <T_WK> Metastases from kidney tumor to any site

Null table	Codes in <MICRO> only

Group 24 <T_WG> Metastases from Harderian gland tumor to any site

Null table	Codes in <MICRO> only

Group 25 <T_WB> Metastases from bone tumor to any site

Null table	Codes in <MICRO> only

Group 26 <TRW_> Metastases from any site to lung

Null table	Codes in <MICRO> only

Group 27 <TKW_> Metastases from any site to kidney

Null table	Codes in <MICRO> only

Group 28 <T_W_> All metastatic tumors (secondaries)

TSEC	Secondary tumors

Combined Pathology Database <H>

MICRO Glossary

Group 1 <PR_T> Primary tumors

TLFS	Fibrosarcoma, lymph node, site specified in comment
TLHL	Histiocytic leukemia
TLHS	Histiocytic lymphoma (reticulum cell tumor, type A)
TLLL	Lymphocytic-lymphoblastic leukemia
TLLS	Lymphocytic-lymphoblastic lymphoma
TLML	Myelogenous leukemia
TLPS	Plasma cell tumor
TLSL	Undifferentiated leukemia
TLSS	Undifferentiated lymphoma
TLUS	Unclassified lymphoma
TLXL	Mixed histiocytic-lymphocytic leukemia
TLXS	Mixed histiocytic-lymphocytic lymphoma (RCT, type B)
TEVO	Hemangioma, spleen
TLVO	Hemangioma, lymphoreticular tissue
TOVO	Hemangioma, ovary
THVO	Hemangioma, liver
TCVO	Hemangioma, connective tissue
TMVO	Hemangioma, muscle
TBVO	Hemangioma, sternal marrow
TDVO	Hemangioma, urinary bladder
TIVO	Hemangioma, gastrointestinal tract
TUVO	Hemangioma, uterus
TAVO	Hemangioma, adrenal
TTVO	Hemangioma, testis
TEVS	Angiosarcoma, spleen
TLVS	Angiosarcoma, lymph node
TRVS	Angiosarcoma, lung
TOVS	Angiosarcoma, ovary
TKVS	Angiosarcoma, kidney
THVS	Angiosarcoma, liver
TCVS	Angiosarcoma, connective tissue
TMVS	Angiosarcoma, muscle
TBVS	Angiosarcoma, bone
TSVS	Angiosarcoma, skin
TIVS	Angiosarcoma, gastrointestinal tract
TDVS	Angiosarcoma, urinary bladder
TUVS	Angiosarcoma, uterus
TPVS	Angiosarcoma, pituitary
TTVS	Angiosarcoma, testis
TVVS	Angiosarcoma, seminal vesicle
TNVS	Angiosarcoma, nervous system
TYVS	Angiosarcoma, heart

<H> MICRO Glossary (Cont.)

TXVS	Angiosarcoma, site specified in comment
TEFS	Fibrosarcoma, spleen
TKFS	Fibrosarcoma, kidney
THFO	Fibroma, liver
TCFO	Fibroma, connective tissue
TCFS	Fibrosarcoma, connective tissue
TCSS	Undifferentiated connective tissue sarcoma
TMFS	Fibrosarcoma, muscle
TMSS	Undifferentiated sarcoma, muscle
TBFS	Fibrosarcoma, bone
TSFS	Fibrosarcoma, skin
TSSS	Undifferentiated sarcoma, skin
TIFO	Fibroma, gastrointestinal tract
TIFS	Fibrosarcoma, gastrointestinal tract
TDFS	Fibrosarcoma, urinary bladder
TUFO	Fibroma, uterus
TUUS	Sarcoma, uterus, undetermined type
TTFA	Fibroma, testis
TTFS	Fibrosarcoma, testis
TVFO	Fibroma, seminal vesicle
TVFS	Fibrosarcoma, seminal vesicle
TVSS	Undifferentiated sarcoma, seminal vesicle
TNFO	Fibroma, nervous system
TNMS	Meningeal sarcoma, nervous system
TYFS	Fibrosarcoma, heart
TXFS	Fibrosarcoma, site specified in comment
TXUS	Undifferentiated sarcoma, site specified in comment
TCMS	Mast cell tumor, connective tissue
TCOO	Osteoma, connective tissue
TMLS	Leiomyosarcoma, muscle
TMRO	Rhabdomyoma, muscle
TMRS	Rhabdomyosarcoma, muscle
TMSO	Leiomyoma, muscle
TBCS	Chondrosarcoma, bone
TBOO	Osteoma, bone
TBOS	Osteosarcoma, bone
TBUS	Odontogenic sarcoma, bone
TINO	Neurilemmoma, gastrointestinal tract
TISO	Leiomyoma, gastrointestinal tract
TISS	Leiomyosarcoma, gastrointestinal tract
TDLS	Leiomyosarcoma, urinary bladder
TULO	Leiomyoma, uterus
TULS	Leiomyosarcoma, uterus
TUNO	Neurilemmoma, uterus
TNAS	Astrocytoma, nervous system
TNNB	Ependymoma, nervous system

<H> MICRO Glossary (Cont.)

TNNO	Neurofibroma, peripheral nerve neurilemmoma
TNNS	Peripheral nerve neurofibrosarcoma
TNOS	Oligodendroglioma, nervous system
TNPO	Papilloma, choroid plexus, nervous system
TNUS	Undifferentiated tumor, nervous system
TNXS	Glioma, mixed, nervous system
TYCS	Chondrosarcoma, heart
TYRO	Rhabdomyoma, heart
TYRS	Rhabdomyosarcoma, heart
TXFA	Fibroadenoma, site specified in comment
TXLS	Leiomyosarcoma, site specified in comment
TANS	Medullary neuroblastoma (ganglioneuroma), adrenal
TAPS	Medullary pheochromocytoma, adrenal

Respiratory system

TRAA	Alveologenic adenoma
TRAC	Alveologenic adenocarcinoma
TRCO	Cystadenoma

Mammary gland

TMAA	Adenocarcinoma A (alveolar)
TMAB	Adenocarcinoma B (ductal, predominantly)
TMAC	Adenocarcinoma C (fibrosarcoma)
TMAT	Adenoacanthoma
TMUO	Mammary gland tumor (undetermined type)

Adrenal cortical tumors

TACC	Cortical carcinoma
TACO	Cortical adenoma
TAUO	Tumor (undetermined cell type)

Pituitary

TPAA	Acidophilic adenoma
TPAC	Carcinoma
TPAO	Adenoma

Thyroid

TZAC	Adenocarcinoma
TZAO	Adenoma

Uterus

TUAC	Adenocarcinoma
TUAO	Adenoma (including papillary type)
TUEC	Squamous cell carcinoma

<H> MICRO Glossary (Cont.)

Testis
- TTAC Carcinoma
- TTGC Seminoma
- TTIO Interstitial cell tumor (Leydig)
- TTKC Sertoli cell tumor
- TTQC Embryonal carcinoma

Seminal vesicle
- TVAO Adenoma
- TVUO Tumor (undetermined cell type)

Harderian gland
- TGAC Adenocarcinoma
- TGAO Papillary cystadenoma
- TGSC Undifferentiated tumor

Kidney
- TKAA Renal adenoma
- TKAC Renal tubular tumor (adenocarcinoma)
- TKCA Cystadenoma
- TKPA Renal papillary cystadenoma
- TKTC Renal pelvic transitional cell carcinoma

Urinary bladder
- TDEC Squamous cell carcinoma
- TDTC Transitional cell carcinoma

Liver
- THAA Adenoma (hepatoma)
- THAC Hepatocarcinoma
- THAO Hyperplastic nodule (pre-neoplastic nodule)
- THCC Cholangiocarcinoma
- THCO Cholangioma (cholangiomatosis)

Gastrointestinal tract
- TIAC Adenocarcinoma
- TIAO Adenoma
- TIEC Squamous cell carcinoma
- TIPL Plaque (pyloric region; polyp)
- TIPO Polyps
- TISC Undifferentiated carcinoma

Skin
- TSAO Adenoma
- TSBC Basal cell carcinoma (hair follicle tumor)
- TSDO Sebaceous gland adenoma

<H> MICRO Glossary (Cont.)

TSEC	Squamous cell carcinoma
TSPO	Papilloma

Rare tissues with tumors

TXAC	Adenocarcinoma, site specified in comment
TXAO	Adenoma, site specified in comment
TXEC	Squamous cell carcinoma, site specified in comment

Ovary

TOAC	Adenocarcinoma
TXAO	Adenoma
TOCO	Cystadenoma
TOGC	Granulosa cell tumor
TOPA	Papillary adenoma
TOSC	Undifferentiated carcinoma
TOTA	Tubular adenoma
TOTO	Luteoma (thecoma)

Group 2 <CT_T> Primary connective tissue tumors

TLFS	Fibrosarcoma, lymph node, site specified in comment
TLHL	Histiocytic leukemia
TLHS	Histiocytic lymphoma (reticulum cell tumor, type A)
TLLL	Lymphocytic-lymphoblastic leukemia
TLLS	Lymphocytic-lymphoblastic lymphoma
TLML	Myelogenous leukemia
TLPS	Plasma cell tumor
TLSL	Undifferentiated leukemia
TLSS	Undifferentiated lymphoma
TLUS	Unclassified lymphoma
TLXL	Mixed histiocytic-lymphocytic leukemia
TLXS	Mixed histiocytic-lymphocytic lymphoma (RCT, type B)
TEVO	Hemangioma, spleen
TLVO	Hemangioma, lymphoreticular tissue
TOVO	Hemangioma, ovary
THVO	Hemangioma, liver
TCVO	Hemangioma, connective tissue
TMVO	Hemangioma, muscle
TBVO	Hemangioma, sternal marrow
TIVO	Hemangioma, gastrointestinal tract
TDVO	Hemangioma, urinary bladder
TUVO	Hemangioma, uterus
TAVO	Hemangioma, adrenal
TTVO	Hemangioma, testis
TEVS	Angiosarcoma, spleen
TLVS	Angiosarcoma, lymph node

<H> MICRO Glossary (Cont.)

TRVS	Angiosarcoma, lung
TOVS	Angiosarcoma, ovary
TKVS	Angiosarcoma, kidney
THVS	Angiosarcoma, liver
TCVS	Angiosarcoma, connective tissue
TMVS	Angiosarcoma, muscle
TBVS	Angiosarcoma, bone
TSVS	Angiosarcoma, skin
TIVS	Angiosarcoma, gastrointestinal tract
TDVS	Angiosarcoma, urinary bladder
TUVS	Angiosarcoma, uterus
TPVS	Angiosarcoma, pituitary
TTVS	Angiosarcoma, testis
TVVS	Angiosarcoma, seminal vesicle
TNVS	Angiosarcoma, nervous system
TYVS	Angiosarcoma, heart
TXVS	Angiosarcoma, site specified in comment
TEFS	Fibrosarcoma, spleen
TKFS	Fibrosarcoma, kidney
THFO	Fibroma, liver
TCFO	Fibroma, connective tissue
TCFS	Fibrosarcoma, connective tissue
TCSS	Undifferentiated connective tissue sarcoma
TMFS	Fibrosarcoma, muscle
TMSS	Undifferentiated sarcoma, muscle
TBFS	Fibrosarcoma, bone
TSFS	Fibrosarcoma, skin
TSSS	Undifferentiated sarcoma, skin
TIFO	Fibroma, gastrointestinal tract
TIFS	Fibrosarcoma, gastrointestinal tract
TDFS	Fibrosarcoma, urinary bladder
TUFO	Fibroma, uterus
TUUS	Sarcoma, uterus, undetermined type
TTFA	Fibroma, testis
TTFS	Fibrosarcoma, testis
TVFO	Fibroma, seminal vesicle
TVFS	Fibrosarcoma, seminal vesicle
TVSS	Undifferentiated sarcoma, seminal vesicle
TNFO	Fibroma, nervous system
TNMS	Meningeal sarcoma, nervous system
TYFS	Fibrosarcoma, heart
TXFS	Fibrosarcoma, site specified in comment
TXUS	Undifferentiated sarcoma, site specified in comment
TCMS	Mast cell tumor, connective tissue
TCOO	Osteoma, connective tissue
TMLS	Leiomyosarcoma, muscle

<H> MICRO Glossary (Cont.)

TMRO	Rhabdomyoma, muscle
TMRS	Rhabdomyosarcoma, muscle
TMSO	Leiomyoma,muscle
TBCS	Chondrosarcoma, bone
TBOO	Osteoma, bone
TBOS	Osteosarcoma, bone
TBUS	Odontogenic sarcoma, bone
TINO	Neurilemmoma, gastrointestinal tract
TISO	Leiomyoma, gastrointestinal tract
TISS	Leiomyosarcoma, gastrointestinal tract
TDLS	Leiomyosarcoma, urinary bladder
TULO	Leiomyoma, uterus
TULS	Leiomyosarcoma, uterus
TUNO	Neurilemmoma, uterus
TNAS	Astrocytoma, nervous system
TNNB	Ependymoma, nervous system
TNNO	Neurofibroma, peripheral nerve neurilemmoma
TNNS	Peripheral nerve neurofibrosarcoma
TNOS	Oligodendroglioma, nervous system
TNPO	Papilloma, choroid plexus, nervous system
TNUS	Undifferentiated tumor, nervous system
TNXS	Glioma, mixed, nervous system
TYCS	Chondrosarcoma, heart
TYRO	Rhabdomyoma, heart
TYRS	Rhabdomyosarcoma, heart
TXFA	Fibroadenoma, site specified in comment
TXLS	Leiomyosarcoma, site specified in comment
TANS	Medullary neuroblastoma (ganglioneuroma), adrenal
TAPS	Medullary pheochromocytoma, adrenal

Group 3 <EP_T> Primary epithelial tumors excluding ovarian tumors

Respiratory system

TRAA	Alveologenic tumor adenoma
TRAC	Alveologenic tumor adenocarcinoma
TRCO	Cystadenoma

Mammary gland

TMAA	Adenocarcinoma A (alveolar)
TMAB	Adenocarcinoma B (ductal, predominantly)
TMAC	Adenocarcinoma C (fibrosarcoma)
TMAT	Adenoacanthoma
TMUO	Mammary gland tumor (undetermined type)

<H> MICRO Glossary (Cont.)

Adrenal cortical tumors
- TACC Cortical carcinoma
- TACO Cortical adenoma
- TAUO Tumor (undetermined cell type)

Pituitary
- TPAA Acidophilic adenoma
- TPAC Carcinoma
- TPAO Adenoma

Thyroid
- TZAC Adenocarcinoma
- TZAO Adenoma

Uterus
- TUAC Adenocarcinoma
- TUAO Adenoma (including papillary type)
- TUEC Squamous cell carcinoma

Testis
- TTAC Carcinoma
- TTGC Seminoma
- TTIO Interstitial cell tumor (Leydig)
- TTKC Sertoli cell tumor
- TTQC Embryonal carcinoma

Seminal vesicle
- TVAO Adenoma
- TVUO Tumor (undetermined cell type)

Harderian gland
- TGAC Adenocarcinoma
- TGAO Papillary cystadenoma
- TGSC Undifferentiated tumor

Kidney
- TKAA Renal adenoma
- TKAC Renal tubular tumor, adenocarcinoma
- TKCA Cystadenoma
- TKPA Renal papillary cystadenoma
- TKTC Renal pelvic transitional cell carcinoma

Urinary bladder
- TDEC Squamous cell carcinoma
- TDTC Transitional cell carcinoma

<H> MICRO Glossary (Cont.)

Liver

THAA	Adenoma (hepatoma)
THAC	Hepatocarcinoma
THAO	Hyperplastic nodule (pre-neoplastic nodule)
THCC	Cholangiocarcinoma
THCO	Cholangioma (cholangiomatosis)

Gastrointestinal tract

TIAC	Adenocarcinoma
TIAO	Adenoma
TIEC	Squamous cell carcinoma
TIPL	Plaque (pyloric region; polyp)
TIPO	Polyps
TISC	Undifferentiated carcinoma

Skin

TSAO	Adenoma
TSBC	Basal cell carcinoma (hair follicle tumor)
TSDO	Sebaceous gland adenoma
TSEC	Squamous cell carcinoma
TSPO	Papilloma

Rare tissues with tumors

TXAC	Adenocarcinoma, site specified in comment
TXAO	Adenoma, site specified in comment
TXEC	Squamous cell carcinoma, site specified in comment

Group 4 <LR_T> Lymphoreticular tumors

TLHL	Histiocytic leukemia
TLHS	Histiocytic lymphoma (reticulum cell tumor, type A)
TLLL	Lymphocytic-lymphoblastic leukemia
TLLS	Lymphocytic-lymphoblastic lymphoma
TLML	Myelogenous leukemia
TLPS	Plasma cell tumor
TLSL	Undifferentiated leukemia
TLSS	Undifferentiated lymphoma
TLUS	Unclassified lymphoma
TLXL	Mixed histiocytic-lymphocytic leukemia
TLXS	Mixed histiocytic-lymphocytic lymphoma (RCT, type B)

Group 5 <TLSA> Lymphosarcoma

TLLS	Lymphocytic-lymphoblastic lymphoma
TLUS	Unclassified lymphoma
TLSS	Undifferentiated lymphoma

<H> MICRO Glossary (Cont.)

Group 6 <TLRC> Reticulum cell sarcoma

TLHS	Histiocytic lymphoma (reticulum cell tumor, type A)
TLXS	Mixed histiocytic-lymphocytic lymphoma (RCT, type B)

Group 7 <TLLE> Lymphocytic leukemia

TLLL	Lymphocytic-lymphoblastic leukemia
TLHL	Histiocytic leukemia
TLML	Myelogenous leukemia
TLPS	Plasma cell tumor
TLSL	Undifferentiated leukemia
TLXL	Mixed histiocytic-lymphocytic leukemia

Group 8 <TCAR> All carcinomas

TRAC	Alveologenic tumor adenocarcinoma
TMAA	Mammary gland, adenocarcinoma A (alveolar)
TMAB	Mammary gland, adenocarcinoma B (ductal, predominantly)
TMAC	Mammary gland, adenocarcinoma C
TACC	Adrenal cortical carcinoma
TPAC	Pituitary, carcinoma
TZAC	Thyroid, adenocarcinoma
TUAC	Uterus, adenocarcinoma
TUEC	Uterus, squamous cell carcinoma
TTAC	Testis, carcinoma
TTQC	Testis, embryonal carcinoma
TGAC	Harderian gland, adenocarcinoma
TKAC	Kidney, renal tubular adenocarcinoma
TKTC	Kidney, renal pelvic transitional cell carcinoma
TDEC	Urinary bladder, squamous cell carcinoma
TDTC	Urinary bladder, transitional cell carcinoma
THAC	Liver, hepatocarcinoma
THCC	Liver, cholangiocarcinoma
TIAC	Gastrointestinal tract, adenocarcinoma
TIEC	Gastrointestinal tract, squamous cell carcinoma
TISC	Gastrointestinal tract, undifferentiated carcinoma
TSBC	Skin, basal cell carcinoma (hair follicle tumor)
TSEC	Skin, squamous cell carcinoma
TXAC	Rare tissues with tumors, adenocarcinoma, site specified in comment
TXEC	Rare tissues with tumors, squamous cell carcinoma, site specified in comment
TOAC	Ovary, adenocarcinoma
TOSC	Ovary, undifferentiated carcinoma

<H> MICRO Glossary (Cont.)

Group 9 <TSAR> All sarcomas

TLFS	Fibrosarcoma, lymph node, site specified in comment
TLHS	Histiocytic lymphoma (reticulum cell tumor, type A)
TLLS	Lymphocytic-lymphoblastic lymphoma
TLSS	Undifferentiated lymphoma
TLUS	Unclassified lymphoma
TLXS	Mixed histiocytic-lymphatic lymphoma (RCT, type B)
TEVS	Angiosarcoma, spleen
TLVS	Angiosarcoma, lymph node
TRVS	Angiosarcoma, lung
TOVS	Angiosarcoma, ovary
TKVS	Angiosarcoma, kidney
THVS	Angiosarcoma, liver
TCVS	Angiosarcoma, connective tissue
TMVS	Angiosarcoma, muscle
TBVS	Angiosarcoma, bone
TSVS	Angiosarcoma, skin
TIVS	Angiosarcoma, gastrointestinal tract
TDVS	Angiosarcoma, urinary bladder
TUVS	Angiosarcoma, uterus
TPVS	Angiosarcoma, pituitary
TTVS	Angiosarcoma, testis
TVVS	Angiosarcoma, seminal vesicle
TNVS	Angiosarcoma, nervous system
TYVS	Angiosarcoma, heart
TXVS	Angiosarcoma, site specified in comment
TEFS	Fibrosarcoma, spleen
TKFS	Fibrosarcoma, kidney
TCFS	Fibrosarcoma, connective tissue
TCSS	Undifferentiated connective tissue sarcoma
TMFS	Fibrosarcoma, muscle
TMSS	Undifferentiated sarcoma, muscle
TBFS	Fibrosarcoma, bone
TSFS	Fibrosarcoma, skin
TSSS	Undifferentiated sarcoma, skin
TIFS	Fibrosarcoma, gastrointestinal tract
TDFS	Fibrosarcoma, urinary bladder
TUUS	Sarcoma, uterus, undetermined type
TTFS	Fibrosarcoma, testis
TVFS	Fibrosarcoma, seminal vesicle
TVSS	Undifferentiated sarcoma, seminal vesicle
TNMS	Meningeal sarcoma, nervous system
TYFS	Fibrosarcoma, heart
TXFS	Fibrosarcoma, site specified in comment
TXUS	Undifferentiated sarcoma, site specified in comment

<H> MICRO Glossary (Cont.)

TCMS	Mast cell tumor, connective tissue
TMLS	Leiomyosarcoma, muscle
TMRS	Rhabdomyosarcoma, muscle
TBCS	Chondrosarcoma, bone
TBOS	Osteosarcoma, bone
TBUS	Odontogenic sarcoma, bone
TISS	Leiomyosarcoma, gastrointestinal tract
TDLS	Leiomyosarcoma, urinary bladder
TULS	Leiomyosarcoma, uterus
TNNS	Peripheral nerve neurofibrosarcoma
TYCS	Chondrosarcoma, heart
TYRS	Rhabdomyosarcoma, heart
TXLS	Leiomyosarcoma, site specified in comment

Group 10 <T_FO> All fibromas

THFO	Fibroma, liver
TCFO	Fibroma, connective tissue
TIFO	Fibroma, gastrointestinal tract
TUFO	Fibroma, uterus
TTFA	Fibroma, testis
TVFO	Fibroma, seminal vesicle
TNFO	Fibroma, nervous system

Group 11 <TFSA> All fibrosarcomas

TEFS	Fibrosarcoma, spleen
TKFS	Fibrosarcoma, kidney
TCFS	Fibrosarcoma, connective tissue
TMFS	Fibrosarcoma, muscle
TBFS	Fibrosarcoma, bone
TSFS	Fibrosarcoma, skin
TIFS	Fibrosarcoma, gastrointestinal tract
TDFS	Fibrosarcoma, urinary bladder
TLFS	Fibrosarcoma, lymph node
TTFS	Fibrosarcoma, testis
TVFS	Fibrosarcoma, seminal vesicle
TXFS	Fibrosarcoma, site specified in comment
TYFS	Fibrosarcoma, heart

Group 12 <TRAA> Alveologenic adenoma

TRAA	Alveologenic adenoma

<H> MICRO Glossary (Cont.)

Group 13 <TRAC> Alveologenic adenocarcinoma

TRAC	Alveologenic adenocarcinoma

Group 14 <TADR> All adrenal tumors

TACC	Cortical carcinoma
TACO	Cortical adenoma
TAUO	Tumor (undetermined cell type)
TANS	Medullary neuroblastoma (ganglioneuroma)
TAPS	Medullary pheochromocytoma

Group 15 <TAC_> Adrenal cortical tumors

TACC	Cortical carcinoma
TACO	Cortical adenoma
TAUO	Tumor (undetermined cell type)

Group 16 <TAM_> Adrenal medullary tumors

TANS	Medullary neuroblastoma (ganglioneuroma)
TAPS	Medullary pheochromocytoma

Group 17 <THA_> Liver, hepatocellular tumors

THAA	Adenoma (hepatoma)
THAC	Hepatocarcinoma
THAO	Hyperplastic nodule (pre-neoplastic nodule)

Group 18 <TK__> Kidney tumors

TKAA	Renal adenoma
TKAC	Renal tubular adenocarcinoma
TKCA	Cystadenoma
TKPA	Renal papillary cystadenoma
TKTC	Renal pelvic transitional cell tumor

Group 19 <TMGL> Mammary gland tumors

TMAA	Adenocarcinoma A (alveolar)
TMAB	Adenocarcinoma B (ductal, predominantly)
TMAC	Adenocarcinoma C
TMAT	Adenoacanthoma
TMUO	Mammary gland tumor (undetermined type)

<H> MICRO Glossary (Cont.)

Group 20 <T_GI> Gastrointestinal tract tumors

TIAC	Adenocarcinoma
TIAO	Adenoma
TIEC	Squamous cell carcinoma
TIPL	Plaque (pyloric region; polyp)
TIPO	Polyps
TISC	Undifferentiated carcinoma
TIFO	Fibroma, gastrointestinal tract
TIFS	Fibrosarcoma, gastrointestinal tract
TISO	Leiomyoma, gastrointestinal tract
TISS	Leiomyosarcoma, gastrointestinal tract
TIVO	Hemangioma, gastrointestinal tract
TIVS	Angiosarcoma, gastrointestinal tract
TINO	Neurilemmoma, gastrointestinal tract

Group 21 <TBON> Bone tumors

TBFS	Fibrosarcoma, bone
TBVS	Angiosarcoma, bone
TBOO	Osteoma, bone
TBOS	Osteosarcoma, bone
TBCS	Chondrosarcoma, bone
TBUS	Odontogenic sarcoma, bone

Group 22 <T_WR> Metastases from lung tumor to any site

TAWR	Metastasis to adrenal
TBWR	Metastasis to bone
TCWR	Metastasis to connective tissue
THWR	Metastasis to liver
TKWR	Metastasis to kidney
TLWR	Metastasis to lymphoreticular tissue
TMWR	Metastasis to muscle
TNWR	Metastasis to nervous system
TXWR	Metastasis to tissue specified in comment
TYWR	Metastasis to heart

Group 23 <T_WK> Metastases from kidney tumor to any site

TAWK	Metastasis to adrenal
TCWK	Metastasis to connective tissue
TEWK	Metastasis to spleen
THWK	Metastasis to liver
TLWK	Metastasis to lymphoreticular tissue
TMWK	Metastasis to muscle

<H> MICRO Glossary (Cont.)

TNWK Metastasis to nervous system
TRWK Metastasis to respiratory system
TXWK Metastasis to tissue specified in comment
TYWK Metastasis to heart

Group 24 <T_WG> Metastases from Harderian gland tumor to any site

TBWG Metastasis to bone
TCWG Metastasis to connective tissue
THWG Metastasis to liver
TKWG Metastasis to kidney
TLWG Metastasis to lymphoreticular tissue
TMWG Metastasis to muscle
TNWG Metastasis to nervous system
TRWG Metastasis to respiratory system
TXWG Metastasis to tissue specified in comment
TYWG Metastasis to heart

Group 25 <T_WB> Metastases from bone tumor to any site

TCWB Metastatis to connective tissue
TEWB Metastasis to spleen
THWB Metastasis to liver
TIWB Metastasis to gastrointestinal tract
TKWB Metastasis to kidney
TLWB Metastasis to lymphoreticular tissue
TMWB Metastasis to muscle
TNWB Metastasis to nervous system
TOWB Metastasis to ovary
TRWB Metastasis to respiratory system
TSWB Metastasis to skin
TXWB Metastasis to tissue specified in comment
TYWB Metastasis to heart

Group 26 <TRW_> Metastases from any site to lung

TRWA Origin, adrenal
TRWB Origin, bone
TRWC Origin, connective tissue
TRWG Origin, Harderian gland
TRWH Origin, liver
TRWI Origin, gastrointestinal tract
TRWK Origin, kidney
TRWM Origin, muscle or mammary gland (tissue specified in comment)
TRWN Origin, nervous system
TRWO Origin, ovary

<H> MICRO Glossary (Cont.)

TRWP Origin, pituitary
TRWS Origin, skin
TRWT Origin, testis
TRWU Origin, uterus
TRWV Origin, seminal vesicle
TRWX Origin, tissue specified in comment
TRWY Origin, heart
TRWZ Origin, thyroid

Group 27 <TKW_> Metastases from any site to kidney

TKWA Origin, adrenal
TKWB Origin, bone
TKWC Origin, connective tissue
TKWG Origin, Harderian gland
TKWH Origin, liver
TKWI Origin, gastrointestinal tract
TKWM Origin, muscle or mammary gland (tissue specified in comment)
TKWN Origin, nervous system
TKWO Origin, ovary
TKWP Origin, pituitary
TKWR Origin, lung
TKWS Origin, skin
TKWU Origin, uterus
TKWX Origin, tissue specified in comment
TKWZ Origin, thyroid

Group 28 <T_W_> All metastatic tumors (secondaries)

Lymphoreticular tissue
TLWA Origin, adrenal
TLWB Origin, bone
TLWC Origin, connective tissue
TLWG Origin, Harderian gland
TLWH Origin, liver
TLWI Origin, gastrointestinal tract
TLWK Origin, kidney
TLWM Origin, muscle
TLWN Origin, nervous system
TLWO Origin, ovary
TLWP Origin, pituitary
TLWR Origin, lung
TLWS Origin, skin
TLWT Origin, testis
TLWU Origin, uterus
TLWX Origin, tissue specified in comment

<H> MICRO Glossary (Cont.)

TLWY	Origin, heart
TLWZ	Origin, thyroid

Lung

TRWA	Origin, adrenal
TRWB	Origin, bone
TRWC	Origin, connective tissue
TRWG	Origin, Harderian gland
TRWH	Origin, liver
TRWI	Origin, gastrointestinal tract
TRWK	Origin, kidney
TRWM	Origin, muscle or mammary gland (tissue specified in comment)
TRWN	Origin, nervous system
TRWO	Origin, ovary
TRWP	Origin, pituitary
TRWS	Origin, skin
TRWT	Origin, testis
TRWU	Origin, uterus
TRWV	Origin, seminal vesicle
TRWX	Origin, tissue specified in comment
TRWY	Origin, heart
TRWZ	Origin, thyroid

Ovary

TOWB	Origin, bone
TOWU	Origin, uterus
TOWX	Origin, tissue specified in comment

Kidney

TKWA	Origin, adrenal
TKWB	Origin, bone
TKWC	Origin, connective tissue
TKWG	Origin, Harderian gland
TKWH	Origin, liver
TKWI	Origin, gastrointestinal tract
TKWM	Origin, muscle or mammary gland (tissue specified in comment)
TKWN	Origin, nervous system
TKWO	Origin, ovary
TKWP	Origin, pituitary
TKWR	Origin, lung
TKWS	Origin, skin
TKWU	Origin, uterus
TKWX	Origin, tissue specified in comment
TKWZ	Origin, thyroid

<H> MICRO Glossary (Cont.)

Liver

THWA	Origin, adrenal
THWB	Origin, bone
THWC	Origin, connective tissue
THWD	Origin, urinary bladder
THWG	Origin, Harderian gland
THWI	Origin, gastrointestinal tract
THWK	Origin, kidney
THWM	Origin, muscle
THWN	Origin, nervous system
THWO	Origin, ovary
THWP	Origin, pituitary
THWR	Origin, lung
THWS	Origin, skin
THWU	Origin, uterus
THWV	Origin, seminal vesicle
THWX	Origin, tissue specified in comment
THWY	Origin, heart
THWZ	Origin, thyroid

Connective tissue

TCWA	Origin, adrenal
TCWB	Origin, bone
TCWD	Origin, urinary bladder
TCWG	Origin, Harderian gland
TCWH	Origin, liver
TCWI	Origin, gastrointestinal tract
TCWK	Origin, kidney
TCWN	Origin, nervous tissue
TCWO	Origin, ovary
TCWP	Origin, pituitary
TCWR	Origin, lung
TCWS	Origin, skin
TCWZ	Origin, thyroid

Muscle

TMWA	Origin, adrenal
TMWB	Origin, bone
TMWC	Origin, connective tissue
TMWD	Origin, urinary bladder
TMWG	Origin, Harderian gland
TMWH	Origin, liver
TMWK	Origin, kidney
TMWM	Origin, mammary gland
TMWN	Origin, nervous system
TMWR	Origin, lung

<H> MICRO Glossary (Cont.)

TMWS	Origin, skin
TMWT	Origin, testis
TMWX	Origin, tissue specified in comment
TMWZ	Origin, thyroid

Bone

TBWG	Origin, Harderian gland
TBWM	Origin, muscle
TBWN	Origin, nervous tissue
TBWR	Origin, lung
TBWS	Origin, skin
TBWX	Origin, tissue specified in comment

Skin

TSWB	Origin, bone
TSWC	Origin, connective tissue
TSWN	Origin, nervous system

Gastrointestinal tract

TIWB	Origin, bone
TIWM	Origin, muscle or mammary gland (tissue specified in comment)
TIWO	Origin, ovary
TIWT	Origin, testis
TIWU	Origin, uterus
TIWZ	Origin, thyroid

Urinary bladder

TDWX	Origin, tissue specified in comment

Adrenal

TAWI	Origin, gastrointestinal tract
TAWK	Origin, kidney
TAWM	Origin, muscle
TAWO	Origin, ovary
TAWR	Origin, lung
TAWS	Origin, skin
TAWU	Origin, uterus
TAWZ	Origin, thyroid

Harderian gland

TGWC	Origin, connective tissue
TGWS	Origin, skin

Nervous system

TNWB	Origin, bone
TNWC	Origin, connective tissue

<H> MICRO Glossary (Cont.)

TNWG	Origin, Harderian gland
TNWK	Origin, kidney
TNWM	Origin, muscle
TNWO	Origin, ovary
TNWR	Origin, lung
TNWS	Origin, skin
TNWP	Origin, pituitary
TNWX	Origin, tissue specified in comment

Heart

TYWA	Origin, adrenal
TYWB	Origin, bone
TYWC	Origin, connective tissue
TYWG	Origin, Harderian gland
TYWH	Origin, liver
TYWK	Origin, kidney
TYWM	Origin, muscle
TYWO	Origin, ovary
TYWR	Origin, lung
TYWS	Origin, skin
TYWT	Origin, testis
TYWU	Origin, uterus
TYWX	Origin, tissue specified in comment

Rare tissues with tumors, metastatic site specified in comment

TXWB	Origin, bone
TXWC	Origin, connective tissue
TXWG	Origin, Harderian gland
TXWI	Origin, gastrointestinal tract
TXWK	Origin, kidney
TXWM	Origin, muscle
TXWO	Origin, ovary
TXWP	Origin, pituitary
TXWR	Origin, lung
TXWS	Origin, skin
TXWU	Origin, uterus
TXWV	Origin, seminal vesicle

Spleen

TEWB	Origin, bone
TEWC	Origin, connective tissue
TEWD	Origin, urinary bladder
TEWH	Origin, liver
TEWK	Origin, kidney
TEWM	Origin, muscle
TEWS	Origin, skin

<H> MICRO Glossary (Cont.)

TEWT	Origin, testis
TEWU	Origin, uterus

Uterus

TUWO	Origin, ovary

Seminal vesicle

TVWD	Origin, urinary bladder
TVWX	Origin, tissue specified in comment

APPENDIX N:

LIST OF SELECTED JANUS PUBLICATIONS

List of Selected JANUS Publications

Ainsworth, E.J., R.J.M. Fry, P.C. Brennan, S.P. Stearner, J.H. Rust, and F.S. Williamson, 1976, Life shortening, neoplasia and systemic injuries in mice after single or fractionated doses of neutron or gamma radiation, in *Biological and Environmental Effects of Low-Level Radiation*, vol. 1, International Atomic Energy Agency, Vienna, pp. 77–92.

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