Summary of Carcinogenic Potency and Positivity for 492 Rodent Carcinogens in the Carcinogenic Potency Database

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A tabulation of carcinogenic potency (TD$_{50}$) by species for 492 chemicals that induce tumors in rats or mice is presented. With the use of the Carcinogenic Potency Database, experimental results are summarized by indicating in which sex-species groups the chemical was tested and the respective evaluations of carcinogenicity. A comparison of three summary measures of TD$_{50}$ for chemicals with more than one positive experiment per species shows that the most potent TD$_{50}$ value is similar to measures that average values or functions of values. This tabulation can be used to investigate associations between rodent potency and other factors such as mutagenicity, teratogenicity, chemical structure, and human exposure.

Introduction

For a variety of purposes it is desirable to have a summary measure of the carcinogenic potency of a chemical in rodents. A single value is needed, for example, to summarize the chronic toxicity of a chemical, to estimate carcinogenic hazards to humans by a comparison of rodent potency and human exposure (1,2), or to compare results of short-term tests with those of rodent bioassays (3). For several years we have been developing the Carcinogenic Potency Database (CPDB), a compilation of the results of chronic rodent cancer tests and the potency values derived from those results (4–6). The CPDB contains data on approximately 3700 experiments of 975 compounds, including tests from the National Cancer Institute and National Toxicology Program (NCI/NTP), as well as from the general published literature. For a given compound, the database may include experiments in both rats and mice, males and females, a variety of strains or routes of administration, and a variety of doses and experimental conditions; alternatively, for a different substance there may be only one experiment conducted in a single sex-species group. In order to construct a chemical-by-chemical list of carcinogenic potency in each species, some method must be selected to summarize the potency of a carcinogen when there is more than one potency estimate for it. Additional information to summarize the experimental results includes the number of sex-species groups tested and the evaluations of carcinogenicity in each group.

In this paper we present a table summarizing carcinogenic potency in rats and mice for the 492 chemicals that have positive results in the CPDB; we also indicate in which sex-species groups the chemical was tested and the respective evaluations of carcinogenicity. Our intent is that this summary compilation will be a useful reference source for the scientific and regulatory communities, and that it will facilitate the use of our larger published plots of the CPDB. The larger plots provide detailed information on each experiment including the species, sex, strain, route of administration, duration of exposure and of experiment, dose levels, target sites, shape of the dose response, estimates of carcinogenic potency and the confidence limits surrounding it, statistical significance of the carcinogenic dose response, tumor incidences, and bibliographic citation to the published paper or to the NCI/NTP Technical Report.

Methods

Our analyses are based on the chemicals reported in the CPDB (4–6), which has been fully described in
Gold et al. (4) as to bioassay inclusion criteria, protocol characteristics and derived variables. The database is organized by chemical using a plot format and includes bioassay results from two sources: papers published in the general literature through 1984, and NCI/NTP Technical Reports published through May 1986. All experiments in the database meet a specific set of inclusion criteria that were designed to permit the estimation of carcinogenic potency; therefore, reasonable consistency of experimental protocols is assured. Rodent bioassays are included in the database only if the test agent was administered alone rather than in combination with other substances; if the bioassay included a control group; if the route of administration was either diet, water, gavage, inhalation, IV injection or IP injection; and if the length of experiment in rodents was at least 1 year with dosing for at least 6 months. For the CPDB, we do not evaluate the evidence for carcinogenicity in an experiment; rather, we report the evaluation of the published author and calculate the statistical significance of the tumorigenic dose response in the experiment.

Carcinogenicity

Our tabular compilation of results by sex-species group and of carcinogenic potency by species is restricted to chemicals identified as carcinogens in our database. We classify the results of an experiment as either positive or negative on the basis of the author’s opinion in the published paper, and we include in the present publication only those chemicals that have been evaluated as positive by the author of at least one experiment. In some cases authors do not clearly state their evaluation, and in some NCI/NTP Technical Reports the evidence for carcinogenicity is considered only suggestive; in our analyses we consider these cases as lacking clear evidence of carcinogenicity and do not use them to identify a chemical as positive. We use the author’s opinion to determine positivity because it often takes into account more information than statistical significance alone, such as historical control rates for particular sites, survival and latency, and/or dose response. Generally, this designation by author’s opinion corresponds well with the results of statistical tests for the significance of the dose-response effect (4,7).

In our tabular compilation of positivity by sex-species group for each of the 492 chemicals classified as positive, we indicate whether the compound was tested in each group and list the strongest level of evidence for carcinogenicity based upon any author’s evaluation in either the general literature or the NCI/NTP. The strongest evaluation is clear evidence of carcinogenicity (I). When there was no such evaluation in one of the sex-species groups, but the compound was tested by NCI/NTP and their evaluation was stronger than “no evidence of carcinogenicity” (M), we indicate whether that NCI/NTP evaluation was “some evidence of carcinogenicity” (A), “equivocal” (E) or “inadequate bioassay” (I). These evaluations correspond to the opinions reported in our published plots; we note that in a few borderline cases our interpretation of the Technical Reports differs from those recently tabulated by Haseman et al. (8).

Carcinogenic Potency Values

In our analyses of carcinogenic potency we use our numerical index, the TD50, which has been fully described in Sawyer et al. (9) and in Peto et al. (10), and which is reported for each target site in our published plots. Briefly, TD50 may be defined as follows: For a given target site(s), TD50 is the chronic dose rate in milligrams per kilogram body weight per day that would induce tumors in half the test animals at the end of a standard lifespan for the species in the absence of tumors in control animals. Since the tumor(s) of interest often occurs in control animals, TD50 is more precisely defined as the chronic dose rate that will halve the probability of remaining tumor-free throughout the standard lifespan of the species (9,10). For bioassays from the NCI/NTP program, TD50 values are estimated from lifetable data (11) and are adjusted for the differential effects of toxicity among dose groups and for differences in the time pattern of tumor incidence. For experiments from the general literature, TD50 values are based on summary incidence data [for a comparison of methods and TD50 values see (9,11)]. The range of TD50 values for carcinogens in the CPDB is more than 10 million-fold.

For the purposes of this summary, in any given positive experiment we select the lowest TD50 value from among positively evaluated target sites with a statistically significant dose response (two-tailed p < 0.1). If no positive sites have a significant dose response, then we select the most potent (lowest TD50) from among positively evaluated sites with p ≥ 0.1. This method provides a single TD50 to represent an experiment. For approximately one-half of the carcinogens in rats and one-third of the carcinogens in mice, the CPDB includes only one positive experiment. For chemicals with more than one positive test, we summarize potency in a species by selecting the lowest significant TD50 value from among those representing each experiment. If none is significant, the lowest is chosen from among these nonsignificant values. In some experiments, no TD50 could be estimated because all animals in the only dose group had the tumor of interest, and the only data available were for crude percentages of animals with a tumor (4). For these cases we use the 99% upper confidence limit of TD50 as a replacement for the TD50.

Results

In Table 1 we report results for the 492 test agents that were evaluated by a published author as tumorigenic in at least one experiment. These are the 492 positive
### SUMMARY OF CARCINOGENIC POTENCY

Table 1. Carcinogenic potency in mg/kg/day (TD50) and positivity in rats and mice for chemicals evaluated as carcinogens in at least one experiment.

| Rat   | Mouse | MR | FR | MM | FM | CAS | Name |
|-------|-------|----|----|----|----|-----|------|
| NT    | NT    | NT | +  | +  | +  | 16568-02-8 | ACETALDEHYDE METHYLFORMYLHYDRAZONE |
| NT    | NT    | NT | +  | +  | +  | 60-35-5 | ACETAMIDE |
| NT    | NT    | +  | +  | +  | +  | 103-90-2 | ACETAMINOPHEN |
| NT    | NT    | +  | NT | +  | NT | 18523-69-8 | ACETONE 4-(5-NITRO-2-FURYL)-2-Thiazolylhydrazone |
| NT    | NT    | +  | NT | +  | NT | 127-06-0 | ACETOXIME |
| NT    | NT    | +  | NT | +  | NT | 34627-78-6 | 1-ACETOXYSAFROLE |
| NT    | NT    | +  | NT | +  | NT | 6574-38-5 | N'-ACETYL-4-(HYDROXYMETHYL)PHENYLHYDRAZONE |
| NT    | NT    | +  | NT | +  | NT | 1078-38-2 | 1-ACETYL-2-ISONICOTINYLHYDRAZONE |
| NT    | NT    | +  | NT | +  | +  | 114-83-0 | 1-ACETYL-2-PHENYLHYDRAZONE |
| NT    | NT    | NT | +  | NT | NT | 4075-79-0 | 4-ACETYLAMINOBIPHENYL |
| NT    | NT    | NT | +  | NT | NT | +  | +  | 53-96-3 | 2-ACETYLAMINOFLOURENE |
| NT    | NT    | +  | +  | +  | +  | 7008-42-6 | ACRONYCINE |
| NT    | NT    | NT | +  | NT | NT | 107-13-1 | ACRYLONITRILE |
| NT    | NT    | +  | NT | NT | +  | 50-76-0 | ACTINOMYCIN D |
| NT    | NT    | +  | NT | +  | +  | 3688-53-7 | AF-2 |
| NT    | NT    | NT | NT | NT | NT | 29611-03-8 | AFLAGOTOXICOL |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 1162-65-8 | AFLAGOXIN B1 |
| NT    | NT    | NT | +  | +  | +  | 309-00-0 | ALDROXIN |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 7712-49-6 | ALLOY ISOELVATE |
| NT    | NT    | NT | +  | NT | NT | +  | +  | 2835-39-4 | ALLOY ISOLVATE |
| NT    | NT    | NT | NT | +  | +  | 30207-83-7 | ALULHYDRAZINE.HCl |
| NT    | NT    | NT | +  | NT | NT | +  | +  | 75104-43-7 | 3-AMINO-1,4-DIMETHYL-5H-PYRIDO[3,4-b]INDOLE ACETATE |
| NT    | NT    | NT | +  | NT | NT | +  | +  | 17026-81-2 | 3-AMINO-4-ETHOXYACETANILIDE |
| NT    | NT    | NT | +  | NT | NT | +  | +  | 68006-83-7 | 3-AMINO-9-ETHYLCARBAZOLE MIXTURE |
| NT    | NT    | NT | +  | NT | NT | +  | +  | 72254-58-1 | 3-AMINO-1-METHYL-5H-PYRIDO[4,3-b]INDOLE ACETATE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 82-28-0 | 1-AMINO-2-METHYLANTHRAQUINONE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 67730-11-4 | 2-AMINO-6-METHYLIDIPYRIDO[2,3'-2',3'-d]IMIDAZOLE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 76180-96-6 | 3-AMINO-3-METHYLIMIDAZO[4,5-f]QUINOLINE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 3757-55-1 | 2-AMINO-5,5'-NITRO-2-FURYL-1,3,4-OXADIAZOLE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 712-68-8 | 2-AMINO-5,5'-NITRO-2-FURYL-1,3,4-OXADIAZOLE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 38514-71-5 | 2-AMINO-4,4'-NITRO-2-FURYLTHIAZOLE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 28754-68-9 | trans-5-AMINO-3,2-(6-NITRO-2-FURYL)VINYL-1,2,4-OXADIAZOLE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 119-34-6 | 4-AMINO-2-NITROPHENOL |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 2104-09-8 | 2-AMINO-4-p-NITROPHENYLTHIAZOLE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 121-66-4 | 2-AMINO-5-NITROTIAZOLE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 26148-68-5 | 2-AMINO-9H-PYRIDO[2,3-b]INDOLE |
| NT    | NT    | NT | NT | +  | +  | 117-93-9 | 2-AMINOANTHRQUINONE |
| NT    | NT    | NT | NT | +  | NT | +  | +  | 97-56-3 | H-O-AZIMINOCOTOLUENE |
| NT    | NT    | NT | NT | +  | NT | +  | +  | 92-67-1 | 2-AMINODIPHENYL |
| NT    | NT    | NT | NT | +  | NT | +  | +  | 3683-22-9 | 2-AMINODIPHENYLENE OXIDE |
| NT    | NT    | NT | NT | +  | NT | +  | +  | 67730-10-3 | 2-AMINODIPYRIDO[1,2-a]3,2'-dIMIDAZOLE |
| NT    | NT    | NT | NT | +  | NT | +  | +  | 64-82-5 | 2-AMINOTRIAZOLE |
| NT    | NT    | NT | NT | +  | NT | +  | +  | 2432-99-7 | 2-AZASURENACOACTIC ACID |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 10589-74-9 | 2-AMYL-1-NITROSOUERA |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 142-04-1 | ANILINE.HCl |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 134-29-2 | o-ANISIDINE.HCl |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 140-57-8 | ARAMITE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 61-94-9 | AECOLINE.HCl |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 27233-18-8 | AROCOLOR 1254 |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 11086-82-5 | AROCOLOR 1260 |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 2465-27-2 | 3-AMINOTHIENONENONENONE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 115-02-6 | AZASERINE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 103-33-3 | AZOBENZENE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 25843-45-2 | AZOXYMETHANE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 92-87-5 | BENZIDINE |
| NT    | NT    | NT | NT | NT | NT | +  | +  | 531-85-1 | BENZIDINE.2HCl |

(Continued on next page)
| Rat | Mouse | MR | FR | MM | FM | CAS | Name |
|-----|-------|----|----|----|----|-----|------|
| 0.956 | 11 | B+ | B+ | - | - | 50-32-8 | BENZOSALICYLIC ACID (BENZOSALICYLIC ACID) |
| NT | 7.35a | NT | NT | + | + | 613-94-5 | BENZYL HYDRAZINE |
| NT | 85.3 | NT | NT | - | + | 20570-96-1 | BENZYLHYDRAZINE2HCI |
| - | 1120 | - | - | A | + | 2185-92-4 | 2-BIPHENYLAMINE.HCL |
| NT | 138a | - | - | - | + | 108-60-1 | BIS-(2-CHLORO-1-METHYLETHYL) ETHER |
| NT | 8.19a | NT | NT | - | - | 111-44-4 | BIS-2-CHLOROETHYLHYDRAZINE |
| NT | 4.62g | NT | NT | NT | + | 13849-18-6 | BIS-1,2-(CHLOROMETHYL)ETHANE |
| NT | 3.11d | NT | NT | NT | + | 56894-91-8 | BIS-1,4-(CHLOROMETHYL)p-XYLENE |
| 0.0057 | 0.182e | + | NT | + | + | 542-88-1 | BIS-(CHLOROMETHYL) ETHER |
| 3.14 | NT | + | NT | NT | - | 4-BIS-(2-HYDROXYETHYL)AMINO-2-(5-NITRO-2-THIENYL)QUINAZOLINE |
| NT | 34.5a | NT | NT | - | + | 23746-34-1 | BIS-2-HYDROXYETHYLDLTHIOCARBAMIC ACID, POTASSIUM |
| 0.945a | NT | + | + | NT | NT | 1907-37-7 | C.I. DIRECT BLACK 38 |
| - | 208a | E | A | + | + | 2784-94-3 | HC BLUE NO. 1 |
| 89.5a | + | + | E | - | - | 2475-48-5 | C.I. DISPERS BLUE 1 |
| 1.18a | NT | + | + | NT | NT | 2602-46-2 | C.I. DIRECT BLUE 6 |
| 9.62a | - | + | + | - | 7758-01-2 | BROMATE, POTASSIUM |
| 2.07 | NT | - | + | NT | NT | 16071-86-6 | C.I. DIRECT BROWN 95 |
| NT | 28.8a | NT | NT | + | + | 106-99-0 | 1,3-BUTADIENE |
| NT | 19.2a | NT | NT | + | + | --- | N-N-BUTYL-N-FORMYLHYDRAZINE |
| 0.432a | NT | + | NT | NT | NT | 3817-11-6 | N-BUTYL-N-(4-HYDROXYBUTYL)NITROSAMINE |
| 0.91a | NT | + | + | NT | NT | 869-01-2 | N-N-BUTYL-N-NITROSUREA |
| 349a | - | + | + | B- | B- | 25010-17-5 | BUTYLATED HYDROXYANISOLE |
| NT | 38.1a | NT | NT | + | + | 368-97-0 | BUTYLATED HYDROXYTOULUENE |
| NT | 90.03a | NT | NT | + | + | 56795-65-4 | 1,1-DI-N-BUTYLHYDRAZINE |
| NT | 34.5a | NT | NT | + | + | 7422-80-2 | 1,2-DI-N-Butylhydrazine2HCl |
| 13.8 | NT | NT | + | NT | NT | 3068-88-0 | beta-BUTYROLACTONE |
| NT | 89.4a | NT | NT | + | + | 2425-06-1 | CAPTAFOL |
| NT | 223a | NT | NT | + | + | 563-41-7 | CARBAMYL HYDRAZINE.HCl |
| NT | 155a | NT | NT | + | + | 103-03-7 | 1-CARBAMYL-2-PHENYLHYDRAZINE |
| 14.1 | - | B+ | B+ | - | - | 63-25-2 | CARBARYL |
| NT | 102a | NT | NT | + | + | 86-74-8 | CARBAZOLE |
| 0.765e | - | + | + | + | + | 56-35-3 | CARBON TETRACHLORIDE |
| 2.3d | NT | + | + | NT | NT | 60391-92-6 | CARBOXYMETHYLNITROSUREA |
| 1490a | NT | + | B+ | NT | NT | - | --- | CARRAGEENAN, ACID-DEGRADED |
| - | 5230 | - | - | A | + | 133-90-4 | CHLORGABEN |
| 1.41d | 0.097a | + | NT | + | + | 305-03-3 | CHLORAMBUCIL |
| - | 21.5a | - | - | + | - | 57-74-9 | CHLORDANE |
| 110a | 86.8a | + | + | + | 63449-39-8 | CHLORINATED PARAFFINS (C12, 60% CHLORINE) |
| - | 6540 | - | E | E | 63449-39-8 | CHLORINATED PARAFFINS (C23, 43% CHLORINE) |
| 37.6 | 346 | + | NT | - | + | 101-79-1 | 4-CHLORO-4'-AMINODIPHENYLETHER |
| 4.85 | NT | + | NT | NT | NT | 24358-29-0 | 2-CHLORO-5-(3,5-DIMETHYLPIPERIDINOSULPHONYL)BENZOIC ACID |
| - | 108a | - | NT | + | + | 88-73-3 | 1-CHLORO-2-NITROBENZENE |
| - | 430a | - | NT | + | + | 100-00-5 | 1-CHLORO-4-NITROBENZENE |
| 315 | 1230 | - | - | - | + | 5131-62-0 | 4-CHLORO-m-PHENYLENEDIAMINE |
| 197a | 957a | + | + | + | + | 95-83-0 | 4-CHLORO-o-PHENYLENEDIAMINE |
| - | 134a | - | - | + | + | 95-79-4 | 5-CHLORO-o-TOLUIDINE |
| - | 15.4d | - | - | - | + | 3165-93-3 | 4-CHLORO-o-TOLUIDINE.HCl |
| 7.47e | 10.8a | + | NT | + | NT | 50892-23-4 | 4-CHLORO-6-(2,3-XYLIDINO)-2-PYRIMIDINYLTHIO)| ACETIC ACID |
| 6.49 | 44.6 | + | NT | NT | + | --- | 4-CHLORO-6-(2,3-XYLIDINO)-2-PYRIMIDINYLTHIO(N-beta-HYDROXYETHYL)ACETAMIDE |
| - | 43.8af | - | - | + | + | 510-15-6 | CHLOROBENZILATE |
| 119 | 48b | + | - | + | + | 67-66-3 | CHLOROFORM |
| 5.5 | NT | + | NT | NT | NT | 107-30-2 | CHLOROMETHYL METHYL ETHER |
| 433 | 161a | + | - | + | + | 6959-48-4 | 3-(CHLOROMETHYL)PYRIDINE.HCl |
| 8.78 | NT | + | NT | NT | NT | 10473-70-8 | 1-(4-CHLOROPHENYL)-1-PHENYL-2-PROPYNYL CARBAMATE |
| NT | 12.9 | NT | NT | - | + | 683-50-1 | 2-CHLOROPROPANOL |
| NT | 5.05 | NT | NT | + | + | 590-21-6 | 1-CHLOROPROPENE |
| 2090a | - | + | + | - | - | 1897-45-6 | CHLORTHALONIL |
| 0.021f | NT | + | NT | NT | NT | 54749-96-5 | CHLOROZOTOCIN |
| 7.39 | 2470a | + | + | - | + | 87-29-6 | CINNAMYL ANTHRANILATE |
| 1.09c | NT | + | NT | NT | NT | 52214-84-3 | CIPROFIBRATE |

(Continued on next page)
| Cas         | Name                                                                 
|-------------|-----------------------------------------------------------------------|
| 518-75-2    | CITRININ                                                              |
| 33979-15-6  | CLIVORINE                                                             |
| 637-07-0    | CLOFIBRATE                                                            |
| 55660-34-5  | CLOPHEN A 30                                                          |
| 102-50-1    | M-CRESIDINE                                                           |
| 120-71-8    | p-CRESIDINE                                                           |
| 135-20-6    | CUPPERRON                                                             |
| 139-05-9    | CYCLAMATE, SODIUM                                                     |
| 12663-46-6  | CYCLOCHLOROTINE                                                       |
| 50-18-0     | CYCLOPHOSPHAMIDE                                                      |
| 16170-75-5  | CYTETMBENA                                                            |
| 4342-03-4   | DACARBAZINE                                                           |
| 1596-84-5   | DAMINOZIDE                                                            |
| 80-08-0     | DAPSONE                                                               |
| 72-54-8     | p,p'-DDD                                                              |
| 52-59-9     | p,p'-DDE                                                              |
| 9011-18-1   | DEXTRAN SULFATE SODIUM (DS-M-1)                                       |
| 5164-11-4   | 1,1-DIALLYLHYDRAZINE                                                  |
| 720-69-4    | 4,6-DIAMINO-2-(5-NITRO-2-FURYL)-s-TRIAZINE                            |
| 39156-41-7  | 2,4-DIAMINOANISOLE SULFATE                                           |
| 95-80-7     | 2,4-DIAMINOTOLUENE                                                    |
| 636-23-7    | 2,4-DIAMINOTOLUENE.2HCl                                              |
| 53-70-3     | DIBENZ(a,h)ANTHRACENE                                                |
| 4106-66-5   | 3-DIBENZOFURANAMINE                                                   |
| 96-12-8     | 1,2-DIBROMO-3-CHLOROPROPANE                                           |
| 10318-26-0  | DIBROMODULCITOL                                                       |
| 106-93-4    | 1,2-DIBROMOETHANE                                                    |
| 448-11-5    | DIBROMOMANNITOL                                                       |
| 56654-52-5  | 1,3-DIBUTYL-1-NITROSOUREA                                            |
| 29850-58-5  | 3,5-DICHLORO(N,1,1-DIMETHYL-2-PROPYNYL)BENZAMIDE                      |
| 609-20-1    | 2,6-DICHLORO-p-PHENYLENEDIAMINE                                       |
| 7012-29-4   | DICHLOORACETYLCENE                                                    |
| 9194-1-1    | 3,3'-DICHLOROBENZIDINE                                               |
| 110-57-6    | trans-1,4-DICHLOROBUTENE-2                                            |
| 107-06-2    | 1,2-DICHLOROETHANE                                                   |
| 115-32-2    | DICOFOL                                                               |
| 60-57-1     | DIETILDIN                                                             |
| 7347-49-1   | N,N-DIETHYL-4-(4'-PYRIDYL-1'-OXIDE,azo)ANILINE                        |
| 685-91-6    | DIETYLACETAMIDE                                                       |
| 111146-6   | DIETHYLENE GLYCOL                                                    |
| 565-53-1    | DIETHYLSTILBESTROL                                                    |
| 105-55-5    | N,N'-DIETHYLTHIOUREA                                                  |
| 62836-47    | 1,2-DIFROMYLHYDRAZINE                                                |
| 21626-89-1  | DIFITALONE                                                            |
| 33389-33-2  | 1,2-DIHYDRO-2-(5-NITRO-2-THIENYL)QUINAZOLIN-4(3H)-ONE                  |
| 3276-41-3   | 3,6-DIHYDRO-2-NITROSO.2H-1,2-OXAZINE                                  |
| 94-58-6     | DIHYDROSAFROLE                                                        |
| 828-00-2    | DIMETHOXYANE                                                          |
| 5803-51-0   | 2,5-DIETHOXY-4'-AMINOSTILBENE                                         |
| 9193-0      | 3,3' DIETHOXYBENZIDINE-4,4'-DIISOCYANATE                             |
| 6011-7      | N,N-DIMETHYL-4-Aminoazobenzene                                        |
| 868-85-9    | DIMETHYL HYDROGEN PHOSPHITE                                          |
| 5395-8      | 4,6-DIMETHYL-2-(6-NITRO-2-FURYL)PYRIMIDINE                            |
| 5359-2      | 1,2-DIMETHYL-5-NITROIMIDAZOLE                                         |
| 55738-54-0  | trans-2-[DIMETHYLAMINO]METHYLMINO;5-[2-(5-NITRO-2-FURYL)VINYL]-1,3,4-OXADIAZOLE |
| 579-76-7    | 7,12-DIMETHYLBENZ(a)ANTHRACENE                                       |
| 7844-47     | DIMETHYLCARBAMYLCHLORIDE                                             |
| 5714-7      | 1,1-DIMETHYLHYDRAZINE                                                |
| 30637-6     | 1,2-DIMETHYLCARBAMYLCHLORIDE                                         |

(Continued on next page)
| Rat | Mouse | MR | FR | MM | FM | CAS | Name |
|-----|-------|----|----|----|----|-----|------|
| 0.41c | NT | NT | + | NT | NT | 26049-69-4 | 2-(2,2-DIMETHYLHYDRAZINO)-4-(5-NITRO-2-FURYL)THIAZOLE |
| 0.256a | NT | + | + | NT | NT | 4164-28-7 | DIMETHYLNITRAMINE |
| 0.0297a | NT | NT | + | NT | NT | 55557-00-1 | DINITROSOPIPERAZINE |
| NT | 2.01a | NT | NT | + | + | 140-79-4 | DINITROSOPIPERAZINE |
| 126af | 594* | + | + | + | + | 123-91-1 | 1,4-DIOXANE |
| NT | 547* | NT | NT | + | + | 68-89-3 | DIPYRONE |
| NT | 0.151af | NT | NT | + | + | 8015-30-3 | ENOVID |
| NT | 0.282a | NT | NT | NT | + | 50-28-2 | ESTRADIOL |
| 0.682a | - | - | - | + | + | 22866-79-6 | ESTRADIOL MUSTARD |
| NT | 5.18 | NT | NT | NT | + | 140-67-0 | ESTRAGOLE |
| - | 69.3 | - | - | - | + | 536-33-4 | ETHIONAMIDE |
| 4.97c | NT | + | NT | NT | NT | 13073-35-3 | ETHIONINE |
| 5.24a | NT | + | NT | NT | NT | 67-21-0 | DL-ETHIONINE |
| 9110 | - | + | - | NT | - | 64-17-5 | ETHYL ALCOHOL |
| NT | 2.49a | NT | NT | + | + | 74920-78-8 | N-ETHYL-N-FORMYLHYDRAZINE |
| NT | 2.84 | NT | NT | B+ | B+ | 63885-21-4 | N-ETHYL-N-NITRO-N-NITROSOGUANIDINE |
| 0.904a | NT | + | + | NT | NT | 739-73-9 | 1-ETHYL-1-NITROSOUREA |
| NT | 0.283a | NT | NT | + | + | 151-56-4 | ETHYLENE IMINE |
| 74.8af | NT | + | + | NT | NT | 75-21-8 | ETHYLENE OXIDE |
| 10.8a | 16.9 | + | + | + | - | 96-45-7 | ETHYLENE THIOUREA |
| - | 3050* | - | - | - | + | 101-23-1 | DI(2-ETHYLHEXYL)ADIPATE |
| 2280a | 3400* | + | + | + | + | 117-81-7 | DI(2-ETHYLHEXYL)PHTHALATE |
| NT | 5.22a | NT | NT | + | + | 18413-14-4 | ETHYLHYDRAZINE.HCl |
| 2.91a | NT | NT | + | NT | NT | 38434-77-4 | ETHYLNITROSOCYANAMIDE |
| NT | 15.3* | NT | NT | NT | + | 842-00-2 | 4-ETHYLSULPHONYL-N-PHTHALENE-1-SULFONAMIDE |
| 1.62 | NT | NT | + | NT | NT | 363-17-7 | N-(2-FLUORENYL)-2,2,2-TRIFLUOROACETAMIDE |
| NT | 1.69* | NT | NT | NT | + | 324-93-6 | 4'FLUORO-4-AMINODIPHENYL |
| 1.01 | NT | + | NT | NT | NT | 398-32-3 | N-4'(4-FLUOROBIPHENYL)ACETAMIDE |
| 26.5a | NT | + | + | NT | NT | 593-70-4 | FLUOROCARBON 31 |
| 60a | NT | + | + | NT | NT | 75-88-7 | FLUOROCARBON 133a |
| 0.798a | 43.9 | + | + | + | + | 50-00-0 | FORMALDEHYDE |
| 14.4 | NT | NT | + | NT | NT | 32852-21-4 | FORMIC ACID 2-(4-METHYL-2-THIAZOLYL)HYDRAZIDE |
| 3.54a | 8.85a | + | + | NT | NT | 3570-75-0 | FORMIC ACID 2-4(5-NITRO-2-FURYL)2-THIAZOLYL HYDRAZIDE |
| NT | 36a | NT | NT | + | + | 624-84-0 | FORMYLHYDRAZINE |
| 3920b | - | + | + | - | + | 4680-78-8 | FD & C GREEN NO. 1 |
| 5640 | - | + | + | B+ | + | 5141-29-8 | FD & C GREEN NO. 2 |
| NT | 1660b | NT | NT | + | + | 126-07-8 | GRISEOFULVIN |
| 5.96E-4 | 8.76E-4 | - | + | + | + | mixture | HCID MIXTURE |
| 1000 | NT | B+ | B+ | NT | NT | 517-28-2 | HEMATOXYLIN |
| - | 1.09b | + | + | - | + | 76-44-8 | HEPTACHLOR |
| 1.65c | 46.4a | NT | + | + | + | 118-74-1 | HEXACHLOROBENZENE |
| 50.5a | NT | + | + | NT | NT | 87-68-3 | HEXACHLOROBUTADIENE |
| NT | 25.3 | NT | NT | NT | NT | 608-73-1 | HEXACHLOROCYCLOHEXANE |
| 11.2 | 6.62a | + | NT | NT | NT | 319-84-6 | alpha-1,2,3,4,5,6-HEXACHLOROCYCLOHEXANE |
| NT | 17.7a | NT | NT | NT | + | 319-85-7 | beta-1,2,3,4,5,6-HEXACHLOROCYCLOHEXANE |
| - | 15.4c | - | + | + | + | 58-89-9 | gamma-1,2,3,4,5,6-HEXACHLOROCYCLOHEXANE |
| - | 319a | - | + | + | + | + | 67-72-1 | HEXACHLOROETHANE |
| 10.2 | NT | NT | NT | NT | NT | 531-18-0 | HEXAMETHYLAMINOL |
| - | 1950 | - | - | - | + | 628-02-4 | HEXANAMIDE |
| NT | 2.2a | NT | NT | + | + | 302-01-2 | HYDRAZINE |
| 39.4a | 3.35d | + | + | + | + | 10034-93-2 | HYDRAZINE SULFATE |
| 1.03 | 11.3 | NT | NT | NT | NT | 26049-71-8 | 2-HYDRAZINO-4-(p-AMINOPHENYL)THIAZOLE |
| 2.83a | 16.4 | NT | NT | NT | NT | 26049-68-3 | 2-HYDRAZINO-4-(5-NITRO-2-FURYL)THIAZOLE |
| 1.97a | 10.6 | NT | NT | NT | NT | 26049-70-7 | 2-HYDRAZINO-4-(p-NITROPHENYL)THIAZOLE |
| 3.55a | 26 | - | + | + | + | 122-66-7 | HYDRAZOBENZENE |
| NT | 9010 | NT | NT | B+ | B+ | 7722-84-1 | HYDROGEN PEROXIDE |
| 6.9E-4 | 6.23 | + | + | NT | NT | 53-95-2 | N-HYDROXY-2-ACETYLAMINOFLUORENE |
| NT | 57.8 | NT | NT | NT | NT | 51410-44-7 | 1'-HYDROXYESTRAGOLE |
| 16.7 | NT | NT | NT | NT | NT | 53036-03-3 | 1-(2-HYDROXYETHYL)-3-(5-NITROFURFURYLIDENE)AMINO-2-MIDAZOLIDINONE |
| 1.52 | NT | NT | NT | NT | NT | 13743-07-2 | 1-(2-HYDROXYETHYL)-1-NITROSOUREA |
| 1.87 | NT | NT | NT | NT | NT | 33389-36-5 | 4-(2-HYDROXYETHYLAMINO)-2-(5-NITRO-2-THIENYL)QUINAZOLINE |

(Continued on next page)
### Table 1. (Continued)

| Rat | Mouse | MR | FR | MM | FM | CAS | Name |
|-----|-------|----|----|----|----|-----|------|
| NT  | 0.314* | NT | NT | +  | +  | 109-84-2 | 2-HYDROXYETHYLHYDRAZINE |
| 12.1* | 49.3* | +  | NT | +  | +  | 55058-77-7 | 2'-HYDROXYSAFROLE |
| 10.7* | 23.7* | -  | +  | -  | +  | 24144-87-5 | ICRF-159 |
| 120* | 11.2* | +  | +  | -  | -  | 58-45-3 | ISONIAZID |
| NT  | 27.4  | NT | NT | B+ | B+ | 149-17-7 | ISONICOTINIC ACID VANILLYLIDENEHYDRAZIDE |
| 0.739* | 5.06* | -  | +  | -  | +  | 3778-73-2 | ISOPHOSPHAMIDE |
| 2.96  | 0.705* | -  | +  | +  | +  | 143-50-0 | KEPONE |
| 0.141* | NT  | +  | NT | NT | 303-34-4 | LASICARCINE |
| 107*  | 472* | +  | +  | +  | -  | 1336-32-6 | LEAD ACETATE, BASIC |
| NT  | 55.8  | NT | NT | +  | -  | 24965-47-7 | LEUPEPTIN |
| NT  | 14.8* | NT | NT | +  | +  | 21884-44-6 | LUTEOSEKYRIN |
| NT  | 14.1  | NT | NT | NT | +  | 24382-04-5 | MALONALDEHYDE, SODIUM |
| 157  | B+    | B+ | -  | B+ | 12427-38-2 | MANGANESE ETHYLENEBISSTHIOCARBAMATE |
| 753  | -     | +  | -  | -  | -  | 108-78-1 | MELAMINE |
| 0.0719* | 0.137* | +  | +  | +  | +  | 148-82-3 | MELPHALAN |
| 4.46  | NT    | +  | NT | NT | 57-39-6 | METEPA |
| 7.65* | NT    | +  | NT | NT | 135-23-9 | METHAPYRILENE,HCl |
| 0.9*  | NT    | +  | NT | NT | 60-56-0 | METHIMAZOLE |
| NT  | 60.2  | NT | NT | B+ | -  | 3544-23-8 | 3-METHOXY-4-AMINOAZOBENZENE |
| 28.7* | NT    | +  | NT | NT | 5834-17-3 | 2-METHOXY-3-AMINODIBENZOFURAN |
| 9.17* | NT    | +  | NT | NT | 21340-68-1 | METHYLCloFENAPATE |
| NT  | 8.03  | NT | NT | B+ | B+ | --- | 1-METHYL-1,4-DIHYDRO-7-2-(5-NITROFURFURYL)VINYL- |
|      |       |    |    |    |    |      | 4-OXO-1,8-NAPHTHYRIDINE-3-CARBOXYLATE, POTASSIUM |
| 1.3* | NT    | +  | NT | NT | 99-80-9 | N-METHYL-N,4-DINITROSOANILINE |
| NT  | 0.745* | NT | NT | +  | +  | 758-17-8 | N-METHYL-N-FORMYLHYDRAZINE |
| NT  | 31.8  | NT | NT | NT | 66-27-3 | METHYL MANGESESULFONATE |
| 0.523* | NT  | +  | NT | NT | 70-25-7 | N-METHYL-N'-NITRO-N-NITROSOGUANIDINE |
| 48.8* | 1.34* | +  | +  | +  | +  | 129-15-7 | 2-METHYL-1-NITROANTHRACINONE |
| 5.34  | NT    | +  | NT | NT | 21683-96-8 | 4-METHYL-1-(5-NITROFURFURYLIDENE)AMINO-2-IMIDAZOLIDINONE |
| 0.48* | NT    | +  | NT | NT | 16699-10-8 | 4-(4-N-METHYL-N-NITROSAMINOSTYRYL)QUINOLINE |
| 3.23* | NT    | +  | NT | NT | 63412-06-6 | N-METHYL-N-NITROSOMAPAMIDE |
| 0.633* | NT    | +  | NT | NT | --- | (N-METHYL-N-NITROSOCARBAMOYL)-L-ORNITHINE |
| 20.4  | NT | B+ | B+ | NT | 14026-03-0 | (R)-2-METHYL-N-NITROSOPIPERIDINE |
| 13.2  | NT | B+ | B+ | NT | 36702-44-0 | S(+)2-METHYL-N-NITROSOPIPERIDINE |
| 0.202* | NT    | +  | NT | NT | 56-49-5 | 3-METHYLCOLANTHRENES |
| 9.09* | NT    | +  | NT | NT | 101-14-4 | 4'-METHYLENE-BIS(2-CHLOROANILINE) |
|       |       | +  | NT | NT | 64949-29-2 | 4'-METHYLENE-BIS(2-CHLOROANILINE)2HCI |
| 6.91* | NT    | +  | NT | NT | 838-88-0 | 4'-METHYLENE-BIS(2-METHYLANILINE) |
| 598   | 817*  | A+ | +  | +  | +  | 75-09-2 | METHYLENE CHLORIDE |
| 16.4* | 207   | +  | +  | +  | -  | 101-61-1 | 4,4'-METHYLENEBIS(N,N-DIMETHYL)BENZENAMINE |
| 12.5* | 22.3* | +  | +  | +  | +  | 13552-44-8 | 4,4'-METHYLENEDIAMINILINE2HCI |
| NT  | 4.58* | NT | NT | +  | B+ | 60-34-4 | METHYLHYDRAZINE |
| NT  | 2.51* | NT | NT | B+ | NT | 302-15-8 | METHYLMETHYLDRAZINE SULFATE |
| NT  | 18    | NT | NT | NT | +  | --- | (N-6)-(METHYLNITROSO)ADENINE |
| NT  | 15.8* | NT | NT | NT | +  | --- | (N-6)-(METHYLNITROSO)ADENOSINE |
| 0.48  | NT    | NT | NT | NT | 33868-17-6 | METHYL ISOCYANAMIDE |
| 437*  | 347*  | +  | +  | +  | +  | 443-48-1 | METRONIDAZOL |
| 4.87* | 53*   | +  | +  | +  | +  | 90-94-8 | MICHLER'S KETONE |
|       | 1.1*  |    | NT | +  | NT | 2385-85-5 | MIREX |
| 1.46  | NT    | +  | NT | NT | 39801-14-4 | MIREX, PHOTO- |
| 9.81E-4* | NT   | +  | NT | NT | 50-07-7 | MITOMYCIN-C |
| NT  | 4.48* | NT | NT | NT | 1068-57-1 | MONOACETYL HYDRAZINE |
| 0.79* | NT    | +  | NT | NT | 315-22-0 | MONOCROTALE |
| 5.03  | NT    | NT | NT | NT | 58139-48-3 | 4-MORPHOLINO-2-(5-NITRO-2-THIENYL)QUINAZOLINE |
| 6.33  | NT    | NT | NT | NT | 3031-51-4 | L-5-MORPHOLINOMETHYL-3-(5-NITROFURFURYLIDENE)AMINO-2-OXAZOLIDINON |
|      | 50.8  | 66.6* | +  | +  | +  | 2242-62-1 | 1,5-NAPHTHALENEDIAMINE |
| 61.6  | 20.5* | B+ | B+ | +  | +  | 91-59-8 | 2-NAPHTHYLAMINE |
| NT  | 145*  | NT | NT | NT | 553-53-7 | NICOTINIC ACID HYDRAZIDE |
| 131   | 758   | -  | +  | -  | -  | 139-94-6 | NITRASIZIDE |
| 1450* | 1470* | +  | +  | +  | +  | 139-13-9 | NITRILITRICETIC ACID |
| 224*  | -     | +  | +  | -  | -  | 18662-53-8 | NITRILITRICETIC ACID, TRISODIUM SALT, MONOHYDRATE |

(Continued on next page)
### Table 1. (Continued)

| Rat | Mouse | MR | FR | MM | FM | CAS | Name |
|-----|-------|----|----|----|----|------|------|
| 124a | - | + | + | - | - | 7632-00-0 | NITRITE, SODIUM |
| 2270 | - | + | - | - | - | 1777-84-0 | 3-NITRO-p-ACETOGENETIDE |
| 3720 | 281a | + | + | + | + | 99-59-2 | 5-NITRO-o-ANISIDINE |
| 4.64c | NT | NT | + | NT | NT | 59-87-0 | 5-NITRO-2-FURALDEHYDE SEMICARBAZONE |
| 11.9a | 20.3c | + | + | + | + | 75198-31-1 | 3-(5-NITRO-2-FURYL)-IMIDAZO[1,2-alpha]PYRIDINE |
| 8.61 | NT | NT | + | NT | NT | 2122-86-3 | 5-(5-NITRO-2-FURYL)-1,3,4-OXADIAZOLE-2-OL |
| 59.6b | NT | NT | + | NT | NT | 36133-88-7 | N-(3-(5-NITRO-2-FURYL)-1,2,4-OXADIAZOLE-5-YL)-METHYL ACETAMIDE |
| 8.84 | 6.74 | NT | + | NT | + | 2578-75-8 | N-(5-(5-NITRO-2-FURYL)-1,3,4-THIAZIAZOL-2-YL)-ACETAMIDE |
| 7.68 | NT | NT | + | NT | NT | 53757-28-4 | 4-(5-NITRO-2-FURYL)THIAZOLE |
| 10.5a | NT | NT | + | NT | NT | 531-82-8 | N-(4-(5-NITRO-2-FURYL)-2-THIAZOLYL)ACETAMIDE |
| 1.31af | 7.72a | + | + | + | + | 24554-26-5 | N-(4-(5-NITRO-2-FURYL)-2-THIAZOLYL)FORMAMIDE |
| 14.1 | NT | NT | + | NT | NT | 51325-35-0 | N,N'-6-(5-NITRO-2-FURYL)-S-TRIAZINE-2,4-DIYL-BISACETAMIDE |
| 8.66 | 0.346 | B+ | B+ | B+ | B+ | 4812-22-0 | 3-NITRO-3-HEXANE |
| 614 | 242** | - | + | - | - | 99-55-8 | 5-NITRO-o-TOLUIDINE |
| 5.98a | 45.3 | + | + | + | + | 602-97-5 | 5-NITROACENAPHTHENE |
| 35a | - | 35a | + | + | + | 94-52-0 | 6-NITROBENZIMIDAZOLE |
| 420 | 64.2a | I | + | + | + | 1836-75-5 | NITROFEN |
| 5.26 | NT | NT | + | NT | NT | 555-84-0 | 1-(5-NITROFURFURYLIDENE)AMINO-2-IMIDAZOLIDINONE |
| 0.0114d | NT | NT | + | NT | NT | 51-75-2 | NITROGEN MUSTARD |
| 0.764d | NT | NT | + | NT | NT | 126-85-2 | NITROGEN MUSTARD N-OXIDE |
| 9.55a | NT | NT | + | NT | NT | 607-35-2 | 8-NITROQUINOLINE |
| 0.364 | NT | NT | + | NT | NT | 38777-13-8 | NITROSO-BAYGON |
| 0.074a | NT | NT | + | NT | NT | + | NITROSO-BIS-(4,4,4-TRIFLUORO-N-BUTYL)AMINE |
| 0.0972a | NT | NT | + | NT | NT | 16813-36-8 | 1-NITROSO-5,6-DIHYDROURACIL |
| 0.0535 | NT | NT | + | NT | NT | 89911-79-5 | N-NITROSO-2,3-DIHYDROXYPROPYL-2-HYDROXYPROPYLAMLINE |
| 0.0353 | NT | NT | + | NT | NT | 92177-50-9 | NITROSO-2,3-DIHYDROXYPROPIL-2-OXOPROPYLAMLINE |
| 5.98 | NT | NT | + | NT | NT | 89911-78-4 | N-NITROSO-2,3-DIHYDROXYPROPYLTHANOLAMline |
| 9.66 | NT | NT | + | NT | NT | 61034-40-0 | 1-NITROSO-3,5-DIMETHYL-4-BENZOYLPIPERAZINE |
| 1.02 | NT | NT | + | NT | NT | 75886-33-2 | N-NITROSO-(2-HYDROXYPROPIL)-(2-HYDROXYETHYL)AMINE |
| 7.65 | NT | B+ | B+ | NT | NT | 56222-35-6 | N-NITROSO-3-HYDROXYPYRROLIDINE |
| 4.73 | NT | NT | + | NT | NT | 760-60-1 | N-NITROSO-N-ISOBUTYRALE |
| 0.487a | NT | + | + | NT | NT | 55090-44-3 | N-NITROSO-N-METHYL-N-DODECYLAMINE |
| 0.255 | NT | + | NT | NT | NT | 937-25-7 | N-NITROSO-N-METHYL-4-FLUOROANILINE |
| 0.00788a | NT | + | NT | NT | NT | 13256-11-6 | N-NITROSO-N-METHYL-N-(2-PHENY)ETHYLAMINE |
| 29.4* | NT | NT | + | NT | NT | 75881-20-8 | N-NITROSO-N-METHYL-N-TETRACRYLAMINE |
| 1.26 | NT | NT | + | NT | NT | 75881-22-0 | N-NITROSO-N-METHYLDECYCLAMINE |
| 1.8 | NT | NT | + | NT | NT | 92177-49-6 | NITROSO-2-OXOPROPYLETHANOLAMLINE |
| 0.166d | NT | NT | + | NT | NT | 15973-99-6 | DI(N-NITROSO)-PERHYDROPRIMIDINE |
| 0.0374a | NT | NT | + | NT | NT | 55566-92-8 | NITROSO-1,2,3,6-TETRACYRUPRIMIDINE |
| 2.52 | NT | NT | + | NT | NT | 82018-90-4 | N-NITROSO(2,2,2-TRIFLUOROETHYL)ETHYLAMLINE |
| 3.31d | NT | NT | + | NT | NT | 29929-77-9 | N-NITROSO-2,2,4-TRIMETHYL-1,2-DIHYDROXINOLINE POLYMER |
| 0.151 | NT | NT | + | NT | NT | 75881-18-4 | 1-NITROSO-3,4,5-TRIMETHYLPIPERAZINE |
| 0.825 | NT | NT | + | NT | NT | 88208-16-6 | N-NITROSOALYL-2,3-DIHYDROXYPROPILAMLINE |
| 0.877 | NT | NT | + | NT | NT | 91308-70-2 | N-NITROSO-2,3-DIHYDROXYPROPILAMLINE |
| 0.335 | NT | NT | + | NT | NT | 91308-71-3 | N-NITROSOALYL-2-OXOPROPYLAMLINE |
| 0.491 | NT | NT | + | NT | NT | 91308-69-9 | N-NITROSOALYLTHANOLAMLINE |
| 1.01 | NT | NT | + | NT | NT | --- | NITROSOAMYLURETHAN |
| 11a | NT | + | NT | NT | NT | 1133-64-8 | NITROSOANABASINE |
| 1.13 | NT | B+ | B+ | NT | NT | 51542-33-7 | N-NITROSOBENZTHIAZURON |
| 0.813a | NT | + | + | + | + | 53609-64-6 | N-NITROSOBIS(2-HYDROXYPROPIL)AMINE |
| 0.232a | NT | + | NT | + | NT | 60599-38-4 | N-NITROSOBIS(2-OXOPROPIL)AMINE |
| 0.691 | 1.09 | + | NT | + | NT | 924-16-3 | NITROSODIBUTYRAMLINE |
| 1.9a | NT | + | NT | NT | NT | 1116-54-7 | N-NITROSOETHANOLAMLINE |
| 0.00787af | NT | + | NT | NT | NT | 55-18-5 | N-NITROSOETHYLANLINE |
| 0.05787af | 0.153a | + | + | + | + | 62-75-9 | N-NITROSOETHYLANLINE |
| 116a | - | + | + | - | - | 80-36-0 | N-NITROSOETHYLPROPILAMLINE |
| 201 | 340 | + | + | + | + | 156-10-5 | p-NITROSOETHYLPROPILAMLINE |
| 0.186 | NT | NT | + | NT | NT | 621-64-7 | N-NITROSOETHYLANLINE |
| 10.9a | NT | + | NT | NT | NT | 40580-89-0 | NITROSODODECAMETHYLENEIMINE |

(Continued on next page)
| Rat | Mouse | MR | FR | FM | CAS          | Name                                      |
|-----|-------|----|----|----|--------------|-------------------------------------------|
| 95.2 | NT    | +  | NT | NT | 17608-59-2  | N-NITROSOEPHEDRINE                        |
| 0.248 | NT    | NT | +  | NT | 614-95-9    | NITROSOETHYLURETHAN                       |
| 0.0292a | NT | +  | NT | NT | 20917-49-1  | NITROSOHEPTAMETHYLENEIMINE                |
| NT  | 0.313a | NT | NT | +  | 902-83-2    | N-NITROSOHEXAMETHYLENEIMINE               |
| 45.8a | NT    | +  | NT | NT | 42579-28-2  | 1-NITROSSOHYDANTOIN                       |
| 0.646 | NT    | +  | NT | NT | 86451-37-8  | N-NITROSOMETHYL-2,3-DIHYDROXYPROPYLAMINE  |
| 0.0442a | NT | +  | NT | NT | 75411-83-5  | N-NITROSOMETHYL-2-HYDROXYPROPYLAMINE      |
| 0.214 | NT    | +  | NT | NT | 16219-88-0  | 2-NITROSOMETHYLAMINOPYRIDINE              |
| 0.0343af | NT | +  | NT | NT | 614-00-6    | NITROSOMETHYLAMILINE                      |
| 2.37 | NT    | +  | NT | NT | 68107-26-6  | NITROSOMETHYLFUCIENCE                     |
| 0.573a | NT    | +  | NT | NT | 78246-24-9  | N'-NITROSONORNICOTINE-1-N-OXIDE           |
| 5.51ab | NT   | +  | NT | NT | 5632-47-3   | N-NITROSOPIPERAZINE                       |
| 1.57  | 1.3   | B+ | B+ | NT | 100-75-4    | N-NITROSOPIPERIDINE                       |
| 1.54c | NT    | +  | NT | NT | 930-55-2    | N-NITROSOPYRROLIDINE                      |
| 4.15a | NT    | +  | NT | NT | 26541-51-5  | N-NITROSOTHIOMORPHOLINE                   |
| 50.7  | NT    | +  | NT | NT | 611-23-4    | o-NITROSOTOLUENE                          |
| 1.94  | 1.34b | B+ | B+ | NT | 8015-12-1   | NORLESTRIN                                |
| 6.17  | NT    | NT | +  | NT | 30960-50-2  | N-(9-OXO-2-FLUORENYL)ACETAMIDE            |
| 6.65a | 19.7a | +  | +  | +  | 101-80-4    | 4,4'-OXYDIANILINE                         |
| -    | 39.8b | A  | -  | +  | 76-01-7     | PENTACHLOROETHANE                         |
| -    | 71.1  | -  | -  | +  | 82-68-8     | PENTACHLORONITROBENZENE                   |
| NT   | 5.87  | NT | NT | +  | 1199-68-2   | N-PENTYLHYDRAZINE.HCl                     |
| 0.662a | NT | +  | NT | NT | 60102-37-6  | PETASITENINE                              |
| 741d | 1100c | +  | +  | +  | 62-44-2     | PHENACETIN                                |
| 1230 | NT    | +  | NT | NT | 60-80-0     | PHENAZONE                                 |
| 303a | 71.1  | +  | +  | +  | 136-40-3    | PHENAZOPYRIDINE.HCl                       |
| 0.523 | 0.211a| -  | +  | +  | 3546-10-9   | PHENESTERIN                               |
| -    | 4.18  | s  | -  | +  | 50-06-6     | PHENOBARBITAL                             |
| 74.3a | 34.6a | +  | +  | +  | 57-30-7     | PHENOBARBITAL, SODIUM                     |
| 0.71b | 4.95s | +  | +  | +  | 63-92-3     | PHENOXAZINENELINE.HCl                     |
| 2.31  | NT    | B+ | B+ | NT | 7227-91-0   | 1-PHENYL-3,3-DIMETHYLTRIAZENE              |
| 17.7  | +    | +  | -  | -  | 842-07-9    | 1-PHENYLALDO-2-NAPHTHOL                   |
| 248   | 611   | +  | NT | +  | 615-28-1    | o-PHENYLENEDIAMINE.2HCl                   |
| NT   | 14.6  | NT | NT | +  | 156-51-4    | PHENYLETHYLHYDRAZINE SULFATE              |
| 29.1a | NT    | +  | NT | NT | 122-60-1    | PHENYLGLICYDYL ETHER                      |
| NT   | 70.6a | NT | NT | +  | 59-88-1     | PHENYLHYDRAZINE.HCl                       |
| 414   | -     | +  | NT | -  | 127-27-4    | o-PHENYLPHENATE, SODIUM                   |
| 232   | -     | -  | NT | -  | 90-43-7     | o-PHENYLENOL                               |
| NT   | 2.21d | NT | NT | +  | 17673-25-5  | PHORBOL                                   |
| -    | 62.2  | -  | -  | -  | 120-62-7    | PIPERONYL SULFOXIDE                       |
| 154c  | -     | +  | +  | -  | 1855-45-9   | PIVALOALACTONE                            |
| 0.149a | 0.381a| +  | +  | -  | 6777-32-7   | POLYBROMINATED BIPHENYL MIXTURE            |
| 4.01d | NT    | NT | NT | NT | 671-16-9    | PROCARBAZINE                              |
| 0.284d | 0.194d| +  | +  | +  | 366-70-1    | PROCARBAZINE.HCl                          |
| 3.64a | NT    | +  | NT | NT | 1120-71-4   | PROPANE SULTONE                           |
| 1.34a | 1.16a | NT | +  | +  | 57-57-8     | beta-PROPIOPILOACTONE                     |
| NT   | 8.74a | NT | NT | +  | 7737-54-3   | N-N'PROPYL-N-FORMYLHYDRAZINE              |
| 0.919a | NT | +  | NT | NT | 13010-07-6  | N-N'PROPYL-N-NITRO-N-NITROSIGUANIDINE     |
| 35.1a | 7.32a | +  | +  | +  | 75-56-9     | 1,2-PROPYLENE OXIDE                       |
| NT   | 41.4a | NT | NT | +  | 56796-66-5  | PROPYLHYDRAZINE.HCl                       |
| 10.3a | 409   | +  | B+ | B+ | 51-52-5     | PROPYLTHIOURACIL                          |
| 24500 | NT    | B+ | B+ | NT | 2611-82-7   | SIX PURPLE                                |
| 175a | NT    | +  | NT | NT | 59-33-6     | PYRILAMINE MALEATE                        |
| 5.12a | +     | +  | +  | -  | 117-39-5    | QUERCETIN                                 |
| 106   | -     | -  | -  | -  | 105-11-3    | p-QUINONE DIOXIME                         |
| 233a  | 659a  | +  | +  | +  | 3761-53-3   | D & C RED NO. 5                          |
| 104   | -     | A  | -  | -  | 5160-02-1   | D & C RED NO. 9                          |
| 225df | NT    | +  | NT | NT | 3564-09-8   | FD & C RED NO. 1                          |
| 632a  | NT    | B+ | B+ | NT | 915-67-3    | FD & C RED NO. 2                          |
| 6130a | 2.32a | B+ | B+ | B- | 4548-53-2   | FD & C RED NO. 4                          |
| 0.306 | 3.58a | +  | +  | +  | 50-55-5     | RESERPINE                                 |
| -    | 33.6  | -  | -  | +  | 13292-46-1  | RIFAMPICIN                                |
| -    | 67.8a | -  | -  | +  | 26308-28-1  | RIPAZEPAM                                 |
| 21.2a | 28.8a | +  | +  | +  | 569-61-9    | p-ROSANILINE.HCl                          |
| 110gf | -     | +  | +  | -  | 128-44-9    | SACCHARIN, SODIUM                         |

(Continued on next page)
Table 1. (Continued)

| Rat | Mouse | MR  | FR  | MM  | FM  | CAS     | Name                                |
|-----|-------|-----|-----|-----|-----|---------|-------------------------------------|
| 340a | 27a   | +   | B+  | +   | +   | 94-59-7 | SAFROLE                             |
| 44.6 | NT    | NT  | NT  | NT  | NT  | 18559-94-9 | SALBUTAMOL                         |
| NT  | 1.49  | -   | +   | -   | +   | 5456-28-0 | SELENIUM DIETHYLTHIOCARbamate      |
| 6.14a | 46.8 | +   | +   | +   | +   | 7446-34-6 | SELENIUM SULFIDE                   |
| 3.7a | NT    | +   | NT  | NT  | 2018-18-5 | SENKIRKINE                          |
| 0.08% | 0.65B | +   | B+  | +   | +   | 10048-13-2 | STERIGMATOCYSTIN                   |
| 0.77a | 0.193d | +   | +   | +   | +   | 18885-66-4 | STREPTOZOtocIN                     |
| NT  | 0.64A | NT  | NT  | +   | +   | 8001-50-1 | STROBANE                            |
| 63a  | NT    | +   | +   | NT  | NT  | 96-09-3  | SYRINE OXIDE                       |
| 17.2a | 27.3a | +   | +   | +   | +   | 95-06-7  | SULFALLATE                          |
| 55.6b | NT   | NT  | +   | NT  | NT  | 77-46-3  | 4,4'-SULFONYLBISACETANILIDE        |
| 1.91d | NT   | +   | NT  | NT  | NT  | 22571-95-5 | SYMPHYTINE                         |
| 33.2 | 36.3  | +   | A   | I   | +   | 542-75-6 | TELONE II                           |
| 410  | NT    | NT  | NT  | NT  | NT  | 23031-25-6 | TETRAMINE                           |
| 385  | 288   | +   | NT  | +   | -   | 7411-49-6 | 3,3',4',4'-TETRAMINOBIPHENVL.4HCl  |
| 6.67E-6 | 8.63E-5 | +   | +   | +   | +   | 1746-01-6 | 2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN|
| -    | 175a  | -   | +   | -   | +   | 630-20-6  | 1,1,1,2-TETRACHLOROETHANE          |
| -    | 35.4a | -   | -   | +   | +   | 79-34-5  | 1,1,2,2-TETRACHLOROETHANE          |
| 90.8 | 75.6a | +   | A   | +   | +   | 127-18-4 | TETRACHLOROETHYLENE                |
| -    | 228   | A   | A   | +   | A   | 961-11-5  | TETRACHLORVINPHOS                   |
| -    | 86.3  | NT  | +   | NT  | +   | 63886-77-1 | TETRAFLUORO-m-PHENYLENEDIAMINE.2HCl|
| 24.3 | NT    | B+  | B+  | NT  | NT  | 40548-68-3 | TETRAHYDRO-2-NITROSO-2H-1,2-OXAZINE|
| 0.123d | 0.21d | +   | +   | +   | +   | 52-24-4  | TETRA-TEPA                          |
| NT  | 5.95  | NT  | NT  | NT  | +   | 62-55-5  | THIOACETAMIDE                      |
| 5.95a | 3.7a  | +   | +   | +   | +   | 139-65-1  | 4,4'-THIODIANILINE                 |
| 2.1d | NT    | A   | I   | I   | +   | 64093-27-6 | beta-THIOGUANINE DEOXYRIBOSIDE     |
| NT  | 48.6a | NT  | NT  | +   | +   | 141-90-2  | THIOURACIL                         |
| 93.5a | -     | +   | +   | NT  | -   | 62-56-6  | THIOUREA                           |
| 3960 | NT    | B+  | B+  | NT  | NT  | 88-19-7  | o-TOLUENESULFONAMIDE               |
| -   | 1440b | NT  | +   | NT  | +   | 638-03-9  | m-TOLUIDINE.HCl                    |
| 23.3a | 646a  | +   | +   | +   | +   | 636-21-5  | o-TOLUIDINE.HCl                    |
| -    | 49.1a | -   | NT  | +   | +   | 540-23-8  | p-TOLUIDINE.HCl                    |
| -    | 206   | -   | +   | +   | +   | 622-51-5  | p-TOLYLUReA                        |
| -    | 4.08a | A   | A   | +   | +   | 8001-35-2 | TOXAPhENE                          |
| 0.00504d | 0.012d | +   | +   | +   | +   | 222,2',2'-TRIFLUORO-N-4-(5-NITRO-2-FURYL)-2-THIAZOLYLACETAMIDE |
| 6.79 | 9.98  | NT  | +   | NT  | +   | 42011-48-3 | 1,1,2,2'-TRIFLUORO-4-(5-NITRO-2-FURYL)-2-THIAZOLYLACETAMIDE |
| -    | 330   | -   | +   | +   | +   | 1582-09-8 | TRIFLURALIN                        |
| 20.4a | 6.13  | +   | +   | +   | +   | 137-17-7  | 2,4,5-TRIMETHYLTHIOANILINE          |
| 98.5b | 40a   | +   | NT  | +   | +   | 21436-97-5 | 2,4,5-TRIMETHYLTHIOANILINE.HCl      |
| 5.17 | 19.3a | +   | NT  | +   | +   | 6334-11-8 | 2,4,6-TRIMETHYLTHIOANILINE.HCl      |
| -    | 335   | A   | -   | +   | +   | 512-56-1  | TRIMETHYLPHOSPHATE                 |
| 25.8 | -     | -   | +   | -   | +   | 2489-77-2  | TRIMETHYLTHIOUREA                  |
| NT  | 3.44d | NT  | NT  | NT  | +   | 38571-73-2 | TRIS-1,2,3-(CHLOROMETHoxy)PROPANE   |
| 1.57a | 80.1a | +   | +   | +   | +   | 126-72-7  | TRIS(2,3-DIBROMOPROPYL)PHOSPHATE    |
| 4.13 | 12.5a | B+  | B+  | +   | +   | 51-79-6  | URETHANE                           |
| 132a | NT    | +   | NT  | NT  | +   | 108-05-4  | VINYL ACETATE                      |
| 17.9a | NT   | +   | NT  | NT  | +   | 593-60-2  | VINYL BROMIDE                      |
| 3.69f | 10.6a | +   | +   | +   | +   | 75-01-4  | VINYL CHLORIDE                     |
| -    | 23.6a | -   | +   | -   | +   | 75-35-4  | VINYLIDENE CHLORIDE                |
| 418a | -     | -   | +   | -   | +   | 1694-09-3 | FD & C VIOLET NO. 1                |
| NT  | 39.6b | NT  | NT  | NT  | +   | 50-14-6  | VITAMIN D2                         |
| -    | 12.4  | NT  | -   | NT  | +   | 21436-96-4 | 2,4-XYLIDINE.HCl                   |
| 152  | 552s  | +   | NT  | +   | +   | 51786-53-9 | 2,5-XYLIDINE.HCl                   |
| 380  | 1020  | +   | NT  | +   | +   | 2832-40-8 | C.I. DISPERSE YELLOW 3             |
| -    | 10900 | +   | +   | +   | +   | 128-66-5  | C.I. Vat YELLOW 4                  |
| -    | 22a   | +   | -   | +   | +   | 17924-92-4 | ZEARELANONE                        |
| 25.8a | +    | B+  | B+  | +   | +   | 137-30-4  | ZINC DIMETHYLDITHIOCARBAMATE        |
| 255  | -     | B+  | B+  | -   | -   | 12122-67-7 | ZINC ETHYLENEBISTHIOCARBAMATE      |
TD50 value:
For each species, the reported TD50 value is the most potent in the CPDB from among sites that a published author evaluated as positive. This TD50 was selected from those with a statistically significant dose response effect (two-tailed p<0.1). If no site evaluated as positive was significant, then the reported TD50 was the most potent among those positive sites, and the footnote “b” indicates that p > 0.1.

Abbreviations:
- CAS = Chemical Abstracts Service registry number
- NT = No Test in the CPDB in this group
- + = The CPDB contains at least one experiment in which the compound was evaluated as a carcinogen by the published author. For NCI/NTP tests, the evaluation was “clear evidence of carcinogenicity.”
- I = No tests in the CPDB in this sex-species group were evaluated as positive; however, the NCI/NTP test was evaluated as inadequate.
- A = The chemical was evaluated as a carcinogen in at least one test in the CPDB, but not in this sex-species group. However, the NCI evaluated the compound in this sex-species group as “associated with carcinogenicity” in their test, or the NTP evaluated it as having “some evidence of carcinogenicity.”
- E = The chemical was evaluated as a carcinogen in at least one test in the CPDB, but not in this sex-species group. The only evidence for carcinogenicity in the CPDB for this sex-species group was an “equivocal” evaluation by the NTP.
- B+ = In the only positive test in the sex-species, results were reported only for males and females combined.
- B- = In the only test in the sex-species, results were reported only for males and females combined, and the test was negative.

Footnotes:
- a = The CPDB contains more than one positive test in the species.
- b = The reported TD50 is not statistically significant (i.e. p>0.1), and all positively evaluated results in the species are not significant.
- c = Only an upper bound and no TD50 could be estimated because all dosed animals had the tumor of interest and only summary data were available. The reported value is the 99% upper confidence limit.
- d = All positive results in the CPDB are from tests in which the compound was administered by either intraperitoneal or intravenous injection.
- e = The reported TD50 is from a test in which the compound was administered by intraperitoneal or intravenous injection; however, the CPDB also contains a positive test with a less potent TD50 value from a test with an oral or inhalation route.
- f = TD50 values from different significant, positive experiments in this species vary by more than ten-fold from one another. The most potent TD50 value is reported here.
chemicals among the 955 chemicals in the CPDB that were tested in rats or mice. The table provides information for each substance on the most potent TD$_{50}$ value in each species, the strength of evidence for carcinogenicity in each sex-species group, and the Chemical Abstracts Service (CAS) registry number. Forty-six percent of these chemicals were tested in both rats and mice, 35% in rats only, and 19% in mice only. The positivity results for the 492 compounds can be summarized as follows: 342 are positive in rats, and 278 are positive in mice. Among the 228 carcinogens tested in both rats and mice, 100 (44%) are positive in only one species. One hundred sixty-two chemicals were tested in all four sex-species groups, and 52 (32%) of these are positive in all four. Only 133 (27%) of the carcinogens listed in Table 1 were tested in the NCI/NTP Bioassay Program. A detailed analysis of positivity and target sites in the CPDB can be found in Gold et al. (7).

The distribution of TD$_{50}$ values in Table 1 is summarized in Figure 1. 2,3,7,8-Tetrachlorodibenzo-p-dioxin (86.8 ng/kg/day) and C.I. Vat Yellow 4 (10.9 g/kg/day) represent the minimum and maximum TD$_{50}$ values for rats. 2,3,7,8-Tetrachlorodibenzo-p-dioxin (6.67 ng/kg/day) and SX Purple (24.5 g/kg/day) represent the minimum and maximum values for rats. Among the 128 chemicals in Table 1 that are positive in both species, the TD$_{50}$ in rats is more potent than the value in mice for 88, and less potent for 40. Species differences in potency values (in mg/kg/day) are within a factor of 10 for 95 of the 128 compounds (74%). A similar proportion has been reported for chemicals administered in the diet, using the lowest TD$_{50}$ per species regardless of the author’s evaluation of carcinogenicity or statistical significance (12).

**Discussion**

**Summary Measures of Carcinogenic Potency**

In Table 1 we selected the TD$_{50}$ value from one case, the most potent, to represent a chemical within a species. When more than one experiment fulfilled the selection criteria, other summary measures of TD$_{50}$ could have been used that take into account all positive results for a compound. We evaluated three summary measures: the harmonic mean, the geometric mean, and the arithmetic mean to determine how different our results would have been had we used one of these measures. These measures differ according to the weight given outlying results. If we define, $T_i, i = 1, n$, to be the $n$ values of TD$_{50}$ that fulfill the selection criteria for a chemical, then the harmonic mean, $T_H$, is defined as

$$T_H = \frac{1}{\frac{1}{n} \sum_{i=1}^{n} \frac{1}{T_i}};$$

the geometric mean, $T_G$, is defined as

$$T_G = \left( \prod_{i=1}^{n} T_i \right)^{\frac{1}{n}};$$

and the arithmetic mean, $T_A$, is defined as

$$T_A = \frac{1}{n} \sum_{i=1}^{n} T_i.$$
SUMMARY OF CARCINOGENIC POTENCY

Means based on these measures can be ordered in terms of their relationship to our most potent site, TP:

\[ TP \leq TH \leq TG \leq TA \]

Table 2 shows the distribution of values of the ratios \( TH/TP, TG/TP, \) and \( TA/TP \) for rats and mice for chemicals that have more than one positive test in a species; Table 2 therefore includes one-half of the rat carcinogens in Table 1 and two-thirds of those in mice. The remaining chemicals in Table 1 have only one positive test. Those compounds for which we obtained a 10-fold or greater discrepancy in these ratios are listed in the footnote to Table 2. We have selected \( TP \) for presentation in Table 1. One could have chosen the harmonic or other forms of the mean for presentation since they take the results of all positive experiments into account. For various purposes one may wish to use different summary measures; however, as we show in Table 2, it makes little difference whether the choice is the most potent site or a mean. The TD50 values used to compute summary estimates can be found in Gold et al. (4-6).

Chemicals with Widely Varying TD50 Estimates

To further indicate particular substances for which TD50 values from two or more experiments differ greatly, we denote in Table 1 those chemicals for which the minimum estimate differs from the maximum estimate by more than a factor of 10 (see footnote f to Table 1). There are 18 such substances in rats and 12 in mice. For these carcinogens, any summary measure of potency masks the variation across experiments. While noting that the number of such cases is small, we have investigated possible reasons for these widely differing potency estimates for a chemical within a species. We first compared the frequency of estimates varying more than 10-fold to the frequency observed for near-replicate experiments (Table 3). In an earlier paper (6), we examined reproducibility of results in 66 comparisons consisting of 2 or more bioassays of the same chemical administered by the same route and using the same sex and strain of rat or mouse. Here we update this analysis to include 35 additional comparisons from our more recent plots of the CPDB (5,6). Overall, there was good reproducibility of positivity: among the 101 comparisons, 51 were concordant and positive in all of the near-replicate tests, 35 were concordant and negative, and 15 were discordant. For each species, we took the ratio of the least potent TD50 and the most potent TD50 in each concordant-positive near-replicate case, and we compared the distribution of these ratios to the distribution of all chemicals having more than one positive experiment, i.e., those chemicals reported in Table 2. (The chemicals with near-replicate tests are also included in the larger distribution, but the TD50 values for those substances may be from different experiments.) Table 3 indicates that the distribution of the ratio of least to most potent TD50 values for all chemicals is similar to that for the near-replicate comparisons. This similarity suggests that the discrepant results for a chemical within a species are not an artifact of combining across strains, routes of administration, and sexes.

We also compared the extreme cases (TD50 values discrepant by > 10-fold) to all other chemicals in Table 1 with more than one positive experiment, in terms of how often they were tested. In mice, 92% of the extreme cases were tested more than twice compared to 33% of all other cases; in rats, 89% of extremes were tested more than twice compared to 42% of others. There are similar differences in the number of positive tests for the two groups. Thus, when there are extreme differences between TD50 values from different tests of the same chemical, the selection of the least and most potent

Table 2. Ratio of harmonic, geometric, and arithmetic means to most potent TD50 for chemicals positive in more than one experiment, by species.

| Ratio of mean | Rats | | | Mice |
|---------------|------|------|------|------|
| TD50 to most potent | N=163 | N=176 |
| | H | G | A | H | G | A |
| Ratios | | | | | | |
| 1:1.99 | 88 | 74 | 61 | 92 | 78 | 72 |
| 2:2.99 | 9 | 15 | 19 | 7 | 14 | 12 |
| 3:3.99 | 2 | 3 | 7 | 0 | 7 | 6 |
| 4:4.99 | 1 | 6 | 9 | 1 | 1 | 8 |
| ≥10 | 0 | 2* | 4* | 0 | 0 | 2* |
| Total | 100% | 100% | 100% | 100% | 100% | 100%

Legend:

H = Ratio of harmonic mean (TH) to most potent TD50 (TP)
G = Ratio of geometric mean (TG) to most potent TD50 (TP)
A = Ratio of arithmetic mean (TA) to most potent TD50 (TP)

*Chemicals with values of ratio greater than 10. Those followed by ‘*’ were in the extreme category for both arithmetic and geometric means.

Rats:
AF-2; Aflatoxin B1; Aniline.HCl; Nitrosomethylaniline (*);
Sodium Saccharin; TCDD (*); Vinyl Chloride (*)

Mice:
Benze; 4-Chloro-o-Toluidine.HCl; Phenacetin

Table 3. Ratio of least to most potent TD50 from different positive experiments for near-replicate comparisons and all chemicals with more than one positive experiment, by species.

| Ratio of least to most potent TD50 | Rats | | | Mice |
|-----------------------------------|------|------|------|------|
| Near-replicate tests | All chemicals | Near-replicate tests | All chemicals |
| N (%) | N (%) | N (%) | N (%) |
| 1:1.99 | 15 | 6 (55) | 76 (46) | 13 | 54 (51) |
| 2:2.99 | 4 | 15 | 21 (13) | 6 | 25 | 35 (20) |
| 3:3.99 | 3 | 11 (19) | 19 (12) | 0 | 10 | 11 (6) |
| 4:4.99 | 2 | 8 | 29 (18) | 4 | 17 | 28 (16) |
| ≥10 | 3 | 11 | 18 (11) | 1 | 4 | 12 (7) |
| Total | 27 | 100 | 163 (100) | 24 | 100 | 176 (100) |
values was made from among a larger number of TD$_{50}$ values.

Finally, we investigated whether differences between the dose levels administered in the comparison tests were greater for the extreme cases. Generally, within a species the doses in different tests of the same chemical are quite similar. We computed the ratio of maximum doses tested in the experiments that yielded the minimum and maximum TD$_{50}$ values. The median of this ratio for the cases that were not extreme (i.e., differed by less than a factor of 10) was 1.09 for mice and 1.25 for rats. We found that three-quarters of the extreme cases with a ratio > 10 were above this median in each species. This result is not surprising since generally the TD$_{50}$ value is restricted by the maximum dose tested in a bioassay, i.e., a statistically significant TD$_{50}$ cannot be very far from the administered dose, given the usual experimental design (13).

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