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Literature Survey of Bacterial, Fungal, and *Drosophila* Assay Systems Used in the Evaluation of Selected Chemical Compounds for Mutagenic Activity^{1,2}

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ABSTRACT—Literature reports were surveyed, with results noted from experiments in seven nonmammalian assay systems used for the detection of mutagenicity or other related genetic effects. A comparison was made of the activities of 54 selected noncarcinogens, procarcinogens, and ultimate carcinogens as revealed by these test systems. Of the compounds tested, 49 (91%) were active in one or more of the assays, and 42 (78%) were positive in at least one system without having to be metabolically activated. In one or more test systems, 17/17 (100%) of the ultimate carcinogens, 27/28 (96%) of the procarcinogens, and 6/9 (67%) of the noncarcinogens were positive. The Ames *Salmonella*-microsome assay responded with increased mutation frequency to 37/44 (84%) of the carcinogenic compounds but to only 2/8 (25%) of the noncarcinogens tested. The *Drosophila* system responded to 19/21 (90%) of the carcinogens and to 3/6 (50%) of the noncarcinogens. Prophages were induced when lysogenic bacteria were exposed to 12/21 (57%) of the carcinogens, but not enough tests were done with the noncarcinogens (1/3, or 33%) for a comparison. The other systems reviewed, such as the killing of repair-deficient bacteria, mutations in *Escherichia coli* and *Neurospora crassa*, and the host-mediated assay, were not challenged by enough of the compounds for valid comparisons.—J Natl Cancer Inst 62: 841-871, 1979.

Results were summarized from published papers that reported the use of selected nonmammalian assay systems to measure the mutagenic activity of chemical compounds of special interest to the National Cancer Institute. The chemicals considered in this summary are shown in table 1 and have been classified as either ultimate carcinogens, procarcinogens, or noncarcinogens in table 5. Other compounds not appearing in this list are sometimes included in the text for comparison. The present compendium is limited to systems in which investigators used *Neurospora crassa*, *Escherichia coli*, *Salmonella typhimurium*, *Drosophila melanogaster*, or the induction of prophage or other episomes in various bacteria. Information was found for 54 of the 103 compounds listed in table 1. Results from these studies will be considered in sections by organism and are summarized in table 5.

The use of nonmammalian assay systems for the detection of chemically induced mutations has been extensively reviewed by de Serres (1) and mentioned by many other investigators (2-9). The specific use of microbial assay systems in cancer research has been recently reviewed by Rosenkranz (10) and McCann et al. (11, 12). This paper attempts to collate published information on the evaluation of specific chemical compounds in nonmammalian systems for possible use in assessing the value of such systems in predicting potential carcinogenic activity. We call special attention to the fact that this is a literature summary and

not a critical review. We have not attempted to evaluate the interpretations of the data made by the authors of the cited papers. Furthermore, citation of results from all available literature or inclusion of results from papers in the most current literature was not feasible. We have, however, tried to be as comprehensive as possible.

NEUROSPORA CRASSA

N. crassa has been used extensively in the evaluation of chemicals for mutagenic activity since Beadle and

ABBREVIATIONS USED: AF=2-fluorenamine; AFB₁=aflatoxin B₁; AFB₂=aflatoxin B₂; AO=acridine orange; BA=benz[a]anthracene; BP=benz[a]pyrene; BPL=β-propiolactone; BrdUrd=5-bromo-2'-deoxyuridine; BrUra=5-bromouracil; DAB=4-(N,N-dimethylamino)-azobenzene; DBA=dibenz[a,h]anthracene; DEB=1,2:3,4-diepoxybutane; DENA=N-nitrosodiethylamine; DMBA=7,12-dimethylbenz[a]anthracene; DMN=N-nitrosodimethylamine; 2-FAA=N-2-fluorenylacetamide; FdUrd=5-fluoro-2'-deoxyuridine; FUra=5-fluorouracil; HA=hydroxylamine; HN₂=nitrogen mustard(s); 4HAQO=4-(hydroxyamino)quinoline N-oxide; IdUrd=5-iodo-2'-deoxyuridine; MAM=methylazoxymethanol; MCA=3-methylcholanthrene; 3'-Me-DAB=3'-methyl-4-(dimethylamino)azobenzene; MNNG=N-methyl-N'-nitro-N-nitrosoguanidine; N-AcO-2-FAA=N-acetoxy-N-2-fluorenylacetamide; NEU=N-nitroso ethylurea; NFTF=N-[4-(5-nitro-2-furyl)-2-thiazolyl]formamide; NMU=N-nitroso methylurea; N-OH-2-AF=N-hydroxy-2-aminofluorene; N-OH-2-FAA=N-hydroxy-N-(2-fluorenyl)acetamide; 4NQO=4-nitroquinoline N-oxide; 1-OH-2-FAA=1-hydroxy-N-2-fluorenylacetamide; PDMT=1-phenyl-3,3-dimethyltriazene; PMMT=1-phenyl-3-methyltriazene.

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