rat or of the hamster and whether the tissue reactivity of the rat or of the hamster more closely resembles that of man.

A study of the ash-pattern (microincineration) of a number of lungs from asbestos workers (exclusive of cases of silicoasbestosis) has disclosed no instance in which the amount of mineral dust in the lung sections has been more than scanty.[12,13] Other investigators have found upon chemical analysis that the silicate content of manifestly asbestotic lungs was surprisingly low.[14,15] These observations approximate the findings in the rat. Another similarity of human chrysotile asbestosis to findings in asbestotic rat lungs is the complete collagenization with associated acellularity that may be found in "burned-out" cases of human asbestosis.[13] Nevertheless, in spite of the similarity of the collagenization in man and rat, there is an important and significant difference. The early disease in rats is multifocal, affecting the proximal portion of the racemus; whereas in man such multifocal distribution has not been described—only diffuse involvement. A possible explanation of the diffuseness of asbestotic involvement in human lungs could be that the inflammation, initially confined to the proximal portion of the racemus because of continued exposure, spreads peripherally, thereby becoming confluent with that of neighboring racemi. The fact that an asbestotic inflammation may "burn out" in man, does not rule out the possibility that this inflammation remained active and progressive for some years after exposure had ceased before finally attaining the terminal healed stage. There is, unfortunately, no information on the activity of the asbestotic inflammatory process in human lungs at various intervals following removal from further exposure to the specific dust.

In guinea pigs, the results of the inhalation of chrysotile dust are very similar to those observed in rats with respect to the site and extent of the lesion, but conversion of argyrophilic stroma to collagen is not encountered in the sections of guinea pigs that had been killed up to seven months after the initiation of the dust exposure. The amount of dust found in the lung sections is scanty and is limited to the proximal portion of the racemus. However, the number of animals exposed to the different dust concentrations is too small, and the time allowed for maturation of the lesion too short to permit definitive conclusions.

The results of this investigation also have given some insight into the relative pathogenicity of chrysotile asbestos dust for rats insofar as a single intratracheal injection of 3.5 mg of this dust has produced minimal asbestotic lesions in rats. This result may be compared with that of King, et al[16] who found that a quantity of more than 2 mg and less than 5 mg of quartz dust injected intratracheally into rats was the smallest amount of silica capable of producing demonstrable silicosis in this animal. Thus, it seems that for the rat, chrysotile has about the same order of pathogenicity as quartz dust.

For the hamster, the smallest amount of intratracheally injected chrysotile dust capable of producing minimal lesions has not been determined. This dose will apparently be smaller than that found for rats.

By the inhalation technique, using a very high concentration of respirable chrysotile dust (86 mg/cu m), the exposure time required to produce minimal asbestosis in rats and guinea pigs seems to be somewhere between 60 and 120 hours.

The hyperplasia of smooth muscle observed in the asbestotic rats is very similar to such hyperplasia observed in human asbestosis cases studied in this laboratory and is also similar to that found in bronchiolar emphysema of the lung.[17] Although the exact origin of the muscle was not determined, its location made it appear most likely that it was derived from the circular muscle in the alveolar ducts that regulate the openings of the evaginating alveoli.

Summary and Conclusions

Rats, hamsters, and guinea pigs were given various lung dust burdens of chrysotile asbestos; some, by inhalation and others, by intratracheal injection. An attempt was made to determine the smallest amount of chrysotile dust that would produce a recognizable minimal asbestotic lesion. The time lapse between the imposition of the lung dust burden and the death of the animal varied from zero to 24 months.

The following conclusions have been reached: