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**The action of respiratory stimulants in morphine and heroin poisoning.**

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In the experiments on cats previously reported, it was apparent that the action of morphine and heroin on respiration was limited to a depression of expiration, and that an extremely slow rate and respiratory failure depended on a primary depression of the circulation. These observations have been confirmed in every case in experiments on dogs, and in most experiments on rabbits, though in one experiment heroin caused temporary respiratory failure and asphyxial effects on the blood pressure of a rabbit, and circulatory depression was usually less marked in rabbits after morphine or heroin than in dogs or cats. The extremely slow regular breathing of advanced morphine or heroin poisoning never occurred, in dogs or rabbits, unless circulation was definitely depressed, and the appearance was that of vasomotor failure.

As respiratory stimulants, atropine, caffeine, and camphor were tried; digitalis was used as a circulatory stimulant; and inhalations of CO<sub>2</sub>, of 7 to 10 per cent strength, were also used, when respiration was seriously depressed by morphine or heroin.

Atropine stimulated respiration only exceptionally, and the stimulation appeared as an increase in depth but never in rate. As a rule, it either had no effect, or it added to the respiratory and circulatory depression especially if large doses were given—2 to 10 mg. to a dog.

Caffeine was the most reliable and safest stimulant, often increasing both rate and depth, and sometimes bringing back active expiration, especially if it improved the circulation. Large doses did no harm unless they depressed the circulation, when respiratory failure usually followed.

Camphor produced striking stimulation of respiration and circulation in one experiment on a rabbit, in 20 mg. dose, but in all other attempts on rabbits and dogs it either had no effect, or produced circulatory depression and respiratory failure. Its

action seemed to depend on improvement of the circulation, and the uncertainty of this effect may explain the uncertain action of camphor as a respiratory stimulant.

Digitalis alone, when it raised blood pressure, sometimes produced definite improvement of respiration. Digitalis and caffeine together proved to be the most reliable form of respiratory stimulation.

Inhalations of CO<sub>2</sub>, when expiration was completely passive, often increased the depth but slowed the rate of breathing, and this sometimes actually decreased the minute volume. Frequently CO<sub>2</sub> inhalation was followed by permanent respiratory failure, after a period of gasps of diminishing rate and depth, in dogs and rabbits whose ventilation was adequate before the inhalation. The appearance was that of inhalation of a depressant concentration of CO<sub>2</sub>, though the same gas mixture had previously produced only stimulation of respiration.

A study of the clinical records of patients with morphine or opium poisoning in this hospital showed that wherever observations of the circulation were made on patients in a critical condition there were signs of serious circulatory depression, and that as the condition improved under treatment the circulation also improved. One patient died of morphine poisoning, and the pulse could not be felt ten minutes before respiratory failure; pulmonary edema was present, for which the autopsy showed no organic or infectious cause, so that it may have been due to extreme circulatory depression. It is possible that circulatory depression plays a larger part in the dangers of morphine poisoning than is generally realized.

### 136 (2368)

The types of tetanus bacilli isolated from stools in Peking.

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We had not seen any confirmation of Tulloch's seriological classification of tetanus bacilli and as we had a number of strains of this organism, isolated from the stools of man, we thought