NOTES, COMMENTS, AND ABSTRACTS

PREVENTIVE MEDICINE IN ITS RELATION TO AVIATION.

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AIR transport has now become so important a factor in the life of the community that preventive medicine must seriously take into account the new problems that inevitably have arisen.

The Pilot.

Medicine in aviation has naturally, up to the present, been chiefly concerned with the pilot. He is the keyman of all flying. His selection and fitness must always be the primary consideration, and examinations at fixed intervals by the same highly trained specialists are necessary to ensure that his efficiency is unimpaired; to note the influences and conditions under which he works. Everything that has a bearing, directly or indirectly, upon his flying health should be observed and rigidly supervised.

Many ingenious tests have been devised for this purpose, and in no other branch of medicine has the psychological side been so well stressed, and its importance so well appreciated as in the selection and care of the aviator.

The medical branch of the Royal Air Force has shown great resource and initiative in dealing with the various difficult problems with which it has been so violently faced, and the pioneer work of Flack, Stamm, Head, and many others,[1] necessarily sets a standard for medicine dealing with the pilot in civil aviation. Most of the pilots engaged in civil aviation transport have been trained in the Service and the system of short-term engagement makes it likely that this will be so for a considerable time to come.

The candidate to become a pilot in civil transport is finally examined at the Air Ministry in London. The medical examinations are carried out here by the same people, the same apparatus, under the same conditions, in the same atmosphere. It will be readily understood that, for such vital, stringent, and complex tests and such comparatively new work, the advantage of these being carried out always by the same personnel is great, and that it will be very difficult to delegate them to a decentralised authority. The value of impressions obtained, too difficult to define, the intuitive knowledge that must be gained, all tend to make this extremely personal and limiting. So too with such work still in its infancy, new devices and experiments are continually being elaborated, which could only be properly evaluated by those already steeped in the work.

The would-be pilot undergoes a super-insurance examination as to his family history, his personal habits, tastes, hobbies; his education and the minutiæ of his occupation since his school days. This being satisfactory, his selection will depend upon what are known as physical efficiency tests.[2] These are devised to determine the conditions of his cardio-vascular system, respiratory capacities, vision, hearing, nervous and muscular reactions. To pass these tests he must prove to be a piece of perfect mechanism both mental and physical, with capabilities of unerring judgment. After a period of training, if satisfactory, he receives certificate B. (the public transport certificate). This must be renewed at six-monthly intervals after re-examination. A woman pilot holding such certificate is re-examined every three months.

The conditions of the pilot's work obviously are of the utmost importance and should come under the supervision and control of a competent authority—at present the Air Ministry. They have a vital effect on his efficiency, and the peculiar nature of his work is such that the easement of any arduous factor makes for safer flying.

The length of flying-time must be regulated, the periods of waiting must be considered; where must the pilot be housed during such periods of his employment, what must he do that he be not depressed—a condition fraught with trouble for pilots? His reaction to night flying should be noted.

The employing company cannot always appreciate that small and apparently trivial difficulties are vital in their reactions. The maker of the machines, in his engineering enthusiasm, unconsciously adds to the pilot's troubles by altering or adding controls, changing what has been an automatic reaction to an extraconscious action—a possible source of error in rapid judgment. The necessity for standard controls cannot be too strongly urged; and every effort should be made to lessen the number of instruments the pilot must watch—air speed indicator, altimeter, oil and petrol gauges, compass, &c.—and these tend to increase. So, too, everything that will minimise the result of an accident to him, such as the special padding of the cockpit, the automatic parachute, tends to give him a certain relaxation of the tenseness of expectancy.

These are all subjects that come under the purview of preventive medicine in aviation as well as a consideration of the length of a pilot's occupational life, the problem of his after career, and the assurance of more than a pittance when his comparatively short flying life is done. It must affect his efficiency if he has a conscious or a subconscious worry as to what is to become of his wife and family, in case of total disability, or—feeling a lessened vitality from a quickening staleness—as to the results of his next medical examination.

It must always be an axiom that the pilot (apart from the machine) is the paramount factor of flying.

The Passenger.

Air transport companies between Great Britain and the continent carried 48,253 passengers in 1929.[3]

AIR-SICKNESS.

There are no statistics available to show how many of the 48,253 suffered air-sickness, but it is stated to be not negligible. Apart from the mental bias to sickness and the unusual movement, probably four main factors tend to operate in the causation of this troublesome condition: poor ventilation, lack of warmth, noise, and vibration; the first being the most important. A reasonable altitude, per se, does not appear to have any bearing on sickness.

The problem of changing the air of the small cubic space allowed to each passenger is a difficult one. To change the air sufficiently often to keep it fresh means draughts. If draughts are prevented then the sense of "stuffiness" arises, due, as Leonard Hill [4] has shown, to lack of the removal of the air next the skin and enmeshed in the clothing.

The heating of the air presents some engineering difficulties. Air heated by contact with hot pipes leading from the exhaust may contain noxious gases and the possibilities of leakage. Humidity and warmth might be measured and controlled by passing air through steam.

The Handley Page 42-seater on the India route has a cubic capacity of approximately 4000 c. ft., giving slightly less than 100 c. ft. per passenger. Hot and cold air inlets are provided at each pair of seats. The *Argosy* on the Paris service, seating 20 passengers, gives about 54 c. ft. to each person. (This does not compare unfavourably with crowded suburban trains.) A room in a dwelling-house is required to have 1000 c. ft. space for each person.

We know from experience that continuous and particularly unusual noise is fatiguing; it is one of

the problems of our mechanised age. The noise of the actual explosion of the cylinders of the engine may be reduced, but in so doing, Heald [5] has pointed out, the unpleasant screaming of the timing gears then become predominant. Vibration he also notes can become fatiguing, and thus may be a reflex cause of sickness. Exhaustive experiments in the sound proofing of aeroplane cabins are being carried out by different authorities.[6]

An investigation promoted by the Daniel Guggenheim Fund for the Promotion of Aeronautics [7] was concluded by the observation that few people are troubled by air-sickness in properly built and efficiently piloted aircraft.

Research carried out by Marrack,[8] as to a fundamental cause of sea-sickness, showed that ketosis occurred in nearly all subjects within 24 hours after vomiting commenced, but that it was incidental, and evidence of a metabolic change which itself may be the cause. According to Flack [9] the connexion between sea- and air-sickness appeared to be slight, though in cases where the labyrinth was unduly sensitive the subject would be both sea-sick and air-sick. Flack also noted that where the labyrinth did not seem to be involved, ocular muscle imbalance was the primary condition. Maitland,[10] in work carried out at the same time as both the above, observed that a passenger can only partially counteract a sudden, unexpected arrest of movement and a change of direction, by bodily adjustment; "the eye fails to pick up the datum levels, to rectify erratic information received by the semi-circular canals."

Much general experience goes to show that all subjects react very differently, as to the various factors which set up the impulse, and that different senses and functions are involved in different people.

DISPOSAL OF EXCRETA.

The Air Ministry regulations [11] at the present time prohibit the dropping of articles from the air, with certain exceptions, but the exceptions apply to excretal matter, a problem that requires urgent attention. It is almost safe to say that at the present time, when a passenger or a pilot urinates or defæcates whilst in the air, the excreta, liquid and solid, is simply allowed to scatter on the four winds of Heaven. This anachronism would never have been permitted had there been visible evidence. No palpable mass can be observed—the height at which it is released being sufficient to cause division into small particles or drops.

The layman will perhaps argue that such division and the exposure of the fine particles to wind, rain, and sun (particularly the sun) is all that can be desired to make such material harmless, although he probably would object on æsthetic grounds; and it may be argued by the more knowledgeable that the bacterial content of the healthy intestine is not of a disease-producing type and that those who are flying or travelling by air are the most likely to be of a healthy normal type. It has been estimated, however, that about 1 in 1000 of the population is a typhoid carrier [12]—apar tfrom other intestinal disease carriers—and there appeais no reason why human carriers of the salmonella group of bacteria should not exist. The dysentery carrier cannot be absolutely disregarded, and on the air routes of Africa, Asia, and South America, dysentery, cholera, and helminth carriers are important, and can be contributors to disease broadcast in such a manner.

If the above estimate is right the Imperial Airways and other companies possibly transported 27 typhoid carriers in 1929. True, they may not all have defæcated or urinated whilst in the air, but it is certain that a proportion of them did so.

What happens to the finely divided particles? Each minute mass is attached to a droplet of moisture and the bacteria present are protected with a coating of fæcal matter from being killed by the sun's rays and the moisture present is necessary for their existence. In calm weather a gradual deposition takes place in the area in which it is dropped. In windy weather it is carried great distances: it may remain suspended in the air, wafted by slight currents; but whatever the weather or conditions there is every possibility of its being finally deposited or blown direct into an open water-supply, on to human food, or taken into the lung. Air routes pass over reservoirs and water-supplies, or in close proximity. Close or distant, the danger exists.

It may be said that we are accustomed to breathing in an atmosphere laden with bacteria among which are intestinal organisms, or that the possibilities of disease arising from aeroplane passenger traffic at present is very slight. But each year sees a larger number of people taking to air, each year the ends of the earth are brought closer, and where definite air routes are established in countries where intestinal disease, such as dysentery and cholera, are both endemic and epidemic, the increase in the danger becomes more marked.

Suggested measures.—There appear to be several possible ways for dealing with excreta on aeroplanes, but the present design and construction of the machine is not such as to expect or allow elaborate, weighty, or bulky mechanism for such purposes, and sanitary authorities would be well advised to be satisfied with simple and possibly primitive devices at first.

For passenger-carrying machines a small, standard, aluminium tank or box could be fitted in the lavatory, containing a small amount of disinfectant of high coefficient. The tank should be of sufficient size to take the excreta of half the number of passengers carried. The size necessary for ten people for a three to four hour journey would be approximately 1½ gallons. (The amount of excreta for 24 hours per person is taken as about 50 oz. of urine and an average of 5 oz. of fæces.) The tank would be preferably of an ink-well pattern; a detachable funnel-top fitting into a cylindrical container with an incurved rim. These would be replaced at the air-port by one of a standard pattern, and the used one emptied, disinfected, and prepared ready for use again.

A further development might be devised at a later date—a tank jacketted for steam, if such were available, or hot air from the exhaust, by which the excreta would be rapidly dried. This would necessitate an exhaust ventilation for fumes and perhaps a method of removing the dried material from the chamber, but if the heat generated was sufficient to dry the material very rapidly, the tank would have the advantage of a very small size and diminished weight of excreta.

A device for breaking down the solids by compressed air and then rendering them innocuous before discharge into the air would probably require too complex machinery for practical use.

For a single-seater machine, a valved funnel arrangement could be planned with a plenum device for forcing the matter by air to a small tank at the rear of the fuselage.

Excreta taken from the machines at air-ports would readily be dealt with where the air-port was favourably situated near a large town, but the establishment of air-ports in primitive surroundings would necessitate the method of disposal best suited for the area.

THE CARRYING OF DISEASE.

As civil aviation increases and international boundaries become of lesser import, the utmost stringency will be imperative to prevent epidemics. The Royal Air Force as a fighting force has control of all the units it carries, but in civil aviation problems arise with regard to the transport of units over which much less control can be exercised; unless, as pointed out by Massey,[13] the very purpose of the speed of aviation is destroyed.

It is now possible to travel half round the world whilst sickening for a disease. A man could drink a typhoid-infected water in the Antipodes and show no signs of it until after he had disembarked from an aeroplane at Croydon. And though the danger of the introduction of disease into this country by aeroplane is not yet very great, each day brings us a little closer to the subtropics and the tropics.

The danger of the spread of the yellow fever mosquito across Africa by air travel has already been urged by James.[14] Draft regulations concerning this

type of menace already exist and in some countries, such as South America, are actually in force; coast-wise seaplane services along yellow fever regions must land and embark passengers at a certain distance from shore.

As an Empire country we must necessarily envisage all the possibilities of the spread of tropical disease by air; cholera, dysentery, and plague, not only into this country, but from one Dominion to another. Yet is seems that our greatest immediate danger from this means is the introduction into, and the spread in the British Isles, of influenza, the exanthemata and the diseases caused by filtrable viruses. In 1930 42,435 passengers were carried between the continent and Great Britain by air.[15] With the cursory supervision possible at present, how great a potentiality for these diseases in their incubation periods?

Without nullifying the very object of aviation, the control of communicable disease will prove to be one of the most difficult problems preventive medicine has had to face. At present our quarantine is under the primary control of H.M. Customs and aeroplanes are cleared as ships. Unless blatantly ill no sick passenger would have much difficulty in evasion, and virulent disease could land with little hindrance.

A bill of health from the port of embarkation has been suggested. This is already in force in certain countries; often it may have little value. It will be readily seen that a passenger hurried by car to the air-port with just enough time to embark (and this is not unusual) is somewhat perfunctorily examined. Also, different countries have not the same standards.

The possibilities of the future would seem to lie in the following directions:—

(1) Reorganisation of the quarantine service and its transfer, as far as aviation is concerned, to the Ministry of Health. At present aircraft in this respect are governed by maritime regulations. Conditions are so different it is self-evident that reorientation is inevitable.

(2) The employment of whole-time medical officers in such quarantine service, and the establishment of small quarantine hospitals at air-ports.

(3) An extension of the use of consular reports telegraphed as to the daily health at this official's station as well as the reports of the Office Internationale d'Hygiène Publique.

(4) The establishment of regulations of an elastic nature and subject to frequent revision.

(5) Immunisation preliminary to travel from epidemic areas.

Some of these points have been discussed by Holden.[16]

The knowledge that a close scrutiny of passengers was carried out on disembarkation would tend to deter a certain number of incubationary carriers. It may be possible at some future date to devise some rapid method of diagnosing "not quite wellness," because it is this state, or lack, of health that must almost always be considered in the aeroplane passenger.

It must be emphasised that authority should endeavour to carry out a measure of control, efficient and elastic, in order that the purpose and development of aviation be not hampered. Even under the best auspices there is no doubt that the more the extension of our freedom as to time and space, the more the restriction of our liberty, where the health of the community is involved. (The dangers of transmission of disease by aircraft apply to all forms of transport, and it would be reasonable, whilst setting this house in order, to give some attention to our far from perfect protection from the same type of disease on cross-channel boat traffic and in trains.)

Accidents.

Confidence in aircraft is becoming established. The number of accidents involving regular passenger traffic may be regarded as almost minimal. During the year 1929–1930, with the Imperial Airways one accident occurred and four persons were killed representing one killed per 360,000 miles flown or one killed for 6270 passengers carried.

On examining the causes of accidents, French figures[17] for 1923–1925 are available and the impressive fact emerges that out of 100 accidents the percentage of causes are in almost constant proportion—over half are due to faulty airmanship (errors of judgment) and less than one-quarter to engine failure. American statistics[18] bear this out. They show about 56 per cent. due, as they put it, to personnel, and 19 per cent. to power plant failure. Our own figures for 1929[19] are still higher, 70 per cent. due to errors of judgment (faulty pilotage). These figures emphasise very strongly the urgent necessity of considering no factor too trivial where the pilot is concerned.

All first-aid outfits on passenger machines should include large and small dressings, iodine or other antiseptic in ampoules, spirits of ammonia, and a dressing for burns. All air-ports should be equipped with a dressing station complete with emergency tools and fire extinguishers.

Surgery in connexion with aviation differs but little from that concerned with accidents generally; mainly in degree. Major injuries do not bulk so largely as might be expected. An admirable and interesting analysis of such accidents is given in a work by Graeme Anderson.[20]

Merchandise.

The carrying of merchandise in ships from foreign ports calls for the inspection of cargo for disease-carrying vermin such as rats which may be infested with plague, fleas, or actual carriers of this and other diseases. Cargo and ship must be disinfected; deratisation and measures for rat-proofing carried out.

The same applies, on a small scale at the present time, to merchandise carried in aeroplanes. Such traffic is still in an elementary stage; mail, gold, and precious stones are common air cargoes but with an extension of such traffic to include materials or foodstuffs, a search for parasites, rats, and insect pests will be imperative.

A new condition also arises to that obtaining in ship transport. The shortened period of the journey by aeroplane may allow arthropod disease-carriers to be landed alive in this country that would not otherwise have survived the longer period on a ship. Other insect pests, so introduced, might well have an economic importance in causing destruction of plant or cereal crops.

The entomologist has made use of the aeroplane in the search for and distribution of the natural enemies of similar pests; locusts and grasshoppers are sprayed from the air, in the effort to arrest their destructive progress. The sanitarian has been able to destroy mosquito larvæ over large tracts of country by spraying larvicides from planes.

Health Services.

The aeroplane has already proved of great value in countries where natural cataclysms frequently occur and where ordinary means of communication are destroyed. Rapid organisation of sanitary measures is an urgent necessity after earthquakes or great floods for first-aid work, to prevent epidemic disease, establish food- and water-supplies, and to rush chlorinating apparatus and disinfectants to the affected areas. The recent earthquake in New Zealand and the large flooded districts of the Mississippi are apt examples.

Mobile laboratories, portable X rays and operating units are not dreams of the future in aviation, but are either in being or on the way to reality. The ambulance aeroplane is a standard Royal Air Force equipment. Antitoxin has been hurried to Alaska; cultures of cholera vibrio have been brought from Basra by air to London for the preparation of vaccines to be returned in the same manner, to replenish depleted supplies during an epidemic.

The health services of the future also promise a use of aviation for therapeutics. metabolism is stimulated by flying—its tonic effect is marked; airmen have also noticed that the common cold reacts favourably to flights at high altitudes. But in a country like England where sunlight is so often infrequent one can foresee the possible establishment of sunlight clinics in the air—airships for altitude treatment of

heart and respiratory diseases. Instead of prescribing a child a few minutes exposure to the sunlight lamp, we may be ordering a flight at such and such an altitude for half an hour. We have a Leysin directly over our heads all day and every day.

Finally, medicine is to gain from the meteorological research now being carried out on the strata of air at very high altitudes.

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HOCKEY INJURIES.

THE casualties at football in America, described by our correspondent from U.S.A. on p. 100, are more fatal and more serious than one would expect, even in the course of a violent game. That few disabling accidents follow hockey has recently been shown by Dr. A. Arnold,[1] of the medical department of the Leipzig University Institute for Physical Exercises. He has recently published his observations on injuries received at hockey in a paper based on their occurrence in 2152 games in which over 23,000 players took part. Like Dr. Glass,[2] who had made similar observations on sets of hockey players, Dr. Arnold classified the injuries into two groups according as the person affected was obliged to give up playing for from three to five minutes, or to abandon the game altogether. In men's teams the incidence of injuries was 0·35 per cent., in boys' teams 0·25 per cent., and in women's and girls' teams 0·34 per cent., or a total incidence of 0·33 per cent. In 38 per cent. the injury was caused by the hockey stick, and in 19 per cent. by the ball, while 43 per cent. were classified as due to indirect causes—i.e., not peculiar to hockey, but such as might occur in any sport—e.g., a fall or collision with another player. The frequency of injuries varied with the different groups of players. As regards the site of the injuries inflicted by the hockey stick the head was affected in 43 per cent., the lower extremities in 33 per cent., the upper extremities in 17 per cent., and the trunk in 7 per cent. of the accidents. The sites of the injuries inflicted by the balls showed a somewhat similar distribution. On the other hand, in injuries due to indirect causes the upper and lower extremities were most frequently affected. The duration of the incapacity caused by the injury was in most cases very short. Only three of the 30 players injured by the stick and only three of the 15 injured by the ball were unfit for playing for longer than a month. On the other hand, of 34 injured by indirect causes, 20 were still unable to resume playing after a month. Three had to give up hockey altogether—one from injury to the kidney and two from injury to the knee. Dr. Arnold comes to the conclusion that since serious injury seems to be rare, and the muscular movements which hockey calls into play are of great variety, the game should be recommended from the medical point of view.

[1] Deut. med. Woch., Dec. 25th, 1931, p. 2175.
[2] Arch. klin. Chir., Bd. 184, p. 742.

COMPULSORY PASTEURISATION OF MILK.

THE Manchester public health committee has approved a memorandum from Dr. R. Veitch Clark, the medical officer of health, proposing that the city council should take powers to insist that all the milk supplied to the city—except certified and Grade A (tuberculin tested)—should in future be pasteurised. As a condition of registration in the business it is intended that the authorities should require the installation of a satisfactory pasteurising and cooling plant, and should undertake the necessary examination and inspection. In order to obviate hardship it is suggested that a year should elapse between the passage of the act and its enforcement. The *Manchester Guardian* states that already about three-quarters of the city's milk-supply is pasteurised.

THE JAMES MACKENZIE INSTITUTE FOR CLINICAL RESEARCH.

THE annual report of this institution shows that the work initiated there is being steadily carried on. During the year 97 new cases and 1150 additional notes were added to the files, while 795 specimens were examined in the laboratories. A complete survey of the records having now been made, certain groups of cases are to be investigated in furtherance of the principles of Sir James Mackenzie's viscero-motor and viscero-sensory reflex theory. Individual members of the staff have studied the ætiology of the common cold and its relationship to carbohydrate intake, the effect of fatique on the position of viscera, the cause of bacilluria, and have surveyed the physical state of children under 5. The scheme of continuous observation of children up to school age is a useful means of investigating the primary causes of ill-health and of ensuring early treatment.

Births, Marriages, and Deaths

BIRTHS.

ANDERSON.—On Dec. 27th, 1931, at Hong-Kong, the wife of James W. Anderson, M.B., Ch.B., F.R.C.S. Ed., of a daughter.

CHITNIS.—On Dec. 20th, 1931, in a Birmingham nursing home, the wife of C. N. Chitnis, M.R.C.S., L.R.C.P., of a son.

COLLEY.—On Dec. 13th, 1931, the wife of R. Colley, M.B., Ch.B., D.O.M.S., of The Circus, Bath, of a son.

RICE.—On Dec. 26th, 1931, at Thorpe-road, Norwich, the wife of Dr. R. A. C. Rice, of a son.

MARRIAGES.

CRUICKSHANK—LOCKHART.—On Dec. 24th, 1931, at the Parish Church, Great Shelford, near Cambridge, Douglas Barron Cruickshank, L.R.C.P. Edin., L.D.S., D.P.H. Camb., to Hilda Joyce, third daughter of Mr. and Mrs. E. W. Lockhart, of Riversdale, Great Shelford.

DEATHS.

ALCOCK.—On Dec. 27th, 1931, George Herbert Alcock, M.R.C.S., L.R.C.P.

BIRD.—On Jan. 3rd, at 27, St. Peter's-road, St. Margaret's-on-Thames, Tom Bird, M.A. Oxon., M.R.C.S., Anæsthetist to Guy's Hospital 1881 to 1903, Consulting Anæsthetist since 1903, aged 88 years.

BROWN.—On Jan. 3rd, suddenly, Joseph Norwood Brown, M.D. Lond., of Finchley-road, N.W.

BROWN.—On Dec. 21st, 1931, at Mayfield, Hatch End, Andrew Brown, M.D., M.R.C.P., in his 91st year.

CAREY.—On Dec. 31st, 1931, at Sausmarez House, Guernsey, Lieut.-Colonel John Thomas Carey, late R.A.M.C., aged 80 years.

HOLBECHE.—On Dec. 25th, 1931, at his residence, Priors Croft, Malvern, Arthur Oliver Holbeche, M.R.C.S., &c., in his 77th year.

HOLTON.—On Dec. 24th, 1931, suddenly, Francis William Parke Holton, M.R.C.S., L.S.A., aged 74.

PITT.—On Jan. 1st, at Brandhoek, Gerrards Cross, Edward Pitt, L.D.S., R.C.S. Eng.

THOMAS.—On Dec. 27th, 1931, at Welwyn, Herts, Dr. Benjamin Wilfred Thomas, third son of the late Dr. Benjamin Thomas, of Llanelly.

WALKER.—On Dec. 27th, 1931, at Peterborough, Russell Ernest Walker, M.B., F.R.C.S.E.

WINTER.—On Dec. 24th, 1931, at The House that Jack Built, Wolverhampton, Walter Henry Trimnell Winter, M.R.C.S., L.R.C.P.I., son of the late G. W. Winter, of Ceylon.

N.B.—A fee of 7s. 6d. is charged for the insertion of Notices of Births, Marriages and Deaths.