the present views are proven. Of course there is a time in the life of every one when punishment must be the consequence of bad conduct, and this applies to the committed insane as well as to other classes. It is, however, only as a detail of personal care that such punishment should be meted out.

If it is accepted that the trend of criminological studies is in the direction above pointed out, it means a proper adjustment of our methods of legal procedure; but I cannot see how it in the least endangers society. Certainly such an outcome seems probable, and, in justice, every effort should be made to prove the hypothesis. The privileges of society carry correlative responsibilities, which are in danger of being largely overlooked in society's view of the criminal question.

The one idea which will lead to the final decision, and which should always be kept in mind by jurists and medical men, is the individuality of the criminal. This idea is sometimes endangered by the tendency to apply the methods of physical anthropology primarily to classes. The criminologist who, for example, studies murders as a class, is on the wrong track, while he who investigates the peculiarities of a murderer is keeping the main idea in view. If he is subsequently able to classify each murderer and produce a type, well and good, though such a classification is unnecessary for the purposes at present advanced. Our immediate interest centres in traits, not types.

Mitral and Tricuspid Incompetence. By W. J. PENFOLD, M.B., C.M., ED.

THE imperfect way in which the pathologist has been accustomed to test the competence of the mitral and tricuspid valves seems to be at variance with the careful and systematic observation given to other parts.

Recently I have applied the water test as follows, and have found it very satisfactory so far. I require for the purpose a conical nozzle about four inches long, having a diameter half an inch at one end and two inches at the other; this is attached to the tap by means of a strong india-rubber tube, having at the

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tap end a brass bulb containing within it a conical india-rubber washer which will fit over any ordinary tap. I open the auricles and wash the clots out of the ventricles, through the pulmonary artery or aorta, by introducing the nozzle into the auriculo-ventricular orifices; I then, if wishing to test the mitral valve for example, introduce the nozzle into the left ventricle through the aortic orifice beyond the cusps, and then, looking at the valve through the widely opened left auricle, turn on the tap and watch for any leakage; in the case of the tricuspid valve the nozzle is introduced through the pulmonary artery, and the valve watched through the right auricle. We must be careful that as soon as the valve margins are apposed we turn off the tap, or forcible dilatation of the cavities will occur, and the test be vitiated. The advantages of this method are as follows:—The ventricular wall is uninjured, the cavity is full, and the different parts of its walls are related to one another as during life; it is easily applied, and the valves are fully seen during its application.

Since introducing this method I have examined post mortem twenty-six hearts. In 16 per cent., that is to say in four cases, mitral incompetence was present; in 92 per cent., that is to say twenty-four cases, tricuspid incompetence was present, so that I conclude that mitral incompetence is much rarer than tricuspid incompetence, and that the latter, therefore, cannot be usually due to the former, as is commonly stated; that tricuspid incompetence, even in moderate degrees, is consistent with perfect health, and may be looked upon as physiological.

I have observed in applying the test that the mitral cusps show to some extent a surface apposition, while in the case of the tricuspid cusps an almost purely marginal apposition is the rule. I think this fact accounts for the frequency and the great degree of tricuspid incompetence. In one of the mitral incompetence cases the regurgitation was marked, while in the three others it was slight. In 20 per cent. of the tricuspid incompetence cases it was slight, in the remainder it was well marked, and in some of the latter excessively pronounced.

In all four cases of mitral incompetence the tricuspid valve was also incompetent. Three of the twenty-six cases had aortic incompetence with the water test; two of these had competent mitral valves, one an incompetent one. The pulmonary valve was competent and healthy in every case. Four-

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teen aortic valves showed chronic changes, varying from vegetations on the one hand to slight patchy chronic thickening on the other, the latter causing appreciable shortening in only a few cases. The mitral valve showed slight thickening in fifteen cases, which usually took the form of two or three patches at the base of its aortic cusp, and caused appreciable shortening in only one case, which was the case of marked mitral incompetence. The tricuspid valve showed in five cases thickening of a lumpy, smooth, marginal character, not of an atheromatous nature. In reference to the size of the orifices I may state that the mitral averaged by cone measurement 1·4 inches in diameter, the tricuspid 1·85 inches.

It has been contended that in the process of drying, an accumulation of blood, taking place in a given cavity, will cause a dilatation of the orifices in the walls of the cavity, and this has been said to operate in the case of the mitral, but more especially in the case of the tricuspid orifice.

Now in the four cases of mitral incompetence the average size was 1·375 inches, that is ·025 less than my general average, so that it does not appear that the incompetence was due to any special dilatation in these cases; in one of the cases of mitral incompetence the measurement was only 1·1 inches; here the cusps showed no evidence of old endocarditis, but simply seemed smaller than usual. As to the tricuspid orifice, in one of the two competent cases it measured 1·9 inches, which is greater by 0·5 than my average, and by ·25 than that given by Hamilton. In the other case of competence it was 1·6 inches. In one case of 1·2 inches the valve was incompetent, which measurement is considerably smaller than either of the competent cases.

As to the deposition of clot in the various chambers, I do not give the exact amounts, as I did not commence to measure the clots until recently; I therefore use the terms small, moderate, or great in amount, which give an approximate idea.

The right ventricle was empty, or practically so, in six cases, the left ventricle in thirteen; the right ventricle contained a small amount of clot in eleven cases, the left ventricle in nine.

Moderate amounts of clot were found in six right ventricles and two left ventricles. A large amount of clot was found in

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two right ventricles and one left ventricle; in one case all the chambers were filled with dark fluid blood.

The two cases of tricuspid competence had each the right ventricle empty, but four others in the series had also empty right ventricles with incompetent tricuspid valves.

The left ventricle was found empty, or practically so, in thirteen cases; but of the four cases of mitral incompetence one was contained in the thirteen, while the other three had only slight amounts of clot, so that the element of distension from the determination of blood to the chambers could not have operated in these cases.

On the other hand, the left ventricle, which was found distended with post-mortem clot, had a competent mitral valve; this was a case of hæmatoporphyrinuria.

Apart from the heart condition, one naturally inquires after the condition of the lungs, since it is commonly believed that obstructive lung disease will give a tricuspid incompetence. Phthisis was present in ten cases, broncho-pneumonia (or hypostatic pneumonia with genuine consolidation) was present in six cases, hydrothorax in one, and emphysema in one—making a total of eighteen.

This large proportion of obstructive lung disease may account for a few of the slighter cases of tricuspid incompetence, but not for the more marked, since in both cases of competent tricuspids advanced phthisis was present, while in the eight cases free from such obstructive disease an incompetent tricuspid was found in each case. So much for the pathological side of my position.

One naturally asks, How does clinical teaching coincide with it? I reply, Not at all, but I think clinical facts do.

We will first consider the question of murmurs; by a murmur I understand any definite impurity of the cardiac sounds. I do not distinguish between impurity and murmur, since I believe it is a distinction without any pathological basis.

I believe this for two reasons. Firstly, on exercising a patient with a cardiac impurity a murmur uniformly appears, having its point of maximum intensity in the position of the impurity; and secondly, because the distinction between them is a purely arbitrary one, the one passing insensibly into the other.

Twenty out of my twenty-six cases had their hearts physically examined during life; of the four cases of mitral incompetence

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only two were examined during life, and in both a mitral systolic murmur was found. An examination was not undertaken in the other cases owing to their mental state. Nine cases, found post mortem to have competent mitral valves, had during life a mitral systolic murmur or impurity; these murmurs could not have arisen, then, at the mitral valve, but must have been due to the incompetence of the tricuspid, which incompetence was present in every case, and the murmur so produced was propagated to the apex-beat.

Four of the cases had systolic tricuspid murmurs during life, and post mortem the tricuspid valve was found incompetent in every case. In one of the cases it was accompanied by a mitral incompetence, as decided by the water test, so that fourteen cases out of the twenty showed one or more murmurs in the region extending from the lower end of the sternum to the apex-beat.

As results stand, systolic tricuspid murmurs were present only with tricuspid incompetence, while in the eleven cases of mitral systolic murmurs nine of the mitral valves were found competent after death.

I am, therefore, bound to conclude that murmurs heard over the apex-beat are not of necessity mitral, but are even more frequently tricuspid, and *I would define the tricuspid area as the region between the lower end of the body of the sternum and the apex-beat.*

Such being the case, the great frequency of apex-beat murmurs or impurities would tend to support the frequency of the tricuspid incompetence, as shown in the twenty-six cases I have examined post mortem.

We have seen that fourteen out of the twenty cases showed murmurs during life in our "*New Tricuspid Area*," that is to say, 70 per cent. of the twenty cases. Eighteen showed incompetence of the tricuspid valve post mortem—that is to say, 90 per cent.

How do we account for this discrepancy between clinical and pathological results? All the hearts were examined in the recumbent position, and when, consequently, the heart-sounds were soft; and I think it is not to be wondered at if occasional slight impurities escaped observation, more especially when we consider that the patients were insane. In this connection I might say it is necessary on auscultating the heart to examine

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every square inch of the præcordia, as impurities are very frequently circumscribed in their extent, and therefore easily missed. On the other hand, it may be that there is a slight relaxation of the valves in the process of death, with a consequently excessive number of cases of incompetent valves found post mortem. In this case, however, the incompetence would probably take the form of a fine jet, similar to what one would get from a hypodermic needle.

Aortic diastolic murmurs were heard during life in three out of the twenty cases, and aortic incompetence was found, in these three cases *only*, after death.

I shall now give the results of palpation and auscultation of 148 hearts of new patients consecutively admitted into the Northumberland County Asylum.

Fifty-nine systolic mitral murmurs were present, and thirty-eight tricuspid systolic; in seventeen of the latter the tricuspid systolic was found without a mitral systolic being present. Since the existence of a mitral incompetence practically implies a co-existent tricuspid incompetence, as seen from our post-mortems, then, as far as murmurs go, between 52 and 53 per cent. of the 148 cases showed tricuspid incompetence. Systolic thrills of varying degree were present in forty-one cases. In eleven of these latter no murmurs were found along the base of the cardiac dulness or over any other part of the heart. I think it is probable that the eleven systolic thrills present without any murmurs were due to tricuspid incompetence also. This, however, is doubtful.

The total cases of tricuspid incompetence, indicated by the above murmurs, are still smaller than the results obtained from the clinical examination of the twenty cases in which I made a post-mortem examination, but the difference is not excessive.

The other clinical indications of mitral and tricuspid incompetence are, in addition to the so-called characteristic murmurs, which we have already dealt with, phenomena arising by back pressure from such incompetence. Systemic back-pressure phenomena are found almost uniformly in mitral disease with failing compensation, which fact is said to be due to a secondary incompetence of the tricuspid valve. Back-pressure phenomena of a pulmonary character are described as arising directly from mitral incompetence, and their presence is taken to be an indi-

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cation that the valvular lesion is mitral. There are some difficulties in accepting these teachings with confidence.

First of all, a pulmonary valvular incompetence arising in the adult is practically an unknown condition, but it is surely reasonable to suppose that a secondary tricuspid incompetence would be preceded, in some cases at least, by a pulmonary. Secondly, back-pressure phenomena affecting the lungs may quite reasonably point to a systemic engorgement, since the bronchial veins open, one into the vena azygos minor superior, the other into the vena azygos major, so that their blood enters the right heart.

Again, since making up my statistics I have had one case of tricuspid competence with a typical chronic venous engorgement of the liver, so that we must not conclude too readily that venous engorgement implies valvular incompetence.

On the other hand, if we get lung back-pressure phenomena, such as those of chronic bronchitis without dropsy of the legs or belly, portal congestion, or albuminuria, together with a mitral systolic murmur, we might reasonably suspect a mitral incompetence. I have not had any such cases on the post-mortem table since I commenced to use this method.

Dyspnœa is found in both lesions, so that it is of little value in differentiation. As to the venous pulse, I might remark it is not uncommon in health, and it would undoubtedly be much more common were it not for the muscular fibres embracing the opening of the superior vena cava, and for the jugular valves in the root of the neck.

A word about the arterial pulse: In the 148 cases only thirteen showed irregularity of the pulse, so that evidently this is a much graver departure from health than the presence of a thrill or murmur over the apex-beat, or in the tricuspid area. One naturally asks, Is the irregularity of the pulse of any use in differentiating between mitral and tricuspid lesions? In nine cases out of the thirteen a systolic apex-beat murmur was present, in three of these along with a tricuspid systolic; in two of the thirteen cases a systolic apex-beat thrill only was present; in one a systolic tricuspid murmur only; and in one case neither thrill nor murmur. The pulse was completely examined and recorded in only two of the cases of mitral incompetence demonstrated post mortem, and in both of these the pulse was irregular, while in grave tricuspid incompetence cases it was

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found regular. These facts seem to point to mitral disease as being the usual cause of irregularity of the arterial pulse.

Again, thirteen in 148 constitutes about 9 per cent., while the mitral incompetence cases in the post-mortem series were found to constitute 16 per cent. The proximity of these numbers cannot fail to strike one.

The great objection against the test has been that the muscular rings help to maintain the size of the orifices; that these rings after death lose their tone, and are consequently somewhat dilated. My reply to this is, if we cut from the apex of the aortic cusp of the mitral valve straight down to the fibrous ring to which it is attached, we will find that the muscular ring in this position varies from $\frac{1}{32}$ to $\frac{1}{16}$ of an inch in thickness, so that its action must be trifling when called upon to withstand the wall of the ventricle. Again, if we admit for a moment that apex-beat murmurs are mitral only, we would expect to find, owing to this dilation after death, a greater incompetence than these murmurs would even lead us to suppose existed during life; but we usually find no incompetence of the mitral valve. Further, an impartial comparison of my post-mortem results with clinical observations, admitting that apex-beat murmurs may be tricuspid in origin, would tend to show that any error present in the method is slight. It has been suggested to me that the test would be more valuable were a manometer introduced into the nozzle, and the valves tested with their respective *intra vitam* pressures. The objection to this is that increase of the pressure after death would be synchronous with a forcible dilatation of the ventricle, and therefore of the orifice, while in life it is synchronous with a contraction of the cavity.

I may state my general results:

FIRSTLY.—The tricuspid area extends from the lower end of the body of the sternum to the apex-beat.

SECONDLY.—Tricuspid incompetence occurs in the majority of men, and may be looked upon as physiological.

THIRDLY.—Mitral disease is comparatively rare, and rarely causes a secondary tricuspid incompetence.

FOURTHLY.—Lung symptoms of cardiac origin—as, for example, those of bronchitis—may be explained by a systemic back pressure through the bronchial veins, and this with a perfectly competent mitral valve.

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FIFTHLY.—If lung symptoms, without any other evidence of systemic back pressure, co-exist with an apex-beat, systolic murmur, and irregular arterial pulse, mitral incompetence is probably superadded to the already existing tricuspid incompetence.

Before closing I must take this opportunity of thanking Dr. McDowall for the facilities he has placed at my disposal for conducting this research, and also for his encouragement and criticism.

DISCUSSION

At the Meeting of the Northern Division on October 3rd, 1900.

Dr. MCDOWALL said that while Dr. Penfold's paper was highly technical and extremely difficult to follow, on account of the constant occurrence of somewhat similar names, yet he himself had seen the work carried out, and noted the remarkable results. He would not refer to the causes of heart disease, several of which were still being discussed by competent men; or the causes of the various murmurs of the heart, regarding which certain of the greatest medical authorities were not at all unanimous; but he came to the absolute facts observed by Dr. Penfold in the pathological room. He regretted that Dr. Penfold could not then show his instrument in operation. All those present accustomed to observe patients in asylums must have been struck by the extreme prevalence of what he might call mitral systolic murmurs. Whilst he was quite prepared to support Dr. Penfold's explanation of the phenomena, he was sure that their colleagues would find it extremely interesting to follow out in their own asylums the conditions of the mitral and tricuspid orifices by means of Dr. Penfold's apparatus. He was sure that Dr. Penfold would be placing them all under a debt of gratitude if he would continue this particular work; but at the same time he would suggest that Dr. Penfold should adopt more scientific methods of ascertaining the amount of pressure used. He ventured to say that Dr. Penfold would be the first himself to admit that at the present time the water pressure employed was not sufficiently under control, and that in future observations it should be recorded with exactness. The pressure applied might sometimes be excessive; and though he must admit that very excessive pressure might be applied with impunity to the mitral valves and no leakage occur, yet when excessive pressure was applied to the tricuspid valves, they leaked with great readiness.

The CHAIRMAN.—We are very much obliged to Dr. Penfold for his valuable paper. I am sorry he has now left our specialty, but I shall be very pleased to give him every opportunity here to continue his researches.

Clinical Notes and Cases.

The Method of Artificial Feeding advocated by Dr. Newth, followed by Gangrene of the Lung in two cases. By D. F. RAMBAUT, M.D., Dublin.

IN the *Journal of Mental Science* for October of last year, Dr. Newth drew attention to a method of artificial feeding

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