its physiological effect on both general and local metabolism.

The further fact that irradiated ergosterol ("radiostol") after long exposure to atmospheric oxygen (especially in a warm temperature) is found to lose its antirachitic value, and also its capacity for liberating oxygen, and no longer oxidizes potassium iodide, as shown by the starch test, is also important. It may perhaps be explained on the assumption that the oxygen additive compound undergoes rearrangement, in consequence of which the oxygen is no longer easily liberated, the final product being the inactive resinous material.

My object in putting forward these suggestions is, first, to point out the value of certain irradiated sterols when used as a dressing for wounds, and secondly, to indicate certain directions in which, as it seems to me, further research would be very useful in throwing light on the mode of action of vitamin D.

Put shortly, the present position is this: we know from the brilliant work of a number of observers that irradiation will convert ergosterol and other unsaturated sterols into a substance having antirachitic qualities—that is, vitamin D. We have now shown that irradiation will also produce from the ergosterol a fat-soluble substance containing oxygen, some portion of which can be readily liberated. We also know that ozonization (and possibly other methods) will convert ergosterol into an oxidizing substance, but we do not yet know whether ozonization will produce an antirachitic substance. Neither do we yet know whether the vitamin D and the oxidizing substance are one and the same thing.

AUTOGENOUS RESIDUAL VACCINES:

THE THERAPEUTIC RESULTS OBTAINED IN A SERIES
OF 360 CASES.

BY

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THE method of preparation of these vaccines was described in this JOURNAL six years ago. On that occasion the results obtained by the treatment of cases of chronic bronchitis in the out-patient department of Salford Royal Hospital were presented and compared with cases treated by a similar stock vaccine prepared according to the older and usual method. The conclusion was drawn that the residual vaccine was superior.¹

The original technique for the preparation of residual vaccines has been slightly modified. One washing, combined with the use of hydrogen peroxide as introduced by Dean,² is found to be sufficient. This paper contains the results obtained when autogenous vaccines are used, and the whole of the cases now described were treated with that type of vaccine.

Detailed comment is best made under the separate group headings, but it is necessary to draw particular attention to the means employed for assessing the benefit or otherwise of the treatment. Almost without exception the result has been assessed by some other medical practitioner, usually the patient's private doctor. A minority of the records were upon hospital case sheets, and where I have been compelled to pass an opinion upon them myself I have classed as successful only those cases which showed a marked improvement obviously related to the administration of the vaccine; cases which showed a slight improvement or no change are failures, and those cases which, from inadequacy of notes or some other reason, showed an obvious benefit not attributable with certainty to the vaccine therapy, are classed as "Not traceable." Cases which slowly improved after vaccine therapy had ceased a month or so previously are deemed to be failures. The remainder of the untraced cases are so owing to disappearance of the patient or to my failure to establish contact with the patient's doctor.

It will be seen that the standard of assessment is of a simple order—succeeded or failed. Obviously such a classifi-

cation must be considered in relation to the disease. Thus the successful treatment of furunculosis means a complete and lasting cure. On the other hand, an advanced case of rheumatoid arthritis cannot be expected to yield so completely to vaccine therapy that all bony deformity disappears; in this case one looks for freedom from pain, disappearance of the swelling of the soft tissues, increased mobility of the affected joints, cessation of periodical acute attacks, and the patient's restoration to a more active life. An early case may be expected to clear up completely. Every case, however, is susceptible to analysis by means of a simple question—Was the vaccine therapy really worth while considering the results and the nature of the case?

I wish to offer my thanks to all the medical practitioners whose time I have taken up and whose memories I have racked in my efforts to assemble these records.

The results now published comprise all the autogenous residual vaccines made between January 1st, 1924, and December 31st, 1926.

Total vaccines prepared ...	...	...	...	...	448
Results not traceable ...	...	...	...	...	53
Still under observation ...	...	...	...	...	35
Results now recorded ...	...	...	...	...	360

The cases still under observation will be mainly, but not necessarily, the most recent. A vaccine for chronic nasal catarrh requires some time before its result is apparent so far as prophylaxis is concerned, whereas the result to be obtained in a case of rheumatoid arthritis may, and frequently does, declare itself after two doses.

It will be convenient to consider the results in seven groups.

GROUP A.

Disease.	Total Cases.	Success.	Failure.	Percentage of Success.
Furunculosis	45	40	5	88.9
Pyogenic abscess	4	4	0	—
Sycosis	3	2	1	—
Total of group	52	46	6	88.5

The failures in furunculosis include a diabetic who refused to limit his diet in any way, and a patient in whom a large carbuncle had already spread to the cord and produced myelitis when I first saw him. The three cases of sycosis barbae show two-thirds of successful results, which is probably unduly flattering.

GROUP B.

Disease.	Total Cases.	Success.	Failure.	Percentage of Success.
Rheumatism and rheumatoid affections	63	50	13	79.3
Gonococcal arthritis	3	3	0	—
Total of group	66	53	13	80.3

In the gonococcal cases the organism was isolated in pure culture from the affected joint. The rheumatic group require explanation and comment. Before a vaccine is prepared a preliminary bacteriological examination is always undertaken. Cultures are made from the throat and faeces as a routine. When pyorrhoea or some other suppurative lesion is present the appropriate cultures are made. The predominating organism I have found to be a streptococcus—*haemolyticus*, *salivarius*, or *faecalis*—or the enterococcus. I have never seen anything to suggest that these streptococci concerned in the rheumatoid group are in any way different from the standard types of these varieties; it is, of course, quite possible that in a susceptible case certain strains do produce toxins which have rather more affinity than usual for the joints and heart valves.

The majority of the vaccines in this group were made from the faeces, and an arbitrary standard of suitability

for vaccine treatment is therefore necessary. The normal proportion of streptococci and enterococci in the faeces is from nil to 2 per cent.; a vaccine is not prepared unless the proportion is greater than 20 per cent. A pure culture is not uncommon. Two specimens separated by a twenty-four-hour interval are obtained, as it is found that the proportion is apt to vary a little from day to day. The standard medium for all routine examinations in the Salford laboratory is nutrient beef broth agar containing 2 per cent. of ox serum. It is possible that a higher percentage of streptococci is thus found than would be the case on "plain" nutrient agar, which is never used.

Other organisms that have been found in the faeces in high proportions and which have given satisfactory results in an autogenous vaccine—and therefore presumably have a causal relationship to the disease—are *Staphylococcus aureus*, *B. lactis aerogenes*, Friedländer's bacillus, *B. proteus vulgaris*, and various diphtheroid bacilli. Approximately one-half of the rheumatoid cases examined show these bacterial abnormalities or foci of infection. Where no abnormality is found a vaccine is not administered, and the results of stock vaccines in such cases have not been impressive. This probably explains why the vaccine treatment of the rheumatoid diseases is the subject of such conflicting opinions. The cases for which a vaccine is proposed must be bacteriologically examined first.

GROUP C.

Disease.	Total Cases.	Success.	Failure.	Percentage of Success.
Intestinal toxæmia ...	21	16	5	76.2
Erythema and urticaria ...	12	9	3	75.0
Mucous colitis ...	4	2	2	—
Total of group ...	37	27	10	73.0

The cases of intestinal toxæmia are a mixed group that showed wide variations of blood pressure, vague skin eruptions, dyspepsia and diarrhoea, anaemia, and in a few instances a mental complex that had been dismissed by various observers as neurasthenia. The improvement in these cases was frequently dramatic. It may be thought that the results obtained were largely produced by suggestion, but several of the patients had had treatment far more spectacular than a bottle of vaccine, and it is difficult to see how suggestion could cure anaemia.

The second section in this group comprises cases which were found to have an infection, usually in the bowel or throat. Where no bacterial abnormality was found a vaccine was not prepared, and about two-thirds of the cases sent for examination were rejected on this ground as being unsuitable for vaccine therapy.

The organisms isolated were varied, and no one organism seemed specially prominent as a cause. The bacteria found comprised *B. lactis aerogenes*, *B. acidilactici*, *B. diffusus*, *B. proteus vulgaris*, *B. coli communis*, Morgan's bacillus, streptococci, and *Staphylococcus aureus*.

GROUP D.

Disease.	Total Cases.	Success.	Failure.	Percentage of Success.
Cystitis ...	33	27	6	81.8
Pyelitis, pyonephrosis, and pyelonephritis	13	9	4	69.2
Vaginitis (not venereal) ...	3	2	1	—
Total of group ...	49	38	11	77.5

The remote results of treatment of this group appear to depend upon the age and sex of the patient. Young women and most men remain clear when they have once been cured, but middle-aged and elderly women, particularly if married, show a decided tendency to relapse after

about two years' freedom from trouble. A further course of vaccine treatment will put them right again for another period of about the same length.

GROUP E.

Disease.	Total Cases.	Success.	Failure.	Percentage of Success.
Septicaemia ...	2	1	1	—
Pyæmia ...	1	0	1	—
Osteomyelitis ...	3	2	1	—
Chronic cellulitis ...	2	1	1	—
Erysipelas ...	1	1	0	—
Ulcerative endocarditis ...	1	0	1	—
Total of group ...	10	5	5	50

The only inference that one can extract from the above figures seems to be the folly of waiting for an autogenous vaccine when a stock one, ready on the spot, could have been given several days earlier for a set of conditions in which time is all-important. It is probable that better results would have been obtained by the use of one of the two special types of stock residual vaccine, designed for the purpose, and given the moment the condition was diagnosed or even suspected. They could have done no possible harm.

GROUP F.

Disease.	Total Cases.	Success.	Failure.	Percentage of Success.
Chronic and recurrent acute catarrh of the respiratory passages, including bronchitis	101	92	9	91.1
Asthma accompanied by bronchitis	15	12	3	80.0
Ulcerative tonsillitis and "septic throats"	10	8	2	80.0
Localized infections of nasal sinuses and antra	6	4	2	—
Total of group ...	132	116	16	88.0

The first section of this group is the largest and the most satisfactory in its results. The average period of protection given by the vaccine is about two years—two complete winters. All the usual causal organisms have been found; the only point of interest is the connexion of the pneumococcus with a certain type of catarrh. In the course of routine work it has been observed that cases of nasal catarrh with a blood-stained discharge or a tendency to catarrhal deafness are more commonly associated with the pneumococcus than with any other organism. At the same time, the association is not as complete as that between bronchitic asthma and the streptococcus.

The asthma cases were interesting inasmuch as they showed the clearest division of the disease into two types—the purely "neurotic" and the type in which the asthma is secondary to chronic bronchitis; that is, asthmatic attacks occur only during or immediately after an attack of the former disease. The organism invariably present is a streptococcus, usually of the *salivarius* variety. It is customary to find this organism forming at least 95 per cent. of the total organisms present in the sputum. A pure culture is not remarkable.

It will be seen that the results of treatment of bronchitic asthma are gratifying. On the few occasions when I have been persuaded to supply a stock streptococcal vaccine for a patient suffering from the other type of asthma I have never seen any result that could be called successful. The benefit in the bronchitic type cannot be due to the action of a non-specific protein. If it were so, the vaccine should benefit both types indifferently. A survey of the facts indicates that the role of the streptococcus could hardly be more specific.

GROUP G.

Disease.	Total Cases.	Success.	Failure.	Percentage of Success.
Pyorrhoea	2	2	0	—
Chronic septic ulceration ...	2	1	1	—
Suppurating sinuses (not tuberculous)	3	2	1	—
Septic thrombo-phlebitis ...	1	1	0	—
Hepatic abscess (not amoebic)	1	0	1	—
Acne vulgaris	3	2	1	—
Unna's ulcerating inguinal granuloma due to <i>B. pyocyaneus</i>	1	0	1	—
Total of group	13	8	5	61.5

This last group does not call for comment at length. The two cases of pyorrhoea were similar—young women who wished to save their own teeth. Pyorrhoea cases associated with rheumatism are placed in Group B.

Grand Total of all Cases.

Total cases	360
Success	224
Failure	66
Percentage of success	81.5

CONCLUSION.

I would again draw attention to the fact that the benefit in the vast majority of these cases has been appraised by independent observers, which fact is rendered doubly important by the nature of the results. The high proportion of success obtained is attributable to two factors. In the first place, selection of suitable cases by bacteriological examination provides one with clinical material that offers a rational basis for the use of vaccine therapy. The results are influenced accordingly. The second factor is the residual vaccine itself, which has an inherent therapeutic efficiency greatly superior to that of the older "whole" type of vaccine.

In recent years the production of improved types of antigens has engaged the attention of a number of workers. The most recent paper on the subject is by Arkwright,³ and deals with typhoid and paratyphoid vaccines. Amongst other facts elucidated he shows that a heat-stable antigen is more efficient than a heat-labile one obtained from the same organism, and notes the interesting detail that a heat-stable antigen that had been heated to 100° C. gave slightly better results than the identical antigen unheated. Precisely the same result is revealed in the tables published in my original paper on residual vaccines.

Horder and Ferry⁴ have produced antigens that differ in the mode of preparation, and almost certainly in their composition, from those of Arkwright and myself. At first sight such results may appear contradictory, but that is not necessarily so. The improvement upon heating the heat-stable antigens can be explained in one of two ways. It may be supposed that the antigen itself is actually improved by heating, which is improbable. The alternative is more feasible: it is that some substance inimical to antibody formation is destroyed by the heat.

The aggressins have not received much attention in recent bacteriological studies, but it has been shown by Bail and subsequent workers that their action is to paralyse the tissue resistance against bacterial invasion, although the aggressins themselves are not toxic, and that immunity can be created against aggressins or against bacteria. When a mixture of bacteria and their aggressins is administered the host experiences increased difficulty in the production of an adequate resistance.

This experimental evidence indicates two methods of producing immunity, and it is conceivable that the immunogens of Horder and Ferry depend in part at least for their efficiency upon the small quantities of aggressin present in the washings. The heat-stable antigens are probably freed from their aggressins when heated, and are therefore capable of stimulating to the fullest extent the resistance appropriate to them.

If this conception of the action of these different bacterial substances be correct, it follows that a mixture of bacteria and their aggressins, such as is represented by an ordinary "whole" vaccine, cannot be as efficient as some of the fractional types of vaccine. Further experience with many of these fractions may show that they are not in opposition to each other as potential remedies, but will perhaps be used most effectively at different stages of the same disease.

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HAIR-BALLS IN THE ALIMENTARY TRACT:

WITH THE

RECORD OF A CASE OF INTESTINAL OBSTRUCTION DUE TO FOUR HAIR-BALLS.

BY

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HAIR-BALLS occurring in the gastro-intestinal tract are not often met with. When found the stomach is the commonest situation for their development, but they may be rarely present in any part of the intestinal tract. The literature contains a few accounts of masses of hair situated in the ileum giving rise to intestinal obstruction, of which the case here recorded is an example.

A woman, aged 30, was admitted to the Norfolk and Norwich Hospital on October 15th, 1925, complaining of abdominal pain. She was married at the age of 24, and had one child, aged 4 years. She had been in good health up to December, 1924, when, on visiting her husband's relatives, she became strange in her manner and difficult to manage. Her mental condition became worse, and she was admitted to the Norfolk County Mental Hospital on January 5th, 1925. On admission her condition was diagnosed as recent mania.

From January to June, 1925, she was difficult to manage, irritable, and destructive. She then began to improve mentally, but at the same time her physical condition deteriorated; she rapidly lost weight, and suffered from constipation, followed by diarrhoea, abdominal pain, and distension. The stools became very offensive. On October 15th, 1925, she was discharged from the mental hospital, and the same day was admitted to the Norfolk and Norwich Hospital.

Condition on Admission.

The patient was a sallow, pale, emaciated woman. Her mental condition was fairly good; she could answer questions intelligently, although she was very ill and in pain. Temperature 99°, pulse 100, respirations 18. The tongue was furred and the breath foul. There was no evidence of any disease of the lungs. The abdominal wall was very thin and the abdomen distended, especially below the umbilicus. There was tenderness all over the abdomen. A fairly well defined swelling could be felt in the region of the caecum. Its surface was smooth and its margins clearly outlined. It was irregular in shape, and measured about 3 by 4 inches. It was painful to touch. The rectum was ballooned, and a bimanual examination was impossible because of the pain and tenderness.

The diagnosis of chronic intestinal obstruction was made, owing to the swelling felt in the abdomen being possibly of inflammatory nature arising in connexion with the appendix.

An exploratory operation was advised and performed soon after admission to hospital.

First Operation.

The abdomen was opened by a mid-line incision below the navel. The lower part of the ileum was found to be much distended, red, and inflamed, and one loop was adherent in the pelvis. On freeing this a small perforation in the intestine was visible. The caecum and the lower part of the ileum were drawn out of the abdomen and packed off. The wall of the lower two feet of the ileum was found to be much thickened, and its lumen contained soft bodies which could be separated one from another. The small perforation in the bowel was examined, and a piece of hair was seen projecting through it. The intestine was then opened, and four hair-balls, smelling offensively, were removed. There was very extensive ulceration of the mucous membrane of the intestine. A large collection of offensive fluid was removed by irrigation, and the intestine drained by a rubber tube stitched in place by Witzel's method. The intestine was then stitched to the abdominal wall.

After the operation the patient's mental condition deteriorated for a time and she was difficult to manage, but she gradually improved, both mentally and physically. The enterostomy worked satisfactorily, although it was difficult to keep the skin of the abdominal wall round the opening free from superficial ulceration. From time to time the patient passed motions by the rectum naturally.

Second Operation.

On December 10th, 1925, two months after the first operation, it was decided to close the opening in the small intestine by a second operation. This was done by resecting 8 inches of small