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TRANSPORT

DES TROUPES PAR LES CHEMINS DE FER.

INFANTERIE, CAVALERIE, ARTILLERIE, GENIE, ÉQUIPAGES, ETC., ETC.;

RÈGLES A SUIVRE POUR L'EMBARQUEMENT, LE TRANSPORT ET LE DÉBARQUEMENT DE CES TROUPES (*Personnel et Matériel*).

OBLIGATIONS DES COMPAGNIES DE CHEMINS DE FER ENVERS LES DÉPARTEMENTS DE LA GUERRE ET DE LA MARINE.

DÉCOMPOSITION EN PRIX DE PÉAGE ET PRIX DE TRANSPORT.

Règlements et Circulaires du 16 septembre 1851.

JOURNAL MILITAIRE 1851.—N° 35.

TROUPES D'INFANTERIE.

PRESCRIPTIONS GÉNÉRALES.

ART. 1er. Les transports sur les chemins de fer exigent, en raison de la masse déplacée et de la vitesse imprimée, une sécurité complète et une grande célérité dans toutes les opérations qui précèdent ou suivent le mouvement. Ces conditions ne peuvent être remplies que par la régularité et l'exacte observation de toutes les règles du service d'exploitation.

En outre, les troupes voyageant par chemin de fer sont dans une situation analogue à celle des corps embarqués sur mer, où la direction de la route et une grande part d'autorité sont concentrées dans les mains des commandants de navire.

Pendant tout le voyage, le chef de corps ou de détachement est donc tenu de suivre strictement les indications qui lui sont données par l'employé chargé de diriger le train, auquel demeure la responsabilité du mouvement.

Par le même motif, les officiers, sous-officiers et soldats doivent se conformer, durant toute la route, aux recommandations des agents du chemin de fer.

2. La troupe est pourvue, avant le départ, des vivres nécessaires. Si l'on prévoit la possibilité de faire la soupe et d'obtenir une distribution de pain à l'arrivée, ces vivres se composent d'une ration de pain et d'une ration de viande cuite ; dans le cas contraire, de deux rations de pain et de deux rations de viande cuite.

Pour cette fixation, il est tenu compte des chances possibles de retard.

Le pain est placé sur le sac. La viande est renfermée dans les petites gamelles, où il n'est rien mis de liquide ; à défaut de ces dernières, la viande est logée dans l'intérieur du pain.

Les petits bidons sont remplis d'eau que l'on mélange avec de l'eau-de-vie dans la saison des chaleurs.

3. Aussitôt que l'ordre de mouvement est reçu, le chef de corps ou de détachement se concerte avec le chef de service du chemin de fer pour reconnaître le point d'embarquement, la composition qu'il convient de donner à chaque convoi, et la disposition du matériel ; enfin, pour savoir l'heure du départ, et prendre connaissance de l'itinéraire dont une copie lui est délivrée.

Le chef de service met cet officier en rapport avec l'employé chargé de diriger le train.

4. Les voitures destinées au transport sont rangées en convoi dans l'ordre suivant :

1° Un ou deux waggons à bagages ou à bestiaux, dans lesquels on charge les bagages réglementaires de la troupe, les tambours, les gros instruments de musique ;

2° Les waggons de troisième classe, et, s'il y a lieu, tous autres waggons reconnus propres au transport de la troupe, en nombre correspondant à la moitié de l'effectif ;

3° Un waggon de première ou de deuxième classe pour les officiers : on le complète au besoin avec des sous-officiers ;

4° Le nombre de waggons nécessaire pour la seconde moitié de la troupe ;

5° Un ou plusieurs waggons pour le transport des chevaux, selon le nombre qui en est accordé par le règlement.

5. Lorsque la troupe a le drapeau avec elle, il est placé dans le waggon du commandant.

6. Il est formé un poste composé :

D'un sergent,
D'un caporal,

D'un tambour ou clairon,
Et d'un nombre de soldats proportionné à l'effectif.

Ce poste occupe un compartiment du waggon le plus voisin de celui des officiers.

Le poste est préposé au maintien de l'ordre aux stations et à l'arrivée.

7. Dans le cas où le corps est suivi de ses gros bagages, les colis sont rendus au chemin de fer une demi-heure avant le corps.

La troupe doit arriver au point désigné pour l'embarquement, trente minutes avant le moment du départ.

8. Le corps est formé en bataille face aux waggons. On fait remettre la baïonnette.

La troupe, y compris les sous officiers en serre-file, ainsi que les cantinières et les enfants de troupe, est partagée de la droite à la gauche (sans avoir égard à l'organisation des compagnies) en fractions correspondantes à la capacité des waggons.

L'adjudant-major, ou l'officier chargé de ce fractionnement, fait écrire au fur et à mesure avec de la craie, sur les brancards des châssis, et des deux côtés, le nombre de places que contient chaque voiture, et les numéros de la compagnie (ou des compagnies) ainsi que du bataillon qui fournissent les hommes (1).

Les fractions sont subdivisées selon la contenance des compartiments (2) ou la disposition des portières, par les officiers de compagnie.

Chaque fraction ou subdivision est formée perpendiculairement à la voie de fer, vis-à-vis le compartiment ou la voiture qu'elle doit occuper. Elle fait face aux waggons.

Un sous officier ou caporal, à défaut le plus ancien soldat est le chef de chaque fraction ; il est chargé de maintenir le bon ordre et de veiller à l'exécution de toutes les mesures ordonnées.

EMBARQUEMENT.

9. Toutes les dispositions ci-dessus prescrites étant prises, le chef du corps ou du détachement fait faire un roulement ou sonner un demi-appel.

Les sous-officiers, caporaux et soldats ôtent leur sac et le prennent à la main.

Ce mouvement terminé, un coup de baguette donne le signal de l'embarquement.

Les hommes montent dans les waggons en ordre, un par un ; les premiers entrés rangent les sacs sous la banquette, en les plaçant

(1) On doit recommander aux sous-officiers, caporaux et soldats de prendre connaissance du numéro de leur waggon et de l'inscription à la craie, afin qu'ils puissent facilement retrouver leur place aux stations.
(2) Voir l'état faisant suite au règlement.

l'un sur l'autre, de manière à ce que les petites gamelles soient juxtaposées. Les sacs chargés de marmites et de grandes gamelles remplissant toute la hauteur disponible, il n'en est mis qu'un seul sous la banquette.

Chaque homme s'embarque après que son sac est placé dans le waggon ; il tient son arme entre ses jambes, la crosse en bas.

L'embarquement dans les waggons à marchandises se fait au même signal, mais à volonté, les hommes s'aidant les uns les autres. S'il n'y a pas de bancs, ils se tiennent debout ou s'asseoient sur leurs sacs.

Pendant la route, le chef de la troupe a soin de faire passer les hommes des waggons à marchandises dans les waggons à voyageurs, et réciproquement, pour répartir sur un plus grand nombre les avantages et les inconvénients de ces diverses voitures.

Les officiers veillent à l'exécution des mouvements prescrits et montent en voiture aussitôt que l'embarquement de la troupe est terminé.

10. Avant le départ, l'officier commandant et le chef de train passent la revue de tout le convoi ; ils font rectifier immédiatement les dispositions défectueuses.

ROUTE.

11. La troupe étant embarquée, il est rigoureusement interdit :
1° De fumer ;
2° De sortir la tête ou les bras hors des parois des waggons pendant la marche ;
3° De passer d'une voiture dans une autre ;
4° De pousser des cris.

12. Aux stations où, d'après l'itinéraire du train et le temps indiqué par l'employé qui dirige le mouvement, le commandant juge convenable que la troupe mette pied à terre, il fait connaître la durée de la halte aux officiers ; ceux-ci se portent, pour diriger et surveiller le mouvement, à la hauteur des waggons où sont embarquées leurs compagnies respectives.

Le poste de police descend immédiatement et fournit des sentinelles partout où il en est besoin (1). Au signal donné par une sonnerie ou batterie convenue, les hommes, tenant leurs armes, descendent en ordre et exclusivement par les portières qui s'ouvrent sur le côté extérieur de la voie. A moins d'ordres contraires, on laisse les sacs dans les voitures. Cinq minutes avant le départ, une sonnerie

(1) Des factionnaires, en nombre suffisant, sont posés du côté intérieur et en dehors de la voie, pour empêcher les hommes d'y stationner ou d'ouvrir les portes des waggons.

A moins de dispositions particulières, personne ne sort des gares. Lorsqu'on fait exception à cette règle, il est rigoureusement interdit d'escalader les clôtures du chemin.

ou une batterie donne le signal du rembarquement qui doit se faire avec ordre et rapidité.

13. Le commandant de la troupe règle les heures des repas.

Si, dans l'itinéraire du train, il se trouve une halte d'une heure environ, le repas est pris de préférence à cette station.

DÉBARQUEMENT.

14. A l'arrivée du train dans la gare de destination, ou sur le point désigné pour le débarquement, les officiers mettent pied à terre les premiers.

Le commandant reconnaît le terrain sur lequel la troupe doit se former, et l'indique aux officiers.

Une sonnerie ou une batterie donne le signal du débarquement. Les hommes sortent en ordre des waggons, remettent leurs sacs, et, guidés par les officiers, se rendent sur le point choisi pour s'y reformer.

15. Les bagages et les chevaux sont déchargés et remis à qui de droit par les employés du chemin de fer.

Paris, le 16 septembre 1851.

Le Ministre de la guerre

Signé : RANDON.

Tableau indiquant la contenance de chaque waggon au 31 *décembre* 1850, *pour faire suite à l'article* 9.

DÉSIGNATION DES CHEMINS DE FER.	CONTENANCE EN HOMMES.		
	WAGGONS à voyageurs.	WAGGONS à marchandises.	WAGGONS à bestiaux.
Orléans, Bordeaux, Centre, etc.	30 à 40	25 à 30	25 à 30
Rouen et embranchements	24 à 30	25 à 30	30
Nord *idem.*	30 à 40	»	30
Lyon *idem.*	40 à 50	30	30
Strasbourg *idem.*	30 à 40	25	30 à 35
Ouest *idem.*	30 à 40	»	30
Nîmes à Cette *idem.*	40	25	25
Avignon à Marseille.	30	»	»

TROUPES DE CAVALERIE.

PRESCRIPTIONS GÉNÉRALES.

ART 1er. Les transports sur les chemins de fer exigent, en raison de la masse déplacée et de la vitesse imprimée, une sécurité complète et une grande célérité dans toutes les opérations qui précèdent ou suivent le mouvement. Ces conditions ne peuvent être remplies que par la régularité et l'exacte observation de toutes les règles du service d'exploitation.

En outre, les troupes voyageant par chemins de fer sont dans une situation analogue à celle des corps embarqués sur mer, où la direction de la route et une grande part d'autorité sont concentrées dans les mains des commandants de navires.

Pendant tout le voyage, le chef de corps ou de détachement est donc tenu de suivre strictement les indications qui lui sont données par l'employé chargé de diriger le train, auquel demeure la responsabilité du mouvement.

Par le même motif, les officiers, sous-officiers et soldats doivent se conformer, durant toute la route, aux recommandations des agents du chemin de fer.

2. La troupe est pourvue, avant le départ, des vivres nécessaires.

Ces vivres, en tenant compte des chances possibles de retard, se composent comme il suit :

HOMMES.

Une ration de pain et une ration de viande cuite, s'il est possible de faire la soupe et d'obtenir une distribution de pain après l'arrivée. Dans le cas contraire, deux rations de pain et deux rations de viande cuite.

Les vivres sont placés d'un côté du bissac ; la viande est mise dans l'intérieur du pain.

Les petits bidons sont remplis d'eau, que l'on mélange avec de l'eau-de-vie dans la saison des chaleurs.

CHEVAUX (1).

Les chevaux mangeant facilement dans les waggons, même pendant la marche, il est distribué, sur le pied de route, une ration

(1) Il conviendra qu'un intervalle suffisant sépare le dernier repas des chevaux du moment de l'embarquement, l'expérience ayant démontré que cette précaution les rend plus dociles pour entrer dans les waggons.

complète ou une demi-ration de fourrages (foin et avoine), selon la durée du voyage.

L'avoine est mise, avec la musette, dans la partie restée libre du bissac.

Le foin est délivré *pressé*, s'il est possible ; dans le cas contraire, il est réduit au moindre volume par l'un des procédés en usage : on le place dans les waggons à chevaux.

3. Aussitôt que l'ordre du mouvement est reçu, le chef de corps ou de détachement se concerte avec le chef de service du chemin de fer, pour reconnaître le point d'embarquement, la composition qu'il convient de donner à chaque convoi, et la disposition du matériel ; enfin, pour savoir l'heure du départ et prendre connaissance de l'itinéraire, dont une copie lui est délivrée.

Le chef de service met cet officier en rapport avec l'employé chargé de diriger le train.

4. Les manœuvres nécessaires pour amener les waggons au point d'embarquement, pour mettre le train en état de marcher, et pour conduire les waggons au quai de déchargement, sont exécutées par les employés du chemin de fer, assistés, toutes les fois qu'il en est besoin, par les cavaliers disponibles.

Le convoi est formé, autant que possible, dans l'ordre suivant :

1° Un waggon contenant les bagages de la troupe ;
2° La moitié des waggons chargés de chevaux (1) ;
3° Les voitures à voyageurs ;
4° Le reste des waggons chargés de chevaux.

Selon les manœuvres de gare à prévoir pendant la route, les waggons à selles sont placés de manière que, lorsqu'on arrive à destination, chacun d'eux se trouve toujours en tête de la série de waggons portant les chevaux auxquels appartient le harnachement.

Chaque voiture est numérotée à la craie des deux côtés.

L'adjudant-major ou l'officier chargé de le suppléer fait ajouter le numéro du peloton et de l'escadron dont font partie les cavaliers et les chevaux à embarquer dans un waggon (2).

5. Lorsque la troupe a l'étendard avec elle, il est placé dans le waggon du commandant.

6. Il est formé un poste composé :

D'un maréchal des logis,
D'un brigadier,
D'un trompette,
Et d'un nombre de cavaliers proportionné à l'effectif.

(1) Toutes les fois que les dispositions le permettront, il sera préférable que les chevaux aient la tête tournée vers le côté extérieur de la voie.

(2) On doit recommander aux officiers, brigadiers et cavaliers de prendre connaissance du numéro de leur waggon et de l'inscription à la craie, afin de pouvoir facilement retrouver leur place aux stations.

Ce poste occupe un compartiment du waggon le plus voisin de celui des officiers.

Le poste est préposé au maintien de l'ordre aux stations et à l'arrivée.

7. Dans le cas où le corps est suivi de ses gros bagages, les colis sont rendus au chemin de fer trente minutes avant le corps.

La troupe doit arriver au point désigné pour l'embarquement deux heures avant le moment du départ.

8. Le corps ou détachement à embarquer arrive en colonne dans la gare ou à proximité. Il est formé en bataille sur un rang, face aux waggons, par un mouvement à droite ou à gauche; les sous-officiers en serre-file entrent dans le rang.

Les officiers reconnaissent les voitures assignées aux chevaux de leurs pelotons respectifs, et les font garnir de paille, à raison de deux bottes par waggon (1).

Un maréchal des logis ou brigadier est désigné pour veiller au chargement des selles dans les waggons à bagages, ainsi qu'au déchargement à l'arrivée; quelques cavaliers lui sont adjoints.

Le commandant fait compter par *fraction* de cinq, six, sept ou huit, selon le nombre de chevaux que chaque waggon peut contenir.

La réunion des *fractions* ainsi formées, dont les selles composent le chargement d'un waggon à bagages, constitue une *série*.

Les chevaux d'officiers sont compris, avec les chevaux de troupe, dans la dernière *fraction* de chaque *série* (2).

Les *fractions* sont placées devant les waggons qu'elles doivent occuper.

Les dragons placent le fusil à la grenadière, les chasseurs et les hussards le mousqueton au crochet.

On met pied à terre, et on suspend le sabre au crochet.

En ce qui concerne les lanciers, un cavalier réunit les lances par *fraction*, et, avec l'aide d'un second cavalier, les place dans l'intérieur du waggon où les chevaux de la *fraction* doivent être embarqués (3).

Lorsque la disposition de la gare ou du point d'embarquement ne permet pas la formation de toute la troupe à la fois, le fractionnement est fait sur le terrain où la colonne s'est arrêtée, et les *fractions* sont dirigées successivement, en nombre suffisant, sur les waggons à chevaux.

(1) La paille nécessaire pour la litière des waggons et pour l'arrimage des selles est fournie par les magasins militaires.

(2) Les cavaliers qui tiennent deux chevaux comptent deux numéros; on déplace un cavalier, si cela est nécessaire, pour que ces chevaux soient embarqués dans le même waggon.

(3) Les flammes sont roulées autour de la hampe. Un homme prend trois ou quatre lances, les introduit dans le waggon, en les dirigeant obliquement à gauche; il élève les sabots, les fait passer sur la traverse de droite, et glisse les hampes diagonalement sur cette traverse, jusqu'à ce que la pointe ait dépassé en dedans, la traverse de gauche, sur laquelle on engage l'arme par un mouvement contraire au précédent. Les lances sont réunies contre le linteau de la porte d'entrée, et fixées avec une ou deux lanières ou cordes, sur chaque traverse.

On procède ensuite à l'embarquement comme il est dit ci-après.

EMBARQUEMENT.

CHEVAUX (1).

9. Les diverses *fractions* de chaque *série* dessellent en même temps, les chevaux restent bridés.

Si les circonstances atmosphériques l'exigent, les couvertes sont étendues sur les chevaux; on les assujettit avec les surfaix.

On porte les selles toutes paquetées au waggon à bagages, où elles sont rangées par piles, le porte-manteau contre la paroi longitudinale du waggon, en suivant l'ordre des fractions (2).

Les cavaliers étant retournés à leurs chevaux, le signal de l'embarquement est donné par un demi-appel.

Le premier cavalier de chaque fraction dirige son cheval, en lui faisant baisser la tête, sur le milieu de la porte du waggon.

Aussitôt entré, il appuie sur la droite et fait ranger son cheval contre la paroi latérale de ce côté, la tête opposée à l'entrée du waggon.

Le deuxième cavalier suit le premier et fait ranger son cheval à gauche, en se plaçant vers le centre de la voiture.

Le troisième cavalier appuie son cheval contre celui du premier; le quatrième, contre celui du second.

Le premier et le deuxième cavalier prennent les chevaux du troisième et du quatrième; ces deux derniers se placent entre leurs chevaux, saisissent l'extrémité des rênes des chevaux suivants et les font entrer dans le waggon (3).

Les cavaliers dont les numéros sont au-dessus de quatre restent hors des waggons. Dès que le dernier cheval est entré, ils mettent la barre de fermeture provisoire, relèvent ou retirent le pont, et ferment les portes. Enlevant ensuite la barre, ils la passent aux hommes restés dans le waggon et embarquent aussitôt le fourrage.

(1) Il est généralement préférable d'embarquer les chevaux dessellés. Si des circonstances particulières obligent de procéder différemment, et que la hauteur des portes des waggons le permette, le chef du corps ou détachement prendra les dispositions indiquées dans l'appendice D.

(2) Voir l'appendice C pour le chargement et le déchargement des selles.

(3) Il est essentiel de faire entrer rapidement les chevaux et de ne pas laisser aux premiers embarqués le temps de se mettre en travers du waggon. Si un cheval résiste, on fait avancer le suivant, et le premier est entraîné vivement à sa suite. Autant que possible, il faut faire entrer d'abord les chevaux dociles, les autres n'ayant pas à appuyer à droite ou à gauche, opposeront moins d'efforts. Il conviendra du reste d'employer préférablement les moyens de douceur.

Deux strapontins sont donnés par waggon, pour que les hommes puissent s'asseoir alternativement.

Les chevaux sont attachés à la barre longitudinale du waggon, avec la longe du licol, ce qui permet de débrider si l'ordre en est donné; dans ce cas, trois ou quatre brides sont réunies, liées ensemble à la têtière par les rênes de l'une d'elles, et attachées à la barre du waggon avec les mêmes rênes vers les encoignures.

Les bâches des waggons couverts restent relevées, à moins que l'état de l'atmosphère n'oblige de les baisser de l'un ou de l'autre côté.

TROUPE.

Les cavaliers non embarqués dans les waggons à chevaux, ainsi que les hommes à pied, sont réunis dans un waggon à voyageurs (1).

Chacun tient ses armes entre ses jambes ou à côté de soi.

Il est interdit de déposer les fusils et mousquetons dans les encoignures ou sur les banquettes.

Dans les waggons à chevaux, on doit avoir soin de ne pas laisser les armes à portée des pieds des chevaux.

Chaque waggon d'hommes ou de chevaux a pour chef le plus ancien cavalier, si aucun maréchal des logis ou brigadier n'y est embarqué.

Le chef du waggon est chargé de maintenir le bon ordre, et de veiller à l'exécution de toutes les mesures ordonnées.

OFFICIERS.

Les officiers montent en voiture dès que l'embarquement de la troupe est terminé.

10. Pendant la formation du convoi, l'officier commandant et le chef de train passent la revue des waggons, pour reconnaître si tout y est bien placé; ils font rectifier immédiatement les dispositions défectueuses.

ROUTE.

11. La troupe étant embarquée, il est rigoureusement interdit :

1° De fumer;

2° De sortir la tête ou les bras hors des parois des waggons pendant la marche;

3° De passer d'une voiture dans une autre;

4° De pousser des cris.

Les cavaliers placés près des chevaux ont soin de les empêcher d'avancer la tête hors des parois des wagons.

A tous les coups de sifflet de la locomotive, les cavaliers tiennent

(1) Si le voyage se prolonge, l'officier commandant a soin de faire relever les cavaliers des waggons à chevaux.

les chevaux par la bride ou le licol pour les maintenir dans les chocs et les oscillations.

12. Aux stations où, d'après l'itinéraire du train et le temps indiqué par l'employé qui dirige le mouvement, le commandant juge convenable que la troupe mette pied à terre, il fait connaître la durée de la halte aux officiers; ceux-ci se portent, pour diriger et surveiller le mouvement, à la hauteur des waggons où sont embarqués leurs pelotons respectifs.

Le poste de police descend immédiatement et fournit des sentinelles partout où il en est besoin (1).

Au signal donné par un demi-appel, les hommes tenant leurs armes, descendent en ordre et exclusivement par les portières qui s'ouvrent sur le côté extérieur de la voie.

Les hommes embarqués avec les chevaux descendent en passant par-dessus la paroi des waggons. Si l'on juge nécessaire de faire ouvrir les portes, la barre de fermeture est placée préalablement.

Cinq minutes avant le départ, un demi-appel donne le signal du rembarquement, qui doit se faire avec ordre et rapidité.

13. Le commandant de la troupe règle les heures des repas.

Si, dans l'itinéraire du train, il se trouve une halte d'une heure environ, le repas est pris de préférence à cette station.

Pendant le temps du repas, il est désigné un cavalier garde d'écurie pour deux waggons à chevaux; on en place un par waggon, si l'avoine est distribuée dans la même station.

L'avoine est mangée dans la musette.

Le foin est donné à la main par les cavaliers; on utilise surtout le temps de la route pour cette distribution.

En temps ordinaire, les chevaux ne sont abreuvés que si la durée du trajet est de plus de douze heures; dans ce cas même ils ont besoin de peu d'eau, et un seau de dimension ordinaire suffit pour deux chevaux.

DÉBARQUEMENT.

14. A l'arrivée du train dans la gare de destination, ou sur le point désigné pour le débarquement, les officiers mettent pied à terre les premiers.

Le commandant reconnaît le terrain sur lequel la troupe doit se former et l'indique aux officiers.

Un demi-appel donne le signal du débarquement. Les officiers se

(1) Des factionnaires, en nombre suffisant, sont posés du côté intérieur et en dehors de la voie, pour empêcher les hommes d'y stationner ou d'ouvrir les portes des waggons.

A moins de dispositions particulières, personne ne sort des gares. Lorsqu'on fait exception à cette règle, il est rigoureusement interdit d'escalader les clôtures du chemin.

portent, avec les hommes embarqués dans les waggons à voyageurs, aux waggons où se trouvent placés les chevaux de leurs pelotons respectifs.

Après les manœuvres de gare, les portes des wagons à chevaux sont ouvertes pour laisser sortir les hommes, elles sont refermées ensuite. Tous les cavaliers se rendent aux waggons à selles pour y prendre le harnachement (1).

15. Immédiatement après, on ouvre les waggons à chevaux ; on abaisse ou on place les ponts de débarquement ; chaque cavalier fait sortir son cheval dans l'ordre inverse de celui où il est entré et le place en bataille.

On selle les chevaux.

Les chevaux étant sellés, les cavaliers montent à cheval et se rendent sur le point désigné pour s'y reformer (2).

16. Les bagages sont déchargés et remis à qui de droit par les employés du chemin de fer.

Paris, le 16 septembre 1851.

Le Ministre de la guerre,
Signé : RANDON.

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(1) Pour le déchargement des selles, voir l'appendice C.

(2) Lorsque les chevaux ont été embarqués tout sellés, on a soin d'examiner le paquetage et de le rectifier, s'il y a lieu.

APPENDICE

AU RÈGLEMENT PROVISOIRE SUR LE TRANSPORT DES TROUPES DE CAVALERIE PAR LES CHEMINS DE FER.

A.

Notice sur les waggons les plus propres au transport des chevaux.

Les waggons à bestiaux, dans lesquels se fait le transport des chevaux, sont des caisses rectangulaires couvertes, ayant leurs petits côtés pleins, leurs grands côtés pleins également jusqu'à 1 mètre du plancher, et à claire-voie au-dessus. Ils s'ouvrent par des portes à deux battants pratiquées sur le milieu des grands côtés.

Les dimensions de ces voitures varient ainsi qu'il suit :

Longueur. . . . . 4m,12 à 4m35.
Largeur. . . . . 2m,32 à 2m47.
Hauteur des portes. 1m,70 à 1m90.

Les waggons ayant 1m,80 de hauteur sous le linteau de la porte peuvent recevoir des chevaux sellés. Ceux qui ont seulement le minimum de 1m,70 (chemins de fer d'Orléans, du Centre et de Bordeaux) ne peuvent recevoir que les chevaux dessellés.

Les waggons à marchandises servent également au transport des chevaux : ce sont des caisses rectangulaires dont les dimensions en longueur et largeur sont les mêmes que celles des waggons à bestiaux, excepté sur le chemin de Rouen, où ils n'ont que 3m,75 sur 2m,20.

Les parois des grands côtés ont 80 à 98 centimètres de hauteur : sur les petits côtés, ces parois de même hauteur sont surmontées par un demi-cercle ou un triangle plein comme les parties inférieures.

Pour transporter sûrement des chevaux dans ces waggons, il faut y faire ajuster :

1° Une planche de 20 à 25 centimètres de largeur sur 3 à 4 centimètres d'épaisseur, et de la longueur du grand côté, supportée par deux montants ou deux boulons, à 40 ou 50 centimètres de la paroi, pour former un obstacle apparent devant les yeux des chevaux;

2° Un madrier de 15 à 20 centimètres de largeur sur 10 d'épaisseur, également de la longueur du grand côté, monté à plat sur deux boulons qui entrent dans le bordage, et y sont retenus par deux clavettes; il est fixé avec des crochets horizontaux sur la paroi des petits côtés, pour résister au recul ; il permet aux chevaux de

s'appuyer pendant la marche. Cette pièce, ainsi que celle de la tête, doit pouvoir s'ôter et se remettre facilement, soit d'un côté, soit de l'autre (1).

Chaque waggon à bestiaux ou à marchandises est muni d'une barre de 10 centimètres d'équarrissage sur 2 mètres de longueur, à angles arrondis, percée et garnie, à chacun des bouts, d'une corde moyenne, assez longue pour s'attacher aux anneaux extérieurs des waggons. Cette barre, placée en dedans du waggon, sert à empêcher les chevaux de reculer pendant les intervalles de fermeture ou d'ouverture des portes.

Les selles sont convenablement embarquées dans les waggons à bagages et à freins extérieurs, qui peuvent en recevoir environ 60. Ces waggons sont des caisses rectangulaires entièrement closes, et fermées par des portes à deux vantaux s'ouvrant à coulisses.

Le nombre de chevaux à faire entrer dans chaque waggon dépend de la dimension de ce véhicule, et de la grosseur des chevaux.

Les strapontins servant de sièges aux cavaliers embarqués dans les waggons à chevaux, sont des planches de 2 centimètres 1/2 d'épaisseur et de 30 centimètres de profondeur sur 45 de large, percées aux quatre coins pour y laisser passer des bouts de corde, qui sont ensuite réunis deux à deux au moyen d'un nœud simple. On attache cet assemblage, par les bouts qui dépassent les nœuds, à la barre longitudinale du waggon.

B.

Notice sur les ponts qui peuvent être nécessaires pour l'embarquement et le débarquement des chevaux.

Lorsque les waggons à chevaux ne sont pas munis d'un tablier qui puisse joindre le quai, il est nécessaire de faire préparer un nombre suffisant de plateaux pour l'embarquement des chevaux. En outre, dans la prévision d'un accident en route, il convient d'être toujours en mesure de faire débarquer les chevaux.

A cet effet, il faut avoir soin d'emporter, selon la force de chaque convoi, un ou plusieurs ponts volants, dont les diverses parties se chargent sur une plate-forme.

Les dimensions d'un pont bien établi sont les suivantes :

Longueur, 5 mètres environ; largeur, 20 centimètres de plus que celle des portes des waggons.

Le pont est garni de garde-corps, qui s'adaptent ou s'enlèvent à volonté.

Il est supporté à son extrémité supérieure par un chevalet mobile, dont la hauteur correspond à celle des waggons.

(1) Lorsque ces ajustements sont nécessaires, ils sont effectués au compte de l'administration de la guerre.

Le débarquement des chevaux s'opère alors en faisant passer successivement les waggons devant ce pont convenablement placé.

Dans certains cas, il sera plus simple de supprimer le chevalet et de fixer, à la partie antérieure du pont, deux fortes brides en fer, reposant sur le plancher du waggon. Ce pont est alors adapté successivement à chacun des waggons que l'on veut décharger.

C.

Mode d'arrimage des selles dans les waggons à bagages.

La couverte est placée, s'il y a lieu, sur la schabraque; la sangle, la croupière et le poitrail sont réunis sur la selle, et, selon le cas, le tout est arrêté soit par la sangle, soit par le surfaix.

Les cavaliers numéros impairs des quatre premières fractions laissent leurs chevaux aux cavaliers numéros pairs, et portent leur harnachement aux waggons à bagages.

Les selles sont placées l'une contre l'autre, chacune sur une botte de paille de la longueur de la selle, le porte-manteau appuyé à la paroi longitudinale du waggon, en conservant la disposition indiquée ci-après :

1° Les trois premiers harnachements de la première fraction, à droite, en entrant;

2° Les trois premiers harnachements de la seconde, à droite, au fond;

3° Les trois premiers harnachements de la troisième fraction, à gauche, en entrant.

4° Les trois premiers harnachements de la quatrième, à gauche, au fond;

Lorsque les fractions sont de sept ou huit chevaux, le cavalier n° 7 place son harnachement sur celui du n° 1.

Aussitôt que les numéros impairs ont rangé leurs selles, ils retournent à leur fraction pour tenir les chevaux; les numéros pairs portent à leur tour leur harnachement au waggon, et le placent exactement sur celui des numéros impairs.

Les selles des quatre premières fractions étant chargées, les numéros impairs des quatre fractions suivantes apportent les leurs et les rangent, savoir :

La cinquième fraction, sur le harnachement de la première, à droite, en entrant;

La sixième, sur celui de la seconde, à droite, au fond;

La septième, sur celui de la troisième, à gauche, en entrant;

La huitième, sur celui de la quatrième, à gauche, au fond.

Les numéros pairs viennent ensuite compléter le chargement, comme il est indiqué pour les premières fractions.

Le sous-officier ou brigadier, chef du waggon à bagages, attache au fur et à mesure du placement des selles d'une fraction complète,

sur le paquetage le plus élevé et le plus rapproché de la porte ou du centre, une étiquette portant le numéro d'ordre du waggon où sont embarqués les chevaux de cette fraction.

Les chevaux des officiers ayant été compris dans les dernières fractions, leurs selles se trouvent rangées à la partie supérieure du chargement.

Si la hauteur du waggon ou la force de chaque fraction ne permet pas de ranger les selles de manière à former des groupes distincts, on étend sur le paquetage de chaque waggon à chevaux complet, soit une ou deux couvertes pliées en long, soit une corde à fourrages, qui sépare ainsi les divers groupes.

Le chef du waggon doit prendre note de cet arrangement, afin d'appeler à leur tour les cavaliers de chaque fraction quand on débarque.

D.

Mode de paqueter les selles, lorsque les chevaux sont embarqués sellés.

Si les circonstances exigent de faire voyager les chevaux sellés, et que la hauteur des portes des waggons le permette, il est procédé comme il suit :

Le surfaix de schabraque est enlevé.

La schabraque est rabattue sur le siége de la selle.

Le manteau reste attaché par le milieu sur le pommeau de la selle; les deux extrémités du manteau, rendues libres par le retrait des courroies de charge, sont réunies sur la partie postérieure de la selle, et assujetties par le surfaix de schabraque.

Les effets de pansage et les bottines restent dans les sacoches adhérentes au corps de la selle.

Au moyen de ces dispositions, la largeur du paquetage de devant se trouve diminuée de 15 à 16 centimètres, ce qui permet de faire entrer dans chaque waggon un cheval de plus sur six.

E.

Tableau présentant la largeur et le poids des chevaux de toutes armes.

INDICATION DES ARMES.		LARGEUR.	POIDS.	OBSERVAT.
		m c	k	
Cavalerie de réserve.	Chevaux sellés. . . .	0 90	600	Les résultats ci-contre ne sont que des données approximatives.
	Chevaux desselles. . .	0 75	560	
Cavalerie de ligne.	Chevaux sellés. . . .	0 80	500	
	Chevaux desselles. . .	0 65	460	
Cavalerie légère. .	Chevaux sellés. . . .	0 70	480	
	Chevaux desselles. . .	0 55	450	

TROUPES D'ARTILLERIE.

(Ce règlement est applicable par analogie aux troupes du génie accompagnées d'un matériel, et aux troupes des équipages militaires.

PRESCRIPTIONS GÉNÉRALES.

ART. 1er. Les transports sur les chemins de fer exigent, en raison de la masse déplacée et de la vitesse imprimée, une sécurité complète et une grande célérité dans les diverses opérations qui précèdent ou suivent le mouvement.

Ces conditions ne peuvent être remplies que par la régularité et l'exacte observation de toutes les règles du service d'exploitation.

Le transport des pièces et des voitures d'artillerie nécessite, d'ailleurs, plus particulièrement, de très-grandes précautions, en raison de la variété et de l'importance du matériel, ainsi que de la nature explosible d'une partie du chargement.

En outre, les troupes voyageant par chemins de fer sont dans une situation analogue à celle des corps embarqués sur mer, où la direction de la route et une grande part d'autorité sont concentrées dans les mains des commandants de navires.

Pendant tout le voyage, le chef de corps ou de détachement est donc tenu de suivre strictement les indications qui lui sont données par l'employé chargé de diriger le train, auquel demeure la responsabilité du mouvement.

Par le même motif, les officiers, sous-officiers et soldats doivent se conformer, durant toute la route, aux recommandations des agents du chemin de fer.

2. La troupe est pourvue, avant le départ, des vivres nécessaires; ces vivres, en tenant compte des chances possibles de retard, se composent comme il suit :

HOMMES.

Une ration de pain et une ration de viande cuite, s'il est possible de faire la soupe et d'obtenir une distribution de pain après l'arrivée; dans le cas contraire, deux rations de pain et deux rations de viande cuite.

La viande est renfermée dans les petites gamelles, où il n'est rien mis de liquide ; à défaut de ces dernières, la viande est logée dans l'intérieur du pain. Les vivres des hommes montés sont placés d'un

côté du bissac. Les petits bidons sont remplis d'eau que l'on mélange avec de l'eau-de-vie dans la saison des chaleurs.

CHEVAUX (1).

Les chevaux mangeant facilement dans les waggons, même pendant la marche, il est distribué, sur le pied de route, une ration complète ou une demi-ration de fourrages (foin et avoine), selon la durée du voyage.

L'avoine est mise avec la musette dans la partie restée libre du bissac.

Le foin est délivré *pressé*, s'il est possible; dans le cas contraire, il est réduit au moindre volume, par l'un des procédés en usage; on le place dans les waggons à chevaux.

3. Aussitôt que l'ordre de mouvement est reçu, le chef de corps ou de détachement se concerte avec le chef de service du chemin de fer pour reconnaître le point d'embarquement, la composition qu'il convient de donner à chaque convoi, et la disposition du matériel du chemin de fer; enfin, pour savoir l'heure du départ et prendre connaissance de l'itinéraire dont une copie lui est délivrée.

Le chef de service met cet officier en rapport avec l'employé chargé de diriger le train.

4. Les waggons destinés au transport sont rangés le long des quais ou sur une voie de service ayant un espace libre suffisant à droite ou à gauche.

Les manœuvres nécessaires pour amener les waggons au point d'embarquement, pour mettre le train en état de marcher, et pour conduire les waggons au quai de déchargement, sont exécutées par les employés du chemin de fer, assistés, toutes les fois qu'il en est besoin, par les canonniers disponibles.

Un convoi ordinaire, comprenant une demi-batterie montée, est formé, autant que possible, dans l'ordre suivant (2):

Un waggon couvert contenant les bagages de la troupe;

Deux waggons portant les chevaux d'attelage de la forge et du chariot (3);

Deux trucks ou plates-formes portant la forge et le chariot;

Deux waggons portant les chevaux d'attelage de trois ou quatre voitures d'artillerie;

Deux trucks portant ces voitures, et ainsi de suite.

Selon les manœuvres de gare à prévoir pendant la route, le

(1) Il conviendra qu'un intervalle suffisant sépare le dernier repas des chevaux, du moment de l'embarquement, l'expérience ayant démontré que cette précaution les rend plus dociles pour entrer dans les waggons.

(2) Sauf les waggons à chevaux, dont il faudra un plus grand nombre, les dispositions seront les mêmes pour une batterie à cheval.

(3) Toutes les fois que les dispositions le permettront, il sera préférable que les chevaux aient la tête tournée vers le côté extérieur de la voie.

waggon à selles est placé de manière qu'il se trouve toujours en tête du train lorsqu'on arrive à destination.

Les waggons à voyageurs sont placés au centre du train.

Chaque waggon est numéroté à la craie des deux côtés; l'officier chargé du fractionnement fait ajouter le numéro de la batterie et celui de la pièce auxquelles appartiennent les canonniers et les chevaux qui doivent être embarqués dans le waggon (1).

5. Lorsque la troupe a l'étendard avec elle, il est placé dans le waggon du commandant.

6. Il est formé un poste composé :

D'un maréchal des logis,
D'un brigadier,
D'un trompette,
Et d'un nombre de canonniers proportionné à l'effectif.

Ce poste occupe un compartiment du waggon le plus voisin de celui des officiers.

Le poste est préposé au maintien de l'ordre aux stations et à l'arrivée.

7. Dans le cas où le corps est suivi de ses gros bagages, les colis sont rendus au chemin de fer trente minutes avant le corps.

La troupe doit arriver au point désigné pour l'embarquement deux heures au moins avant le moment du départ.

8. Les batteries ou fractions de batteries à embarquer arrivent dans la gare ou à proximité.

Chaque batterie ou fraction est formée, selon le terrain, de manière à prendre le moins de développement possible. Les dispositions suivantes sont aussitôt exécutées.

Les officiers reconnaissent les waggons assignés au matériel et aux chevaux; ils font garnir chacun des waggons à chevaux de deux bottes de paille (2).

Un maréchal des logis ou brigadier est désigné pour veiller au chargement des selles dans un ou plusieurs waggons à bagages, ainsi qu'au déchargement à l'arrivée; quelques canonniers lui sont adjoints.

Les servants déposent le sac et le mousqueton; ils sont formés, sous la surveillance d'un ou de plusieurs officiers, en détachements proportionnés à l'importance du matériel à embarquer.

On dételle les chevaux de devant et du milieu, on les réunit sous les ordres d'un sous-officier, avec les chevaux de selle, dans un lieu voisin du quai où ils doivent être embarqués.

(1) Il est recommandé aux sous-officiers, brigadiers et soldats de prendre connaissance du numéro de leur waggon et de l'inscription à la craie, afin de pouvoir facilement retrouver leur place aux stations.

(2) La paille nécessaire pour la litière des waggons et pour l'arrimage des selles est fournie par les magasins militaires.

Les voitures sont amenées sur le quai d'embarquement; aussitôt après, les chevaux de derrière sont conduits successivement au point susindiqué.

Les chevaux sont divisés par fractions correspondantes à la capacité de chaque waggon; autant que faire se peut, les chevaux d'un même attelage sont placés dans le même waggon.

Les diverses fractions sont rangées devant les waggons qui doivent les recevoir. On procède ensuite à l'embarquement comme il est dit ci-après.

EMBARQUEMENT.

VOITURES.

9. Les deux trains de chaque voiture sont séparés et placés tout montés sur les trucks ou plates-formes.

Les conditions essentielles du chargement sont les suivantes (1) :

1° Répartir les poids sur toute la surface du truck, en occupant le moins de place possible;

2° Faire en sorte que les bouts de timons et les roues de rechange ne dépassent point les tampons du truck qui les porte;

3° Consolider, caler, brêler et amarrer avec un soin extrême les parties du chargement qui en sont susceptibles, de manière à les rendre toutes parfaitement solidaires entre elles et à en assurer la complète stabilité.

CHEVAUX.

Les chevaux de selle et les porteurs sont dessellés, mais non débridés (2).

Si les circonstances atmosphériques l'exigent, les couvertes sont étendues sur les chevaux; on les assujettit avec les surfaix.

On porte les selles toutes paquetées au waggon à bagages, où elles sont rangées par piles, le porte-manteau contre la paroi longitudinale du waggon, en suivant l'ordre des *pièces*, et l'ordre des voitures de chaque *pièce*.

Les harnais sont laissés aux chevaux d'attelage; on relève sur le collier les traits, fourreaux, plates-longes et avaloires, au moyen des courroies-trousse-traits, de manière que le tout soit fixé le plus solidement possible en arrière des mamelles.

Ces divers préparatifs terminés, le signal de l'embarquement est donné par un demi-appel.

Un conducteur, assisté d'un homme haut le pied, fait entrer successivement deux chevaux en leur faisant baisser la tête; il les fait ranger contre la paroi latérale de droite, la tête opposée à l'entrée du waggon (1); deux autres chevaux de trait sont rangés à gauche par les soins du second et du troisième conducteur, qui font entrer ensuite le dernier attelage et le cheval de selle. Les trois conducteurs restent dans le waggon à la tête de leurs chevaux.

(1) Pour les détails, voir l'appendice A.

(2) Il est généralement préférable d'embarquer les chevaux dessellés. Si des circonstances particulières obligent de procéder différemment, et que la hauteur des portes des waggons le permette, le chef du corps ou détachement prendra les dispositions indiquées dans l'appendice D.

Les conducteurs ou servants demeurés à l'extérieur mettent la barre de fermeture provisoire, relèvent ou retirent le pont d'embarquement et ferment les portes. Enlevant ensuite la barre, ils la passent aux hommes du waggon et embarquent aussitôt le fourrage.

Deux strapontins sont donnés par waggon, pour que les conducteurs puissent s'asseoir alternativement.

Les chevaux sont attachés à la barre longitudinale du waggon avec la longe du licou, ce qui permet de débrider, si l'ordre en est donné; dans ce cas, trois ou quatre brides sont réunies, liées ensemble à la têtière par les rênes de l'une d'elles, et attachées à la barre du waggon avec les mêmes rênes vers les encoignures.

Les bâches des waggons couverts restent relevées, à moins que l'état de l'atmosphère n'oblige de les baisser de l'un ou de l'autre côté.

TROUPE.

Les servants reprennent le sac et le mousqueton. Deux servants sont placés sur chaque truck de matériel; les autres sont réunis aux conducteurs qui ne sont pas embarqués dans les waggons à chevaux (2).

Ils prennent place dans un waggon à voyageurs.

Les sacs des hommes non montés sont rangés sous la banquette.

Chacun tient ses armes entre ses jambes ou à côté de lui.

Il est interdit de déposer les mousquetons dans les encoignures ou sous les banquettes; dans les waggons à chevaux, on doit avoir soin de ne pas laisser les armes à portée des pieds des chevaux.

Chaque waggon d'hommes ou de chevaux et chaque truck de matériel ont pour chef le plus ancien canonnier, si aucun maréchal des logis ou brigadier n'y est embarqué.

Le chef du waggon est chargé de maintenir le bon ordre et de veiller à l'exécution de toutes les mesures ordonnées.

OFFICIERS.

Les officiers montent en voiture dès que l'embarquement de la troupe est terminé.

(1) Il est essentiel de faire entrer rapidement les chevaux, et de ne pas laisser aux premiers embarqués le temps de se mettre en travers du waggon. Si un cheval résiste, on fait avancer le suivant, et le premier est entraîné vivement à sa suite. Autant que possible, il faut faire entrer d'abord les chevaux dociles; les autres n'ayant pas à appuyer à droite ou à gauche, opposeront moins de d'efforts. Il conviendra, du reste, d'employer préférablement les moyens de douceur.

(2) Si le voyage se prolonge, l'officier commandant a soin de faire relever les canonniers des waggons à chevaux et les servants des trucks de matériel.

10. Pendant la formation du convoi, l'officier commandant et le chef de train passent la revue de chacun des waggons pour reconnaître si tout y est bien placé; ils font rectifier immédiatement les dispositions vicieuses et les arrimages défectueux.

ROUTE.

11. La troupe étant embarquée, il est rigoureusement interdit :

1° De fumer;

2° De sortir la tête ou les bras hors des parois des waggons pendant la marche;

3° De passer d'une voiture dans une autre.

Les canonniers ont soin d'empêcher les chevaux d'avancer la tête hors des parois.

A tous les coups de sifflet de la locomotive, les hommes tiennent les chevaux par la bride ou le licou, pour les maintenir dans les chocs et les oscillations.

Les servants embarqués sur les waggons à matériel resserrent les brélages qui se relâcheraient. S'il survient quelque dérangement auquel ils ne puissent remédier, ils élèvent leur schako à l'extrémité du mousqueton. Ce signal est répété par tous les servants, jusqu'à ce que les gardes-freins l'aperçoivent et que le signal d'arrêt soit donné.

Il ne doit être poussé de cris dans aucun cas (1).

12. Aux stations où, d'après l'itinéraire du train et le temps indiqué par l'employé qui dirige le mouvement, le commandant juge convenable que la troupe mette pied à terre, il fait connaître la durée de la halte aux officiers; ceux-ci se portent, pour diriger et surveiller le mouvement, à la hauteur des waggons où leur troupe est embarquée.

Le poste de police descend immédiatement et fournit des sentinelles partout où il en est besoin (2).

Au signal donné par un demi-appel, les hommes, tenant leurs armes, descendent en ordre des waggons et des trucks à matériel, et exclusivement par le côté extérieur de la voie.

Les hommes embarqués avec les chevaux descendent en passant par dessus la paroi des waggons. Si on juge nécessaire de faire ouvrir les portes, la barre de fermeture est placée préalablement.

(1) Lorsque les coffres des voitures sont chargés de munitions, les servants sont munis de seaux et de bidons remplis d'eau pour prévenir tout accident qui pourrait résulter d'étincelles.

(2) Des factionnaires, en nombre suffisant, sont posés du côté intérieur et en dehors de la voie pour empêcher les hommes d'y stationner ou d'ouvrir les portes des waggons.

A moins de dispositions particulières, personne ne sort des gares, et, lorsqu'on fait exception à cette règle, il est rigoureusement interdit d'escalader les clôtures du chemin.

Cinq minutes avant le départ, un demi-appel donne le signal du rembarquement qui doit se faire avec ordre et rapidité.

Le commandant de la troupe règle les heures de repas.

Si, dans l'itinéraire du train, il se trouve une halte d'une heure ou environ, le repas est pris de préférence à cette station.

Pendant le temps du repas, il est désigné un canonnier garde d'écurie pour deux waggons à chevaux; on en place un par waggon, si l'avoine est distribuée durant la même station.

L'avoine est mangée dans la musette. Le foin est donné à la main par les conducteurs; on utilise surtout le temps de la route pour cette distribution.

En temps ordinaire, les chevaux ne sont abreuvés que si la durée du trajet est de plus de douze heures; dans ce cas même, ils ont besoin de peu d'eau, et un seau de dimension ordinaire suffit pour deux chevaux.

DÉBARQUEMENT.

14. A l'arrivée du train dans la gare de destination, ou sur le point désigné pour le débarquement, les officiers mettent pied à terre les premiers.

Le commandant reconnaît le terrain sur lequel la troupe doit se former et l'indique aux officiers.

Un demi-appel donne le signal du débarquement.

Les officiers réunissent les servants, font déposer le sac et le mousqueton, et forment des détachements d'après le nombre et la disposition des points de débarquement.

15. Le matériel est mis à quai par des moyens inverses de ceux qui ont été employés pour l'embarquement. Pendant cette opération, on fait extraire les selles du waggon à bagages, et débarquer les chevaux.

Aussitôt que deux chevaux de derrière sont disponibles, on attelle la voiture débarquée et on l'emmène au parc, où les attelages sont complétés (1).

Chaque voiture se forme ensuite dans l'ordre prescrit par le commandant.

16. Les bagages de la troupe sont déchargés et remis à qui de droit par les employés du chemin de fer.

Paris, le 16 septembre 1851.

Le Ministre de la guerre,

Signé : RANDON.

(1) Lorsque les chevaux de selle et les porteurs ont été embarqués tout sellés, on a soin d'examiner le paquetage et de le rectifier s'il y a lieu.

APPENDICE

AU RÈGLEMENT PROVISOIRE SUR LE TRANSPORT DES TROUPES D'ARTILLERIE PAR LES CHEMINS DE FER.

A.

Notice sur les waggons les plus propres au transport du matériel et des chevaux d'artillerie.

VOITURES D'ARTILLERIE.

Les trucks ou plates-formes (1) sont les véhicules qui conviennent le mieux au transport des voitures d'artillerie. On choisira de préférence les trucks qui se chargent par les petits côtés, et ceux dont les rebords ont le moins d'élévation.

Les trucks ayant une longueur de 5m,30 peuvent recevoir deux voitures.

Si l'on en emploie qui aient 4m,35, il en faut deux pour trois voitures; et au-dessous de cette dimension, une seule voiture fait le chargement du truck.

Les dimensions de l'arrière-train des forges et chariots de batterie ne permettent pas de mettre, avec chacun d'eux, plus d'un avant-train sur un truck de 4m,35. Aussi ces voitures sont-elles embarquées seules sur un truck de ce genre.

Le chargement s'opère de la manière suivante :

1° TRUCKS DE 4m,35 SE CHARGEANT PAR LE PETIT CÔTÉ.

1er truck.—Engager un arrière-train, la flèche en arrière, jusqu'à ce que ses roues touchent l'autre petit côté du truck; poser la flèche sur le plancher. Engager un avant-train, le timon en avant et élevé, jusqu'à ce que les roues touchent celles du premier arrière-train.

Engager un second arrière-train, la flèche en avant et posée à terre, en évitant que le coffre de devant ne touche celui de l'avant-train.

2e truck. Engager un arrière-train la flèche en arrière, la poser sur le plancher; ensuite, un avant-train, le timon en avant, comme sur le premier truck. Compléter le chargement par un avant-train, le timon en avant et baissé sur le plancher, sous le premier avant-train.

(1) Pour la facilité de la rédaction, on emploiera, dans cette notice, le mot truck comme terme générique.

2° TRUCKS DE 5m,30.

Embarquer la première voiture, en procédant comme pour le chargement des deux premiers trains sur les trucks de 4m,35. Engager un avant-train, timon en arrière et élevé, faire entrer le second arrière-train, la flèche en avant et abaissée sur le plancher.

Lorsque les dispositions de la gare où la construction des trucks obligent à embarquer les voitures par le grand côté, on engage deux arrière-trains de suite, la flèche en arrière (ou un arrière-train et un avant-train) et on les dispose aux deux extrémités du truck, comme il a été dit plus haut.

L'avant-train chargé en dernier lieu est porté à bras, le timon en haut, à la place qu'il doit occuper.

Dans certains cas, la roue de rechange est enlevée et placée, soit à plat sur le plancher, soit contre un des trains chargés sur le truck.

Dans les opérations d'embarquement, les timons doivent être maintenus au moyen d'une jarretière fixée à leur extrémité.

Il sont ensuite fortement brêlés à l'une des parties de l'arrière-train déjà chargé.

Dès qu'un truck a reçu son chargement, on fixe entre elles les roues des divers trains au moyen de jarretières ou autres cordages de 12 millimètres de diamètre; à défaut, au moyen de traits à canon. On complète ensuite la stabilité des voitures en calant les roues et en les amarrant aux anneaux du truck. Il conviendra, du reste, de prévenir les frottements des divers parties des voitures les unes contre les autres, en faisant usage de torons de paille ou de tout autre moyen.

CHEVAUX.

Les chevaux sont embarqués dans des waggons à bestiaux, ou dans des waggons à marchandises appropriés pour ce transport (1). Les waggons à bestiaux ayant 1m,80 de hauteur sous le linteau de la porte, peuvent recevoir des chevaux sellés. Ceux qui ont seulement 1m,70 (chemins de fer d'Orléans, du Centre, de Bordeaux) ne peuvent recevoir que des chevaux dessellés.

Afin d'éviter tout accident, il convient, après l'introduction du dernier cheval dans le waggon, de fermer provisoirement l'ouverture avec une barre mobile de longueur suffisante, dont les angles sont arrondis, et que l'on fixe en dedans des montants au moyen de deux cordes passées dans les anneaux extérieurs du waggon.

Les waggons ayant 4m,35 de longueur peuvent recevoir :

Six chevaux avec harnais et selle;

(1) Lorsque ces ajustements sont nécessaires, ils sont effectués au compte de l'administration de la guerre.

Sept chevaux garnis de la selle (avec paquetage relevé) et du harnachement tout entier;

Sept chevaux dessellés et les traits des porteurs troussés sur le collier.

Dans un transport nécessitant un grand nombre de trains, on doit proportionner l'effectif des chevaux à la contenance à plein des waggons.

Lorsque le nombre total des chevaux n'est pas exactement divisible par la contenance des waggons, il y a lieu de diminuer d'un cheval le chargement d'autant de waggons que cela est nécessaire pour porter au complet moins un le chargement du dernier waggon, ou de faire barrer les chevaux qui sont embarqués dans celui-ci.

Si la hauteur des portes le permet, les chevaux des waggons décomplétés sont embarqués alors tout harnachés.

B.

Notice sur les ponts qui peuvent être nécessaires pour l'embarquement et le débarquement du matériel et des chevaux d'artillerie.

Lorsque les trucks de matériel et les waggons à chevaux ne sont pas munis d'un tablier qui puisse joindre le quai, il est nécessaire de faire préparer un nombre suffisant de madriers ou de plateaux pour le chargement des voitures et l'embarquement des chevaux.

S'il y a lieu de débarquer le matériel sur un point où il n'y a pas de quai, on peut, au besoin, faciliter cette opération en formant un plan incliné avec des rails; on les empruntera même à la voie, *si cela est indispensable*, avec l'autorisation des agents du chemin de fer.

Dans ce cas, on doit avoir le plus grand soin de remettre ces rails en place, sous la direction des mêmes agents.

Dans la prévision d'un accident de route, il convient d'être toujours en mesure de faire débarquer les chevaux.

A cet effet, il faut avoir soin d'emporter (suivant la force de chaque convoi) un ou plusieurs ponts volants, dont les diverses parties se chargent sur les trucks portant le matériel.

Les dimensions d'un pont volant bien établi sont les suivantes :

Longueur : 5 mètres environ; largeur : 20 centimètres de plus que celle des portes des waggons.

Le pont est garni de garde-corps qui s'adaptent ou s'enlèvent à volonté; il est supporté à son extrémité supérieure par un chevalet mobile, dont la hauteur correspond à celle de la porte des waggons.

Le débarquement des chevaux s'opère alors en faisant passer successivement les waggons devant ce pont convenablement placé.

Dans certains cas, il sera plus simple de supprimer le chevalet et

de fixer à la partie antérieure du pont deux fortes brides en fer reposant sur le plancher du waggon. Ce pont est alors adapté successivement à chacun des waggons que l'on doit décharger.

C.

Mode d'arrimage des selles dans les waggons à bagages.

Les selles sont convenablement chargées dans les waggons à bagages et à freins extérieurs.

On doit les ranger de manière que le porte-manteau soit appuyé contre la paroi longitudinale du waggon. On place une botte de paille de la longueur du paquetage sous chacune des premières selles pour faire chevalet, et on empile les autres jusqu'au haut du waggon; les quatre selles du chef et des conducteurs d'une voiture d'artillerie sont réunies dans la même pile.

Un waggon à bagages pouvant contenir environ soixante selles suffit pour une demi-batterie montée.

Le sous-officier chef du waggon de harnachement fait embarquer les selles dans un ordre tel, que les effets appartenant aux divers attelages qui composent une pièce soient réunis dans un groupe distinct, et puissent être rendus promptement et sans confusion au moment de l'arrivée.

D.

Mode de paqueter les selles, lorsque les chevaux sont embarqués sellés.

On déboucle les deux courroies de paquetage de devant, en ne maintenant serrée que la courroie de manteau.

On dégage la schabraque et on la replie sur le siége de la selle; on réunit également en arrière sur le siége les bouts du sac à distribution, les deux musettes et les deux extrémités du manteau roulé.

On maintient le tout en l'embrassant avec une des courroies de paquetage, que l'on a entièrement dégagée de la selle.

E.

TABLEAU présentant les dimensions et le poids du matériel roulant de l'artillerie.

DÉSIGNATION DES OBJETS.	DIMENSIONS prises aux points les plus saillants. Longueur. timon compris	Longueur. sans le timon.	Largeur.	Hauteur.	POIDS. Non chargé.	Chargé.	OBSERVATIONS.
	mètre.	mètre.	mètre.	mètre.	kilog.	kilog.	
ARTILLERIE DE CAMPAGNE.							
Avant-train de campagne (commun aux affûts, caissons, chariot et forge)	4. 365	1. 685	1. 900	1. 615	454	696	
Affûts de 12 et d'obusier de 16e — Arrière-train	»	3. 725	1. 900	1. 490	571	1,470	
Affûts de 12 et d'obusier de 16e — Complet	7. 580	4. 890	1. 900	1. 615	1,050	2,150	
Affûts de 8 et d'obusier de 15e — Arrière-train	»	3. 525	1. 900	1. 490	551	1,188	
Affûts de 8 et d'obusier de 15e — Complet	7. 365	4. 675	1. 900	1. 615	985	1,806	
Caisson à munitions — Arrière-train	»	3. 490	1. 900	1. 816	584	1,155	
Caisson à munitions — Complet	7. 410	4. 420	1. 900	1. 762	1,038	1,851 (a)	(a) Varie entre 1,800 k., poids du caisson de 8 sans roue de rechange et 2,060 k., poids du caisson d'infanterie avec roue de rechange.
Chariot de batterie — Arrière-train	»	3. 645	1. 900	2. 310	555	1,346	
Chariot de batterie — Complet	7. 595	4. 905	1. 900	2. 075	1,009	2,038	
Forge de campagne — Arrière-train	»	3. 270	1. 900	1. 885	624	1,013	
Forge de campagne — Complet	7. 220	4. 535	1. 900	1. 837	1,078	1,810	

ÉQUIPAGE DE PONT.							
Haquet à bateau — Avant-train	4. 930	2. 430	1. 900	1. 230	345	»	
Haquet à bateau — Arrière-train (non chargé)	»	5. 310	1. 900	1. 593	551	»	
Haquet à bateau — Complet et chargé du bateau	11. 622	9. 822	1. 900	2. 580	»	2,170	
Haquet à bateau — Complet et chargé de la nacelle	10. 880	8. 907	1. 900	2. 040	»	1,975	
Haquet à bateau — Complet et chargé de la sonnette	9. 846	8. 000	1. 900	1. 614	»	1,319	
ARTILLERIE DE SIÉGE.							
Avant-train de siége (commun aux deux affûts et au chariot porte-corps)	4. 687	1. 750	2. 016	1. 550	536	»	
Affûts de 24. — Arrière-train non chargé	»	4. 085	2. 016	1. 550	970	»	
Affûts de 24. — Complet et chargé d'un canon de 24	7. 597	4. 660	2. 016	1. 550	1,506	4,246	
Affûts de 24. — Complet et chargé d'un obusier de 22	7. 297	4. 360	2. 016	1. 550	1,506	2,706	
Affûts de 16. — Arrière-train	»	3. 920	2. 016	1. 550	878	2,878	
Affûts de 16. — Complet	7. 437	4. 500	2. 016	1. 550	1,414	3,414	
Chariot porte-corps — Arrière-train	»	3. 660	2. 016	1. 550	752	(a)	(a) Varie selon que le chariot est chargé de : 1 canon de 24. . . . 2,740k. 1 canon de 16. . . . 2,000. 1 obusier de 22 c. . . 1,200. 2 obusiers de 22 c. . . 2,400. 1 mortier de 27 c. sur son affût . . . . . 2,300. 2 mortiers de 22 c. sur leurs affûts . . . . 2,340. Des projectiles selon le besoin.
Chariot porte-corps — Complet	7. 312	4. 375	2. 016	1. 550	1,288		
Triqueballe — Avant-train	4. 240	1. 470	1. 900	1. 230	345	»	
Triqueballe — Arrière-train	»	4. 230	2. 016	2. 030	845	»	
Triqueballe — Complet	7. 810	5. 040	2. 016	2. 030	1,190	»	
Chariot de parc — Avant-train	4. 487	1. 417	1. 900	1. 230	330	»	
Chariot de parc — Arrière-train	»	3. 510	1. 900	1. 567	552	»	
Chariot de parc — Complet	7. 020	4. 250	1. 900	1. 490	882	1,800 (c)	(c) Environ.
Charrette	»	3. 735	1. 900	1. 780	457	900 (c)	

F.

TABLEAU présentant les dimensions et le poids du matériel roulant du génie.

DÉSIGNATION DES OBJETS DU MATÉRIEL.	DIMENSIONS ET POIDS sans le chargement.						DIMENSIONS ET POIDS avec le chargement.				OBSERVATIONS.
	Longueur.			Largeur.	Hauteur.	Poids.	Longueur avec l'avant-train.	Largeur.	Hauteur.	Poids.	
	de l'avant-train.	du corps de la voiture	de la voiture réunie à son grand train.								
	mètres	mètres	mètres	mètres	mètres	kilog.	mètres	mètres	mètres	kilog.	
Prolonge portant les outils de parc.						841				1,880	
Prolonge portant les outils de mineur.						841				1,920	
Prolonge portant les outils d'art.						841				1,803	
Prolonge portant les instruments de sape.						841				1,951	On suppose que le châssis de chargement, l'échelle, les deux jumelles et les deux mantelets de la sonnette, ont été enlevés du chargement et placés à part; avec ces six pièces, la prolonge chargée présenterait une longueur de 8 m. 45 c. et une hauteur de 3 m. 60 c.
Prolonge chargée des agrès de la nacelle.	4.60	3.98	7.90	1.96	1.38	841	7.90	1.96	1.75	1,701	
Prolonge portant la sonnette et les objets nécessaires à la sonnette.						841				1,709	
Prolonge portant les cordages, clameaux, Broches, etc., pour les ponts.						841				1,962	
Prolonge portant les objets de rechange pour les réparations des voitures.						841				1,825	
Prolonge pour le service particulier du train.						841				1,349	
Forge de campagne pour le service particulier du train.	4.60	3.65	7.50	1.96	1.71	894	7.50	1.96	1.71	1,312	
Caisson à poudre, bombes et pétards.	4.60	3.45	7.40	1.96	1.76	802	7.40	1.96	1.76	1,495	
Haquet avec sa nacelle.	4.85	5.50	9.30	1.96	1.60	836	11.45	1.96	1.92	1,907	La nacelle seule a 9 m. 30 c. de longueur. Il ne faudrait donc que 9 m. 30 c. au lieu de 11 m. 45 c., si on voulait à l'enlever de dessus le haquet.

G.

TABLEAU présentant les dimensions et le poids du matériel roulant du train des équipages.

DÉSIGNATION DES OBJETS.		DIMENSIONS prises AUX POINTS LES PLUS SAILLANTS. Longueur, timon compris.	Longueur, sans le timon.	Largeur.	Hauteur.	Poids.	OBSERVATIONS.
		mètres.	mètres.	mètres.	mètres.	kilog.	
Caissons. . .	de 1,600 rations, modèle de 1842.	6. 700	4. 270	1. 920	2. 300	857	Le poids variant selon la nature du chargement, on n'a pas cru devoir indiquer le poids des voitures chargées.
	suspendus de 1,200 rations, modèle de 1848. .	6. 230	3. 900	1. 820	2. 300	1,446	
	d'ambulance.	6. 340	3. 800	1. 920	2. 430	765	
Chariots. . .	fourragères-prolonges, modèle de 1842. . . .	6. 940	4. 430	1. 920	2. 600	950	
	de parc, modèle de 1848.	6. 475	4. 270	1. 820	1. 450	819	
Forges d'équipages militaires.	Modèle *dit* de cavalerie.	5. 980	3. 400	1. 772	1. 600	550	Y compris l'outillage, pesant 122 kilog.
	Modèle *dit* d'équipages, 1842.	6. 645	3. 850	1. 950	2. 000	805	Y compris l'outillage, pesant 113 kilog.
	Modèle *dit* de campagne, 1848.	6. 200	3. 995	1. 820	1. 800	930	Y compris l'approvisionnement, rechanges et outillage, pesant 542 kilog.

H.

TABLEAU présentant la largeur et le poids des chevaux d'artillerie.

			LARGEUR.	POIDS.	OBSERVATIONS.
			m. c.	kilog.	
Chevaux de selle.		sellés.	1.00	500	Les résultats ci-contre ne sont que des données approximatives.
		dessellés.	0.70	450	
Chevaux de trait. . . .	porteurs.	Harnachés et sellés. . .	1.00	515	
		Nus.	0.80	450	
	sous verge.	Harnachés.	1.00	473	
		Nus.	0.80	450	

NOTA. La largeur et le poids susindiqués peuvent être considérés comme s'appliquant aux chevaux du génie et du train des équipages militaires.

N° 202. *Le Ministre de la guerre à MM. les Généraux commandant les divisions et subdivisions territoriales ou actives de l'intérieur.* (Direction de l'Administration; Bureau de l'Intendance militaire, des Personnels administratifs et des Transports, Convois et Equipages.)

Paris, le 16 septembre 1851.

(Envoi de règlements pour le transport des troupes de toutes armes sur les chemins de fer).

Général, je vous adresse, ci-inclus, des exemplaires de trois règlements que j'ai approuvés, sous la date du 16 septembre courant, pour le transport, par chemins de fer, des troupes de toutes armes.

En admettant les plus fortes réductions que les lois de concession garantissent à l'État, depuis 1844, sur les taxes des tarifs, le transport des troupes par chemins de fer occasionne au budget de la guerre des augmentations de charges dont il est utile que vous connaissiez la progression :

Infanterie, deux fois la dépense ordinaire de route par journées d'étape;
Cavalerie, six fois cette dépense;
Artillerie, quinze fois cette dépense.

Ce rapprochement, et plus encore la nécessité, au point de vue militaire, de ne pas laisser perdre aux troupes l'habitude des longues marches, démontre qu'il importe essentiellement de ne recourir à l'emploi des chemins de fer que lorsqu'il se manifeste une urgence incontestable.

En conséquence, je recommande que, à l'exception des circonstances extraordinaires qui justifieraient l'initiative du commandement, mon autorisation préalable soit toujours demandée pour faire transporter des troupes (surtout de la cavalerie et de l'artillerie) par les voies ferrées.

Les lois de concession disposent diversement en ce qui concerne les transports militaires, et même quelques-unes (celles qui ont été votées de 1826 à 1833) sont complétement muettes à ce sujet. Toutes les fois qu'il y aura lieu de recourir à ce mode de locomotion, les fonctionnaires de l'intendance ou leurs suppléants légaux devront donc, selon le cas, procéder, soit par voie de transaction, soit par avis ou réquisition, en se conformant aux dispositions prescrites par ma circulaire en date de ce jour, dont je joins ici un exemplaire.

Il sera indispensable que les fonctionnaires de l'intendance, informés en temps utile par l'autorité militaire, puissent ainsi prévenir les compagnies assez à l'avance pour que le transport soit effectué dans le délai voulu.

Je ne saurais trop appuyer sur ce point, dont il faudra tenir plus

particulièrement compte dans les localités où la portion principale du matériel d'exploitation ne se trouve pas habituellement réunie.

Lorsqu'une troupe devra être embarquée sur un chemin de fer, le Commandement aura le soin de s'assurer si le chef de corps et les officiers sous ses ordres se sont bien pénétrés des dispositions du règlement qui concerne l'arme. Je n'ai pas besoin d'insister pour que, comme toujours, les officiers donnent l'exemple de l'exacte observation de toutes les dispositions ordonnées, *sans en excepter aucune*. En effet, dans un transport par chemin de fer, la moindre déviation des règles tracées peut entraîner des conséquences incalculables, et rien ne doit être épargné pour prévenir des accidents qui, indépendamment de malheurs irréparables, feraient échouer peut-être le projet que le Gouvernement se serait proposé en prescrivant le transport d'une troupe par la voie rapide. J'appelle, à ce sujet, votre attention d'une manière plus particulière sur les recommandations consignées aux articles 1, 6, 9, 10, 11 et 12 des trois règlements.

L'article 2 contient, relativement aux vivres et aux fourrages, des prescriptions qui exigent quelques explications.

Le but que l'on a dû se proposer a été que hommes et chevaux arrivassent invariablement en état d'agir ou de continuer immédiatement leur route, par suite sans qu'il y eût à se préoccuper de la préparation d'un repas au lieu où la troupe doit quitter la voie ferrée. C'est là un point essentiel que les chefs de corps ou de détachements ne devront jamais perdre de vue.

Comme conséquence de ce qui précède, les rations de pain et de fourrages dont la distribution est ordonnée, constitueront en principe une *allocation extraordinaire* plutôt qu'une *avance*. Cependant, comme il pourra y avoir des circonstances (et de ce nombre, notamment, la brièveté du parcours en chemin de fer) qui ne justifieraient pas le supplément d'une ration de pain pour les hommes, d'une ration ou d'une demi-ration de fourrages pour les chevaux, je vous autorise expressément à statuer à ce sujet pour chaque transport.

Vous me rendrez compte (*bureau de l'intendance militaire*) des ordres que vous aurez cru devoir donner, le cas échéant.

Quelle que soit votre décision, les vivres et les fourrages seront délivrés, autant que possible, la veille du départ, et, de toute façon, quelques heures avant que la troupe ne se rende à la gare. Selon la durée de voyage, et si les ressources des magasins le permettent, on munira les hommes de petits bidons, s'ils n'en sont pas pourvus, à charge de réintégration au point de destination.

Je vous prie de faire distribuer les trois règlements du 16 septembre 1851 dans les corps de l'arme qu'ils concernent, et d'après la proportion suivante :

Chef de corps et officier supérieur. . . . . Un exemplaire de chacun des *trois règlements.*

Bataillon d'infanterie.	Deux exemplaires du règlement spécial à l'arme.
Escadron de cavalerie.	Un exemplaire du règlement spécial à l'arme.
Batterie d'artillerie.	
Compagnie du train des parcs d'artillerie et des équipages militaires.	
Bataillon du génie.	Deux exemplaires de chacun des règlements de l'infanterie et de l'artillerie.

Recevez, etc.

Le Ministre de la guerre,
Signé : RANDON.

N° 203. *Le Ministre de la guerre à MM. les Intendants des divisions militaires.* (Direction de l'Administration; Bureau de l'Intendance militaire; des Personnels administratifs et des Transports; Convois et Equipages militaires.)

Paris, le 16 septembre 1851.

(Envoi de trois règlements concernant le transport par chemin de fer des troupes de toutes armes.—Instructions à ce sujet.)

Monsieur l'intendant, je vous envoie en communication quelques exemplaires de trois règlements et des instructions qui les accompagnent, concernant le transport des troupes de toutes armes par les chemins de fer.

Vous remarquerez, dans les instructions, la recommandation expresse qui est faite à l'autorité militaire de recourir invariablement à l'intervention des fonctionnaires de l'intendance, ou de leurs suppléants légaux, pour assurer l'exécution de ces transports.

Il ressort du tableau que je vous ai adressé le 13 juin dernier une très-grande diversité dans les devoirs des compagnies envers les départements de la guerre et de la marine (1).

Les lois de concession qui ont été votées de 1826 à 1833 ne mettent à la charge des compagnies aucune obligation définie.

Dans les cahiers des charges votés depuis 1835 jusqu'au mois de mai 1837, le législateur a imposé aux compagnies l'obligation de mettre à la disposition du Gouvernement la totalité de leurs ressources, à moitié prix des taxes du tarif légal, si l'administration a besoin de faire transporter des troupes et un matériel militaire.

D'après les lois votées du mois de juillet 1837 au 7 juillet 1844, les compagnies sont tenues :

(1) Voir, ci-après, ce tableau, pages 276 et 277.

1° D'exécuter, *à moitié prix*, le transport des militaires voyageant en corps ou isolément avec leurs bagages ;

2° De mettre à la disposition du Gouvernement la totalité de leurs ressources, *à moitié prix*, pour les transports de troupes et de matériel militaire.

Du 26 juillet 1844 à ce jour, les lois de concession règlent comme il suit les obligations des compagnies :

1° Exécuter, *à moitié de la taxe du tarif*, le transport des militaires ou marins isolés et de leurs bagages ;

2° Exécuter, *au quart de la taxe du tarif*, le transport des corps et détachements et de leurs bagages ;

3° Mettre à la disposition du Gouvernement la totalité de leurs ressources, *à moitié prix*, si l'administration a besoin de faire transporter des troupes et un matériel militaire ou naval.

Enfin, en ce qui concerne les chemins de fer de Tours à Nantes et d'Orléans à Bordeaux, la loi du 6 août 1850 dispose « que les compagnies seront tenues de transporter, *à leur prix de revient*, les troupes de toutes armes voyageant en corps ; les militaires voyageant isolément continuant de jouir de la réduction de *moitié de la taxe du tarif*.

Il importe de déterminer, d'une manière très-précise, la ligne de conduite que les fonctionnaires de l'intendance devront suivre en présence de dispositions aussi diverses. A cet effet, je vais examiner celles qui sont propres à chacune des périodes que je viens de passer en revue.

1re PÉRIODE.

(Du 7 juin 1826 au 29 juin 1833.)

Aucune obligation définie n'étant imposée aux compagnies, les fonctionnaires de l'intendance devront passer des conventions spéciales ou périodiques, selon qu'ils y seront autorisés, et rechercher les conditions les plus favorables à l'Etat ; mais le silence de la loi n'affaiblit en rien le droit imprescriptible de réquisition qui est acquis au Gouvernement, toutes les fois qu'il s'agit du maintien de l'ordre et de la défense du territoire, droit dont l'administration reste toujours libre d'user lorsque de pareilles circonstances se présentent.

2e PÉRIODE.

(Du 9 juillet 1835 au 24 mai 1837.)

Les stipulations légales étant communes à tous les transports de troupes, il ne saurait exister aucune incertitude sur les droits de l'administration.

S'il s'agit de corps ou de détachements dont le transport exige seulement la formation additionnelle d'un ou de plusieurs convois, sans interrompre le mouvement commercial du chemin de fer, le fonctionnaire de l'intendance, ou son suppléant légal, informera la

compagnie, par un *avis* dont je crois devoir joindre ici la formule (n° 1); il conviendra que cet avis soit toujours adressé le plus longtemps possible avant le jour du départ de la troupe, afin de donner aux compagnies toutes les facilités désirables pour réunir le matériel nécessaire.

Une *réquisition* conforme à la formule également ci-jointe (n° 2) sera adressée, lorsqu'il y aura lieu de constituer les compagnies en demeure de mettre immédiatement à la disposition de l'administration « *tous les moyens de transport affectés à l'exploitation du chemin de fer* », et de les réserver momentanément aux besoins exclusifs de l'armée.

3e PÉRIODE.

(Du 17 juillet 1837 au 7 juillet 1844.)

Les recommandations qui précèdent sont entièrement applicables à la 3e période, en ce qui concerne les corps ou détachements.

4e PÉRIODE.

(Du 26 juillet 1844 jusqu'à ce jour.)

Les lois votées pendant cette période, sauf celle du 6 août 1850, qui sera ci-après l'objet d'une prescription spéciale, ont fait une distinction entre le transport des troupes suivies de leurs bagages seulement, et le transport des troupes accompagnées d'un matériel militaire ou naval. Il y a lieu de préciser, par suite, dans quels cas les départements de la guerre et de la marine jouiront de la réduction des *trois quarts* du tarif, et dans quelles occasions ils devront payer *la moitié de la taxe*.

Pour arriver à cette solution, il suffit de reproduire les termes mêmes de la loi. *Le voyage en corps* s'applique aux corps entiers et aux fractions de corps dont la moindre force doit être de *six hommes*, chiffre au-dessous duquel les militaires sont considérés comme *voyageant isolément*. Conséquemment, toute force de six hommes du même corps (montés ou non montés) et au-dessus, sera transportée avec réduction *au quart de la taxe du tarif*, pour les hommes et pour les chevaux. Dans cette catégorie, seront comprises toutes les troupes qui n'auront pas avec elles un matériel militaire ou naval : ainsi, l'infanterie, la cavalerie, l'artillerie sans son matériel, le génie sans son matériel, les équipages militaires sans leurs voitures.

L'adjonction d'un matériel militaire ou naval aux troupes de toutes armes, élève à *la moitié des taxes légales* les prix à payer par les départements de la guerre et de la marine pour les hommes et pour les chevaux.

De même que pour la 2e et la 3e période, les fonctionnaires de l'intendance, ou leurs suppléants légaux, procéderont par voie de *simple avis*, toutes les fois qu'il s'agira de transports ordinaires; on réservera la formalité de la *réquisition* pour le cas où, selon les

expressions de la loi, l'administration aurait à exiger des compagnies qu'elles missent à sa disposition *toutes les ressources d'exploitation des chemins de fer*.

LOI DU 6 AOUT 1850.

Les lois des 26 juillet 1844 (Orléans à Bordeaux) et 19 juillet 1845 (Tours à Nantes), avaient stipulé, en faveur de la guerre et de la marine, les avantages qui viennent d'être définis au titre de la 4e période. Lors de la modification qui fut apportée aux clauses et conditions de la concession de ces chemins, l'Assemblée nationale, voulant garantir plus particulièrement encore les intérêts du Trésor, a réduit au *prix de revient* le remboursement à effectuer à ces compagnies pour le transport des troupes de toutes armes.

Cette disposition étant purement fiscale, les fonctionnaires de l'intendance n'auront pas à s'y arrêter pour assurer l'exécution des transports qui seront ordonnés sur les chemins susmentionnés, et ils procéderont, selon le cas, par voie d'avis ou de réquisition, conformément à ce qui a été indiqué ci-dessus. Seulement, comme la prescription législative exigera un accord préalable de mon administration avec les compagnies, les fonctionnaires de l'intendance devront me réserver, dans ce dernier cas, le soin d'ordonnancer directement le prix du transport des troupes.

Ils auront à mandater, au contraire, en faveur de tous les autres chemins de fer, le montant des sommes qui pourront leur être acquises; mais ils s'en abstiendraient pour laisser intacte l'action de mon département, si les compagnies élevaient des prétentions qui sortissent des limites tracées dans les présentes instructions; ils se borneraient alors à transmettre les pièces justificatives de la dépense, pour que le montant en fût acquitté sur ordonnance directe, après liquidation ministérielle.

Je joins à la présente circulaire les modèles des justifications qui devront être produites pour valider les créances.

Dans le but de vous mettre à même d'établir, d'une manière parfaitement exacte, les prix à allouer aux compagnies, je vous envoie en outre, ci-inclus, pour être annexé au tableau que je vous ai adressé le 13 juin dernier, un état présentant la décomposition, en *prix de péage* et prix de *transport*, des tarifs faisant suite aux lois de concession. Cet état servira à calculer l'impôt du dixième et du décime en sus, exigible pour les voyageurs, sur la fraction du *transport* proprement dit.

Quant au *matériel militaire qui ne serait pas à la suite d'une troupe*, je me réserve de vous adresser prochainement des instructions pour vous faire connaître les conventions qui seront intervenues à ce sujet entre mon département et les compagnies de chemins de fer.

Recevez, etc.

Le Ministre de la guerre,
Signé: RANDON.

DIVISION MILITAIRE.

SOUS-INTENDANCE

d

FORMULE N° 1.

(1) Indiquer le corps ou détachement.
(2) Indiquer le lieu de départ.
(3) Indiquer le lieu de destination.
(4) Indiquer le jour et l'heure.

	NOMBRE d'hommes.	NOMBRE de chevaux.	QUANTITÉS de matériel.
EFFECTIF.			
Officiers supérieurs. . .			»
Officiers. . .			»
Sous-officiers et soldats. . .			»
MATÉRIEL.			
TOTAUX. .			

Monsieur,

Il est prescrit (1)
dont la force est indiquée au tableau ci-contre,
de partir d (2) par le chemin
de fer pour (3) où cette troupe
devra être arrivée le (4) à
heure du

En conséquence, et en conformité des dispositions de la loi de concession, qui déterminent les obligations de votre compagnie envers le département de la guerre, je vous invite, sur le vu de la feuille de route qui vous sera présentée par l'officier commandant, à faire transporter le (1) à sa destination.

Je vous prie de vous concerter avec moi pour régler le départ de manière à ce que la troupe puisse être rendue en temps utile.

Monsieur (*Indiquer la qualité, directeur, chef de service, etc.*)

DIVISION MILITAIRE.

SOUS-INTENDANCE

d

(1) Nom et qualité du fonctionnaire.

FORMULE N° 2.

RÉQUISITION.

	NOMBRE d'hommes.	NOMBRE de chevaux.	QUANTITÉS de matériel.
EFFECTIF.			
Officiers supérieurs. . .			»
Officiers. . .			»
Sous-officiers et soldats. . .			»
MATÉRIEL.			
TOTAUX. .			

Nous (1) en conformité des dispositions de la loi de concession, qui déterminent les obligations de la compagnie du chemin de fer d envers l'État, requérons, au nom du ministre, l'administration de ce chemin de mettre immédiatement a la disposition du département de la guerre toutes ses ressources d'exploitation, pour le transport des troupes et du matériel dont l'importance est indiquée ci-contre.

En conséquence, l'administration du chemin de fer nous communiquera, sans aucun retard, l'état du matériel dont la compagnie peut disposer sur toute la ligne, et se concertera immédiatement avec l'autorité militaire et avec nous pour régler la force des convois et les heures de départ.

Monsieur (*Indiquer la qualité, directeur, chef de service, etc.*)

J. M.

MINISTÈRE DE LA GUERRE.

TRANSPORTS PAR CHEMINS DE FER.

Nomenclature des pièces à produire pour la justification des créances de transports de troupes et de matériel à leur suite.

1° Copie conforme, en double expédition, de l'avis ou de la réquisition concernant le transport. (Formule n° 1 ou Formule n° 2, selon le cas.)

2° Etat, en double expédition, de l'effectif et du matériel à la suite de la troupe transportée, établi conformément au modèle ci-après :

DIVISION militaire.
—
Sous-Intendance d

(1)

Composition de l'effectif et du matériel constatés par la revue de départ passée au moment de l'embarquement.

	NOMBRE d'hommes.	NOMBRE de chevaux	QUANTITÉS de matériel.	OBSERVAT.
EFFECTIF. —				
Officiers supérieurs.			»	
Officiers.			»	
Sous-officiers et soldats..			»	
MATÉRIEL. —				
(2)				
TOTAUX. . .				

A le 18 .

Le Sous-Intendant militaire,

(1) Indication du corps ou du détachement.

(2) Détail du matériel.

3° Facture, en double expédition, dont une sur papier timbré dans la forme du modèle ci-dessous.

(1) Indication du chemin de fer.

(2) Au prix, à la moitié ou au quart, selon la loi de concession.

(3) Indication de l'article.

(4) Date de la loi.

(5) Indication du corps ou détachement.

(6) Détail du matériel.

CHEMIN DE FER d (1)

Facture des transports de troupes et de matériel, exécutés a (2) de la taxe du tarif légal, en conformité de l'article (3) du cahier des charges annexé à la loi de concession du (4)

PRIX DU TARIF.

Voyageurs. { 1re classe. 0 » / 2e classe. 0 » / 3e classe. 0 } par personne et par kilomètre, y compris l'impôt du dixième et décime en sus.

Chevaux. . . . . 0 » par tête et par kilomètre.

Matériel. . . . . 0 » par 1000 kilogrammes et par kilomètre.

Date du transport.	LIEUX de départ et de destination.	Nombre de kilom. parcourus.	Vitesse employée.	TROUPES transportées.	Nombre de militaires.	Indication des classes.	Nombre de chevaux.	Quantité de matériel.	PRIX calculés à raison du nombre de kilom. franchis, et réduits à (2)	DÉCOMPTE	OBSERVATIONS.
				(5)							
				EFFECTIF. —							
				Officiers supérieurs. .			»	»			
				Officiers. . .			»	»			
				Sous-officiers et soldats..			»	»			
				Chevaux. . .				»			
				MATÉRIEL. —							
				(6)							
									TOTAL..		

A le 185 .

Vu : *Le*

	DATES DES LOIS.	COMPA
	7 juin 1826. . .	Saint-Étienne à Lyon. . . . .
1re PÉRIODE.	27 août 1828. . .	Andrezieux à Roanne. . . . .
1823 à 1835.	26 avril 1833. . .	Montbrison à Montrond. . . . .
	29 juin 1833. . .	Alais à Beaucaire. . . . .
	9 juillet 1835. . .	Paris à Saint-Germain. . . . .
2e PÉRIODE.	9 juillet 1836. . .	Montpellier à Cette. . . . .
1835 à 1837.	9 juillet 1836. . . et 24 mai 1837. . .	Paris à Versailles. { Rive droite. Rive gauche.

N° 201.

OBLIGATIONS

DES

COMPAGNIES DE CHEMINS DE FER

ENVERS

LES DÉPARTEMENTS DE LA GUERRE ET DE LA MARINE.

	DATES DES LOIS.	COMPAGNIES DE CHEMINS DE FER.	NULLE OBLIGATION IMPOSÉE AUX COMPAGNIES. PRIX PAR KILOMÈTRE.				
			VOYAGEURS.			Chevaux.	Tonnes de marchandises.
			1re classe.	2e classe.	3e classe.		
	7 juin 1826. . .	Saint-Étienne à Lyon.	»	»	»	»	»
1re PÉRIODE.	27 août 1828. . .	Andrezieux à Roanne.	»	»	»	»	»
1823 à 1835.	26 avril 1833. . .	Montbrison à Montrond.	»	»	»	»	»
	29 juin 1833. . .	Alais à Beaucaire.	»	»	»	»	»
	9 juillet 1835. . .	Paris à Saint-Germain.	»	»	»	»	»
2e PÉRIODE.	9 juillet 1836. . .	Montpellier à Cette.	»	»	»	»	»
1835 à 1837.	9 juillet 1836. . . et 24 mai 1837. . . .	Paris à Versailles. { Rive droite.	»	»	»	»	»
		Rive gauche.	»	»	»	»	»
	17 juillet 1837. . .	Bordeaux à la Teste.	»	»	»	»	»
	Idem.	Mulhouse à Thann.	»	»	»	»	»
	15 juillet 1837. . .	Paris à Orléans (avec embranchement sur Corbeil).	»	»	»	»	»
3e PÉRIODE.	*Idem*.	Paris à Rouen.	»	»	»	»	»
1837 à 1844.	29 octobre 1840. . (Annexe).	Strasbourg à Bâle.	»	»	»	»	»
	11 juin 1842. . .	Rouen au Havre.	»	»	»	»	»
	24 juillet 1843. . .	Marseille à Avignon.	»	»	»	»	»
	7 juillet 1844. . .	Montpellier à Nîmes.	»	»	»	»	»
	26 juillet 1844. . .	(3) Orléans à Bordeaux.	»	»	»	»	»
	Idem.	Centre (Orléans à Bourges et à Châteauroux).	»	»	»	»	»
	5 août 1844. . .	Paris à Sceaux.	»	»	»	»	»
	9 septembre 1844.	Amiens à Boulogne.	»	»	»	»	»
	14 décembre 1844.	Montereau à Troyes.	»	»	»	»	»
4e PÉRIODE.	15 juillet 1845. . .	Nord (Paris à Lille, Calais, Dunkerque, Saint-Quentin, etc.).	»	»	»	»	»
1844 à 1851.	16 juillet 1845. . .	Paris à Lyon et à Avignon.	»	»	»	»	»
	19 juillet 1845. . .	(3) Tours à Nantes.	»	»	»	»	»
	Idem.	Paris à Strasbourg.	»	»	»	»	»
	Idem.	Dieppe et Fécamp (Embranchement sur le chemin de fer de Rouen au Havre.).	»	»	»	»	»
	Idem.	Aix (Embranchement avec le chemin d'Avignon à Marseille.).	»	»	»	»	»
	11 mai 1851. . .	Versailles à Rennes.	»	»	»	»	»

OBLIGATION, POUR LES COMPAGNIES, de mettre à la disposition du Gouvernement la totalité de leurs ressources, à moitié prix, si l'administration a besoin de faire transporter des troupes et un matériel militaire.					OBLIGATION, POUR LES COMPAGNIES, 1° D'exécuter, à moitié prix, les transports de militaires voyageant en corps ou isolément avec leurs bagages; 2° De mettre à la disposition du Gouvernement la totalité de leurs ressources, à moitié prix si l'administration a besoin de faire transporter des troupes et un matériel militaire.					OBLIGATION, POUR LES COMPAGNIES, 1° D'exécuter, à moitié de la taxe du tarif, le transport des militaires et marins isolés et de leurs bagages; 2° D'exécuter, au quart de la taxe du tarif, le transport des corps et détachements et de leurs bagages; 3° De mettre à la disposition du Gouvernement la totalité de leurs ressources, à moitié prix, si l'administration a besoin de faire transporter des troupes et un matériel militaire ou naval.					OBSERVATIONS.
PRIX PAR KILOMÈTRE.					PRIX PAR KILOMÈTRE.					PRIX PAR KILOMÈTRE.					
VOYAGEURS.			Chevaux.	Tonnes de marchandises.	VOYAGEURS.			Chevaux.	Tonnes de marchandises.	VOYAGEURS.			Chevaux.	Tonnes de marchandises.	
1re classe.	2e classe.	3e classe.			1re classe.	2e classe.	3e classe.			1re classe.	2e classe.	3e classe.			
»	»	»	»	»	»	»	»	»	»	»	»	»	»	»	Dans le prix des places des voyageurs, on n'a pas compris l'impôt du dixième, dû au Trésor, et décime en sus, que les compagnies ajoutent toujours au taux du tarif.
»	»	»	»	»	»	»	»	»	»	»	»	»	»	»	
»	»	»	»	»	»	»	»	»	»	»	»	»	»	»	Le prix est du double pour le transport des chevaux et des marchandises à la vitesse des voyageurs, excepté, toutefois, pour le chemin de fer d'Avignon à Marseille, dont le cahier des charges porte à 40 c. le prix du transport des marchandises seulement, le prix du transport des chevaux restant du double.
»	»	»	»	»	»	»	»	»	»	»	»	»	»	»	
»	»	0f 075	0f 06c	0f 16c	»	»	»	»	»	»	»	»	»	»	
»	0f 075	0 05	0 10	0 16	»	»	»	»	»	»	»	»	»	»	(1) L'adjudication a eu lieu au rabais sur le prix de 1 fr. 80 c. par tête, pour le transport des voyageurs et pour toute la distance à parcourir.
»	»	(1) 0 98	0 06	0 16	»	»	»	»	»	»	»	»	»	»	
»	»	(1) 1 72	0 06	0 16	»	»	»	»	»	»	»	»	»	»	
»	»	»	»	»	»	0f 075	0f 05	0f 10c	0f 16c	»	»	»	»	»	
»	»	»	»	»	»	0 08	0 06	0 10	0 17	»	»	»	»	»	(2) Le cahier des charges annexé à l'ordonnance du 15 juillet 1837 avait porté le prix des places de 3e classe à 0 fr. 05 c.; mais un décret, en date du 20 mars 1848, a élevé ce prix à 0 fr. 055.
»	»	»	»	»	0f 10	0 075	(2) 0 055	0 15	0 20	»	»	»	»	»	
»	»	»	»	»	0 125	0 10	0 075	0 15	0 20	»	»	»	»	»	
»	»	»	»	»	0 10	0 075	0 05	0 15	0 20	»	»	»	»	»	
»	»	»	»	»	0 125	0 10	0 075	0 15	0 20	»	»	»	»	»	
»	»	»	»	»	0 10	0 075	0 050	0 10	0 18	»	»	»	»	»	
»	»	»	»	»	0 10	0 075	0 055	0 10	0 18	»	»	»	»	»	
»	»	»	»	»	»	»	»	»	»	0f 10c	0f 75c	0f 055	0f 10c	0f 18c	(3) Extrait de la loi du 6 août 1850, qui modifie les clauses et conditions de la concession des chemins de fer de Tours à Nantes et d'Orléans à Bordeaux :
»	»	»	»	»	»	»	»	»	»	0 10	0 75	0 055	0 10	0 18	
»	»	»	»	»	»	»	»	»	»	0 10	0 75	0 055	0 10.	0 18	« Article 4. Les compagnies de Tours à Nantes et d'Orléans « à Bordeaux seront tenues de transporter les troupes de « toutes armes voyageant en corps à leur prix de revient. »
»	»	»	»	»	»	»	»	»	»	0 10	0 75	0 055	0 10	0 18	
»	»	»	»	»	»	»	»	»	»	0 10	0 75	0 055	0 10	0 18	« Les militaires voyageant isolément continueront de « jouir du bénéfice du tarif actuel. »
»	»	»	»	»	»	»	»	»	»	0 10	0 75	0 055	0 10	0 18	
»	»	»	»	»	»	»	»	»	»	0 10	0 75	0 055	0 10	0 18	
»	»	»	»	»	»	»	»	»	»	0 10	0 75	0 055	0 10	0 18	
»	»	»	»	»	»	»	»	»	»	0 10	0 75	0 055	0 10	0 18	
»	»	»	»	»	»	»	»	»	»	0 10	0 75	0 055	0 10	0 18	
»	»	»	»	»	»	»	»	»	»	0 10	0 75	0 055	0 10	0 18	
»	»	»	»	»	»	»	»	»	»	0 10	0 75	0 055	0 10	0 18	

N° 205. *DÉCOMPOSITION, en prix de* péage *et prix de* transport, *des Tarifs annexés aux lois de concession des chemins de fer, servant à calculer l'impôt du dixième et du décime en sus exigible, pour les voyageurs, sur la fraction du* transport, *et à déterminer par suite le prix total dû aux Compagnies.*

			PRIX de péage.	PRIX de transport.	PRIX TOTAL.
			fr. c.	fr. c.	fr. c.
Paris à St Germain. . . .		Voyageurs.	0 05	0 025	0 075
		Chevaux.	0 04	0 02	0 06
		Marchandises.	0 10	0 06	0 16
Montpellier a Cette. . .		Voyageurs. Voitures couvertes. .	0 05	0 025	0 075
		Voyageurs. Voitures découvertes.	0 03	0 02	0 05
		Chevaux.	0 06	0 04	0 10
		Marchandises.	0 10	0 06	0 16
Paris à Versailles.	Rive droite.	Voyageurs.	»	»	0 98 (1)
		Chevaux.	0 04	0 02	0 06
		Marchandises.	0 09	0 07	0 16
	Rive gauche.	Voyageurs.	»	»	1 72 (1)
		Chevaux.	0 04	0 02	0 06
		Marchandises.	0 09	0 07	0 16
Bordeaux a la Teste. . .		Voyageurs. Voitures couvertes. .	0 05	0 025	0 075
		Voyageurs. Voitures découvertes.	0 03	0 02	0 05
		Chevaux.	0 06	0 04	0 10
		Marchandises.	0 10	0 06	0 16
Mulhouse a Thann. . . .		Voyageurs. Voitures fermées . .	0 05	0 03	0 08
		Voyageurs. Voitures découvertes.	0 04	0 02	0 06
		Chevaux.	0 07	0 03	0 10
		Marchandises.	0 11	0 06	0 17
Paris a Orléans.		Voyageurs. 1re classe.	0 07	0 03	0 10
		Voyageurs. 2e id.	0 05	0 025	0 075
		Voyageurs. 3e id.	0 03	0 025	0 055
		Chevaux.	0 10	0 05	0 15
		Marchandises.	0 11	0 09	0 20
Paris a Rouen et au Havre.		Voyageurs. 1re classe.	0 08	0 045	0 125
		Voyageurs. 2e id.	0 07	0 03	0 10
		Voyageurs. 3e id.	0 05	0 025	0 075
		Chevaux.	0 10	0 05	0 15
		Marchandises.	0 11	0 09	0 20

(1) Prix fixé pour la distance entière de Paris à Versailles, non compris l'impôt du dixième, lequel se perçoit sur le tiers de ce prix.

LIGATION.
ES COMPAGNIES,
la moitié de la taxe du
ort des militaires et ma-
le leurs bagages;
au quart de la taxe du
ort des corps et déta-
rs bagages;
a disposition du Gouver-
aisé de leurs ressources,
si l'administration a be-
transporter des troupes
militaire ou naval.

AR KILOMÈTRE.

3e classe.	Chevaux.	Tonnes de marchandises.	OBSERVATIONS.
»	»	»	Dans le prix des places des voyageurs, on n'a pas compris l'impôt du dixième, dû au Trésor, et décime en sus, que les compagnies ajoutent toujours au taux du tarif.
»	»	»	
»	»	»	Le prix est du double pour le transport des chevaux et des marchandises à la vitesse des voyageurs, excepté, toutefois, pour le chemin de fer d'Avignon à Marseille, dont le cahier des charges porte à 10 c. le prix du transport des marchandises seulement, le prix du transport des chevaux restant du double.
»	»	»	
»	»	»	(1) L'adjudication a eu lieu au rabais sur le prix de 1 fr. 80 c. par tête, pour le transport des voyageurs et pour toute la distance à parcourir.
»	»	»	

			PRIX de péage.	PRIX de transport.	PRIX TOTAL.
			f. c.	f. c.	f. c.
STRASBOURG A BALE. . . .	Voyageurs.	1re classe.	0 07	0 03	0 10
		2e id.	0 05	0 025	0 075
		3e id.	0 03	0 02	0 05
	Chevaux.		0 10	0 05	0 15
	Marchandises.		0 11	0 09	0 20
MARSEILLE A AVIGNON. . .	Voyageurs.	1re classe.	0 05	0 05	0 10
		2e id.	0 0375	0 0375	0 075
		3e id.	0 025	0 025	0 05
	Chevaux.		0 05	0 05	0 10
	Marchandises.		0 09	0 09	0 13
MONTPELLIER A NIMES, ORLÉANS A BORDEAUX, CENTRE (Orléans à Bourges et à Châteauroux), PARIS A SCEAUX, AMIENS A BOULOGNE, MONTEREAU A TROYES, NORD, PARIS A LYON ET A AVIGNON, TOURS A NANTES, PARIS A STRASBOURG, DIEPPE ET FÉCAMP (Embranchement), AIX (Embranchement), VERSAILLES A RENNES.	Voyageurs.	1re classe.	0 07	0 03	0 10
		2e id.	0 05	0 025	0 075
		3e id.	0 03	0 025	0 055
	Chevaux.		0 07	0 03	0 10
	Marchandises.		0 10	0 08	0 18

COLLATIONNÉ :
Le Chef du Bureau du Secrétariat et des Lois et Archives,
PITTAUD DEFORGES.

CERTIFIÉ conforme :
Paris, le 29 octobre 1851.
Le Secrétaire général,
BOURJADE.

ON THE DETERMINATION
OF THE AMOUNT OF
ORGANIC MATTERS IN DRINKING WATERS,
BY MEANS OF A STANDARD
SOLUTION OF PERMANGANATE OF POTASH.

[*Reprinted from the Journal of the Chemical Society.*]

On the Determination of the Amount of Organic Matters in Drinking Waters, by means of a Standard Solution of Permanganate of Potash.

By Dr. Woods, Army Medical Staff.

The deleterious effects resulting to the health of communities from the presence of organic matter in drinking waters, renders the detection of this contamination a subject of serious importance.

The mere presence may be detected, either by a solution of chloride of gold, or by one of permanganate of potash, a fact already pointed out by several observers, and now widely known.

The determination of the precise amount of organic matter, by the gravimetrical method, offers considerable difficulty, owing to the volatilization of some of the constituents of the salts with which it is ordinarily mixed. The following method, based on the oxidizing power of a solution of chamæleon, and tested by a considerable number of experiments, shows the value of a certain weight of permanganate of potash, as compared with a certain weight of organic matter. Elevation of temperature aids in a high degree the oxidizing power of the salt. Some compounds, owing to their fixed character, or the already high degree of oxidation to which they have attained, remain unaffected; and in all cases a very considerable lapse of time is found to be necessary to complete the process.

All waters I have hitherto examined, decolorized, owing to the organic matters which they contained, certain proportions of the test-solution; and as such organic matters are in most cases similar in character, being derived either from the soil or from sewage contamination, the deoxidizing power which they exert,

is most likely in all cases to produce an influence proportionate to their quantity.

To arrive at the value of a known weight of permanganate of potash, with reference to organic matter, I first determined, by weight, the amount of the latter in a certain measure of sewage. Of a similar sewage fixed quantities were taken, and after dilution with varying amounts of water, rendered acid by sulphuric acid; the action of a standard solution of permanganate of potash was noted.

The points which I found most necessary carefully to attend to, as influencing the results derived from my experiments were:—

1st. The degree of acidity of this solution.

2nd. The temperature of the fluid during the addition of the oxidizing solution.

3rd. The period occupied by the experiment.

With reference to the degree of acidity of a fluid, as affecting the amount of the test-solution required to produce a colour lasting for a certain period, I found that whilst 300 cc. of water, acidified by 2 cc. of sulphuric acid, sp. gr. 1·614*, and heated to 140° Fah., required but 0·32 cc. of the standard solution which I used; 300 cc. of the same water, with 10 cc. of acid, required 6·6 cc. to produce in each case a colour lasting for half an hour.

The fact that the degree of acidity of a fluid affects in a corresponding degree a solution of chamæleon is, of course, well known, and I merely allude to the subject here, as demanding special attention, owing to the very small amount of organic matter (= 0·24 cc. of the test-solution) present in a litre of some waters which I have examined.

Variations in the temperature of the liquids exercised a marked influence on the permanency of the colour produced, enduring for a longer or shorter period; thus a shade of colour, which at a temperature of 140° would have remained permanent for half-an-hour, was rapidly destroyed by raising the temperature to 160°; a change of temperature equal to 10° or 20° Fah., producing marked effects. Now, as the contact of the oxidizing solution with the organic element must be more or less prolonged, to avoid error, it was found necessary that a fixed temperature should be taken for all experiments.

* The sp. gr. of the acid used in all the experiments = 1·614. The quantities of the test-solution necessary to produce permanent coloration were found to vary in each case, with varying quantities of acid, and not to follow any fixed relation that could be observed.

A large number of experiments, in which the liquid containing organic matter and a proportion of sulphuric acid, was heated to 140° Fah., the heating apparatus being removed prior to the addition of the test-solution, gave as results:—that 1·24 cc. of the test-solution, containing 0·00124 grms. of permanganate of potash, produces a colour permanent for half-an-hour, in a liquid made up of 300 cc. of water, 2 cc. sulphuric acid, and 0·005 grms. organic matter.

Deducting 0·24 cc., the amount, as determined by previous experiment, decolorized by a corresponding quantity of acid and pure distilled water, we have 1 cc. or 0·001 grms. of permanganate of potash, equivalent to 0·005 grms. organic matter. To ascertain the correctness or otherwise of the results just stated, I instituted two other series of experiments. In the first, I added to known quantities of water sewage and acid, at ordinary temperatures, successive small quantities of the standard test-solution, until a colour permanent for 12 hours was produced. In the second series, I added at one time the total quantity found necessary in the first. The results may be briefly stated as follows:—

1st. That the time necessary for the total oxidation of organic matter in waters at ordinary temperatures, varies with the amount, the decolorization of the oxidizing solution requiring from 24 to 48 hours.

2nd. That within a minute proportion, varying from 0·01 to 0·02 cc., twice the amount of the test-solution was required to complete the experiment at ordinary temperatures, to that found necessary when the liquid was heated. A proportion of the permanganate solution however undergoes deoxidation by causes independent of the action of organic matter, the amount depending on the value of each addition, or in other words, on the strength of the solution. Thus I found, that in an acid liquid, made up of 300 cc. of water and 2 cc. of sulphuric acid, a proportion of the test-solution equal to 0·1 cc., was destroyed in each successive period of 24 hours, when the addition did not exceed 0·50 cc.; but that when larger quantities were added, the amount decomposed might equal 0·50 cc. This variable decomposition, therefore, renders results derived from experiments performed on waters at ordinary temperatures, of less value than those deduced when the liquid is heated, and the time occupied by the experiment reduced to a minimum.

In the drinking waters which I have examined, employing an elevated temperature, I found that the smallest quantity required

of the test-solution was 0·24 cc., and the largest 7·5 cc., to produce a colour permanent for half-an-hour, in a litre of the fluid submitted to examination; thus indicating the presence in one case of 0·0840, and in the other of 2·62 grains in a gallon.

The former water, derived from the chalk strata, and furnished by the Chatham Water-works, is thus shown to be, as we should *a priori* expect, an extremely pure liquid, whilst the latter, derived from the same geological series, but taken from a pump in close juxtaposition to a cesspool, is shown to be largely impregnated with organic impurities, and had to be discontinued for household purposes by a family, in whom its use produced serious diarrhœa, which immediately ceased when the purer liquid supplied by the town water-works was substituted. In another water examined, and in which 0·96 cc. of the test-solution were required, affording evidence of the presence of 0·336 grains in a gallon, no bad effects, so far as I could learn, resulted; but in this case filtration was had recourse to previous to use. It is to be hoped future researches will give us a more definite knowledge on this head; but with my present experience, I should reject all waters which afford evidence of the presence of half a grain of organic matter in a gallon, as determined by the test-solution. It must not be left out of view that the presence of iron, in the state of protoxide, in the water, will, if in any quantity, seriously interefere with our deductions, and should therefore be taken into account.

After what has preceded, little need be stated as to the mode of performing the experiment. For ordinary valuation, a solution of chamæleon containing 0·001 grm. in each cubic centimeter will suffice, if made on each occasion immediately prior to being used; but as such a solution undergoes deoxidation by keeping, it should be graduated before employing it in any experiment, in such a manner that 13 cc. will produce a colour permanent for half-an-hour in 300 cc. of pure distilled water, to which 40 cc. of a solution of oxalic acid containing in each cc. 0·00063 grm. and 2 cc. of strong commercial sulphuric acid have been added. A litre of the water whose purity we require to determine, is the most convenient quantity to take. After the addition of 2 cc. of commercial sulphuric acid, the liquid should be heated in a perfectly clean and white porcelain dish to 140° Fah. when any further application of heat must be avoided. The test-solution should then be added, beginning with even minute quantities—con to two drops at a time—and waiting after each addition for the total

disappearance of colour. When a shade persistent for half-an-hour has been produced, we may consider the experiment as at an end. It is convenient and useful to have on the table a second porcelain dish, containing a quantity of the water, by comparison with which we may be made aware of the total disappearance of colour from the liquid under examination. Assuming as correct the conclusions at which I have arrived, namely that 1 cc. of the test-solution corresponds to 0·005 grm. of organic matter, a simple calculation suffices to give us the number of grains in a gallon. Thus, let us suppose 1·24 cc. of the test-solution were required to produce a shade persistent for the necessary time, deducting 0·24 cc. for the quantity corresponding to 1000 cc. of distilled water, and 2 cc. of sulphuric acid, we should have remaining 1 cc. as corresponding to the amount of organic matter present, therefore $1 \times 0{\cdot}005 = 0{\cdot}005$ grm. in a litre, which, multiplied by 70, gives, as a sufficiently accurate result, 0·350 grains in a gallon. When our chamælcon solution is not of the exact titre indicated, we can yet easily determine, from the amount required by the oxalic acid solution of known strength, the volume equivalent to a certain quantity of organic matter. Thus, let us suppose we have used 26 cc. instead of 13 cc. to produce a lasting colour in the oxalic acid solution, then $\frac{26 \times 1}{13} = 2$ cc. equal to 0·005 grm. of organic matter.

PRINTED BY HARRISON AND SONS, ST. MARTIN'S LANE, W.C.

REPORT

OF THE

COMMITTEE OF VISITORS

OF THE

Bedford Lunatic Asylum,

FOR THE YEAR ENDING

THE 31ST OF DECEMBER, 1857.

WITH APPENDIX.

BEDFORD:
PRINTED BY W. C. GREY, BOOKSELLER, ETC.
MDCCCLVIII.

THE COMMITTEE OF VISITORS,

FOR THE YEAR, 1858.

FOR THE COUNTY OF BEDFORD.

THOMAS CHARLES HIGGINS, Esq., Chairman, *Turvey, Newport*
JOHN HARVEY, Esq., *Ickwell Bury, Biggleswade.* [*Pagnel.*
LIEUT. COLONEL HIGGINS, *Picts Hill, Newport Pagnel.*
HENRY LITTLEDALE, Esq., *Kempston, Bedford.*
CHARLES MOORE, Esq., *Maulden, Silsoe.*
WILLIAM ST. QUINTIN, Esq., *Goldington, Bedford.*
WILLIAM LYNN SMART, Esq., *Linden, Woburn.*
CAPTAIN WILLIAM STUART, *Kempston, Bedford.*
WILLIAM HENRY WHITBREAD, Esq., *Southill, Biggleswade.*
REV. CHAS. COLYEAR BEATY-POWNALL, *Milton Ernest, Bedford.*

FOR THE COUNTY OF HERTFORD.

THE MOST NOBLE THE MARQUIS OF SALISBURY, K. G., *Hatfield.*
RIGHT HON. THE EARL OF VERULAM, *Gorhambury St. Albans.*
THE RIGHT HON. THE LORD DACRE, *The Hoo, Welwyn.*
WILLIAM FRANKS, JUNR., Esq., 2, *Upper Hyde Park Sreet,*
THOMAS MILLS, Esq., M.P., *Tolmers, Hertford.* [*London,* W.
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GEORGE ROBERT MARTEN, Esq., *Marshalls Wick, Sandridge.*
WILLIAM WILSHERE, Esq., *The Thryfte, Welwyn.*
MARLBOROUGH PRYOR, Esq., *Weston, Stevenage.*
REV. FREDERICK SULLIVAN, *Kimpton, Hitchin.*

FOR THE COUNTY OF HUNTINGDON.

COLONEL LINTON, *Stirtloe House, Buckden.*
GEORGE THORNHILL, Esq., *Diddington, Buckden.*
GEORGE WILLIAM ROWLEY, Esq., *The Priory, St. Neots.*
GEORGE RUST, Esq., *Cromwell House, Huntingdon.*
CAPTAIN WILLIAM HUMBLEY, *Eynesbury, St. Neots*
PHILIP TILLARD, Esq., *Stukeley Hall, Huntingdon.*
REV. JAMES LINTON, *Hemingford Abbotts, St. Ives.*

REPORT.

—o—

To Her Majesty's Justices of the Peace of the united Counties of Bedford, Hertford, and Huntingdon, in Quarter Sessions assembled.

The annual report of the Committee of Visitors of the Lunatic Asylum, for the said counties, presented in pursuance of the provisions of "The Lunatic Asylums' Act, 1853."

The number of admissions, discharges, deaths, and removals during the year, are contained in the annexed table.

ADMISSIONS.	M.	F.	T.
Patients in the Asylum, Dec. 31st, 1856	154	157	311
Absent upon trial, on same date	0	1	1
Received during the year	33	56	89
Total	187	214	401
DISCHARGES, ETC.	M.	F.	T.
Patients discharged—recovered	10	19	29
" " relieved	9	7	16
" " not improved	0	0	0
Removed to other Asylums	31	30	61
Died	12	16	28
	62	72	134
Patients in the Asylum, Dec. 31st, 1857	125	142	267
Total	187	214	401

The patients in the Asylum on the 31st December, 1857, belonged to the following Counties, &c., viz. :—

NAME OF COUNTY, ETC.	M.	F.	T.
Bedfordshire	52	54	106
Hertfordshire	53	55	108
Huntingdonshire	18	29	47
Borough of Bedford	2	4	6
Total	125	142	267

The daily average number of patients maintained in the Asylum during the year has been 304, shewing a decrease of 3 compared with the year 1856.

The patients who have been employed during the year in industrial occupations, average 200, viz. : males 86 ; females 114 ; being a decrease of 16, viz : males 4 ; females 12.

The numbers who have attended divine service in Chapel during the year average 92, or a decrease of 20.

The number of deaths during the year is 28, being a mortality after the rate of 7 per cent., or a decrease of 3.7 compared with the preceding year.

The Committee, in the first place, revert to the minute of the Commissioners in Lunacy on their visit to the Asylum, December 12th, 1856, (inserted in the last annual report).

The Committee, at the annual meeting in February last, discussed the various suggestions and recommendations of the Commissioners, the result of which is contained in the following memoranda :—

1. The harmless and incurable cases are discharged as frequently as the Resident Medical Superintendent finds such patients fit to be recommended to the committee for that purpose, and Mr. Denne will continue to direct his attention to that subject.

2. Matting has already been provided for some of the stone and slate floors, and an additional quantity will be provided for the other sleeping apartments.

3. Many of the perpendicular bars have already been removed under a former order of the committee, and the residue will be taken down as early as practicable.

4. The walls of the airing courts will be improved as far as it may be considered advisable to alter the structural arrangements of the building.

5. The patients are frequently taken out in the country in large numbers, and the Committee have granted small sums towards excursion trips ; the same course will be continued by Mr. and Mrs. Denne.

The Committee in their last annual report, expressed an opinion that it was not desirable under the then existing circumstances, to enter into arrangements for the purpose of securing temporary accommodation for the pauper patients who could not be received into this Asylum. Subsequently, however, through the heavy pressure of applications for the admission of patients from the united Counties, the Committee reconsidered the question, and determined upon contracting with some one or more other Institutions for the reception of a limited number of patients in order to afford room for a greater number of curable cases in this Asylum.

Accordingly, negociations were set on foot for the purpose, and eventually terms were agreed upon with the Committee of Visitors of the County and City of Worcester Asylum, at Powick, for the lodging, maintenance, &c., of 30 male patients, at the rate of payment of 11s. 6d. per week, exclusive of the costs of removal, conveyance, or burial.

The Committee have also agreed with Dr. Finch, proprietor of Fisherton House Asylum, near Salisbury, for the reception of 30 female patients into his establishment upon similar conditions to the Worcester Asylum, at the weekly rate of payment of Thirteen shillings. The terms and conditions thus agreed to were severally embodied into formal contracts, and

submitted to the Commissioners in Lunacy, as required by law, and were eventually approved by the Right Honorable Sir George Grey, Bart., Secretary of State for the Home Department. The Contracts are to be determined on the 30th June, 1860.

Afterwards, 30 patients of each sex were removed accordingly, and the Committee directed a circular to be issued to the several Boards of Guardians in the united Counties, stating that the Committee proposed to fill up the vacancies occasioned by the last-mentioned removals from the pauper lunatics who were then residing with their friends, or were confined in work-houses, or either of them, and who might be considered proper objects to be confined in an asylum. The Committee are happy to report that from the replies received to this circular, it appeared there were only 10 patients in the three counties of the classes last referred to. The Committee then finding that the patients from these two sources would be insufficient to fill up the vacancies, caused a further inquiry to be made as to the number of patients in other asylums and licensed houses, which it would be desirable to remove to this asylum, and at the date of this report there have been 20 applications for such removals, all of which have been or are about to be effected. The principal result of this proceeding will be to bring almost all the pauper lunatics in the united Counties under the immediate control of

the Committee of Visitors, and to afford facilities for the admission of curable cases as they may from time to time arise.

The Committee have the satisfaction of stating that the improved condition of the patients referred to in the last annual report has continued during the year, and that they have had pleasure in awarding a gratuity to the Resident Medical Superintendent for his efficient services, rather than to increase his salary, which the Committee did not wish to decide at this time, as 'ere long some completely new arrangement must necessarily be made.

The management of the housekeeping department, as well as the garden and farm, has been satisfactory to the Committee. They have awarded the House Steward a gratuity as an expression of this opinion.

The Committee report that they have made a regulation in favor of such of the female ward attendants, who have been in the service of the Asylum for a period of two years, which they believe will be attended with beneficial results. The object of the regulation is to give them leave of absence once a year, and one at a time, for a fortnight, to enable them to obtain a change of scene, with a weekly allowance of seven shillings each for board wages during such permitted absence.

The Committee report that a new bath-room has been constructed on the female side. The Commissioners in Lunacy have addressed a circular on the subject of the construction, employment, and mode of administration of baths, together with the regulations prepared by them and recommended for adoption, which the Committee referred to the Resident Medical Superintendent to carry out as far as practicable.

The Commissioners in Lunacy made their annual inspection of the Asylum on the 5th and 6th of August last.

The following is a record of their visitation :—

"Bedford Lunatic Asylum, August 5th and 6th, 1857.

"Since the last visit of the Commissioners, on the 12th December, 1856, 48 patients have been admitted, 25 have been discharged, and 12 have died; the prevailing cause of death having been general paralysis.

"There are now 323 patients in this Asylum, viz.: 154 males and 169 females. Eight patients are registered as being at present under medical treatment, and three as having been secluded during the last week.

"We have, during the above two days, seen the patients and inspected their day-rooms, galleries, and bed-rooms. With the exception of two cases (one of each sex) the patients were generally tranquil. About 86 men and 130 women are employed in various ways, and about 98 (53 men and 45 women) attended Chapel last Sunday.

"We have also noted the various suggestions made by the Commissioners on their last visit to the Asylum.

"Learning from enquiring that the new Asylum intended for the patients is commenced, we forbear from making several suggestions which occur to us from the very imperfect structure of the present establishment.

"There are several points however that do not relate to the building, and that are not likely to involve considerable outlay, that we feel bound to bring again under the notice of the Committee of Visitors, and earnestly to recommend their adoption.

1. It appears to us indispensable that the Infirmaries should be supplied generally with better bedding, and that there should be a large provision of water beds and water pillows. We do not think that straw beds or pillows are fit for any of the sick or infirm patients, more especially for those who have, or are likely to have bedsores.

2. The female wing is throughout infested by bugs, which are also found in various other parts of the asylum.

"With a view of preventing the increase of these, and of rendering the patients (some of whom are much annoyed and disturbed at night) more comfortable, we beg to suggest that the whole of the series of wooden partitions, now forming very small single rooms, should be swept away, and the wings on each side be converted into two dormitories. The old wooden bedsteads should be removed (some of them may be used in forming sun shades and seats in the grounds), and iron bedsteads provided. These would serve for the new asylum, and by proper precautions might be ensured against harbouring any insects.

"3. The means of washing are exceedingly scanty, quite insufficient for the large numbers now in the asylum. Jugs and basins should be purchased and placed in the bedrooms. These might be removed when necessary to the new asylum now in the course of building.

"4. Coir or cheap matting (in small quantities) should be placed in each of the bedrooms having stone or slate flooring.

"5. The ventilation in parts of the asylum requires attention.

"6. The dress of the patients is in the course of improvement as we understand. We recommend that the use of the grey cloth (adopted in prisons) be discontinued.

"7. We recommend that the front walls should be removed, so as to give the patients a more cheerful view—that the division walls be lowered to half their present height—and that some cheap creeping plants be placed so as to cover the outer or boundary walls.

"8. It appears to us scarcely practicable for one medical gentleman to superintend and manage the details of an asylum of this size and character,

without some assistance. At present there are 323 patients in this asylum, the construction and inconveniences of which greatly add to the labor and responsibility of the Superintendent's office.

"9. Considering the crowded state of the establishment, we recommend that more patients should be sent out on leave, and some chronic harmless cases remitted to their workhouses. We think that 3s. 6d. per week is an insufficient allowance for the patients who may be absent on leave. The pressure on all licensed houses and most of the asylums is at present so great, that there is no probability of obtaining admission for patients elsewhere. We therefore think it our duty once more to bring under the consideration of the Visitors the expediency of renting some place for patients until the new asylum shall be completed.

"10. More patients should be taken out for exercise beyond the limits of the asylum. Whether the staff of male attendants and nurses (especially of nurses) be sufficient for this purpose, must be left to the decision of the medical superintendent. Who, as well as the matron, are manifestly most careful and anxious for the well being of the asylum and its inmates.

B. W. PROCTER, JAMES WILKES, } Commissioners in Lunacy.

The Committee report that with reference to the recommendation No. 2, they have directed that the wooden partitions in the two wings which form eight small single rooms to be removed, so as to form two dormitories in each wing, and they have further directed that the wooden bedsteads be taken away and those of iron substituted.

The Committee are enabled to report that these alterations have been partly executed, and the residue are in progress, and will be shortly completed. Various other alterations and improvements (not involving structural works) have been effected for the greater comfort and convenience of the patients.

The Committtee do not consider they would be justified in incurring any large outlay in the alteration of the present buildings, as the occupation of the new Asylum cannot be very far distant.

The Committee have visited the Asylum regularly throughout the year, and they report that its state and condition, as well as its management and the care of the patients, are as good under existing circumstances as can be expected.

The Committee, lastly, report that the average rate of payment during the year has been 8s. 9d., or a decrease of 1s. 3d. per head per week, compared with last year.

Signed, on behalf of the Committee of Visitors,

THO. CHA. HIGGINS, Chairman.

The following Documents are appended to this Report:—

APPENDIX
[A.]

REPORT
OF THE
RESIDENT MEDICAL SUPERINTENDENT.

To the Committee of Visitors,
of the Beds., Herts., & Hunts., Lunatic Asylum.

GENTLEMEN,

Compared with the preceding year the number of admissions have been less by 21, viz., 20 males and 1 female, the total for 1857, being only 89; of these 33 were males, and 56 females, the form of mental disorders are comprised in 42 cases of mania, 25 melancholia, 18 imbecility, and 6 idiots; a large proportion of whom have some combination of disease, incurable in its nature, and amongst them were 18, who had been previously in an asylum.

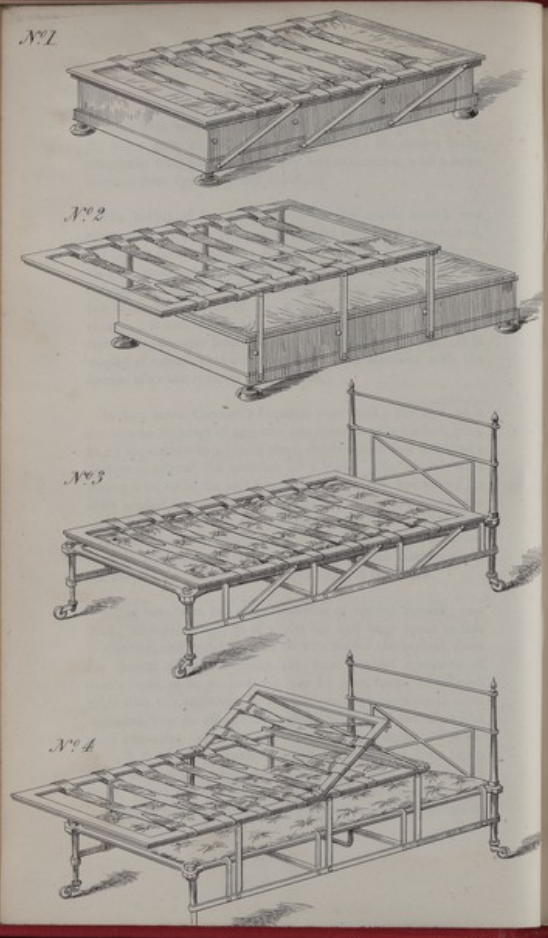
In consequence of it having been found advisable to remove a number of patients, to allow admission to the more recent cases, and those already in the several unions, and such an arrangement having been carried out in November last, by the transmission of 30 males to the Worcester County Asylum, and 29 females to Fisherton House Asylum, the discharges would appear to be greatly in excess of last year; but which in reality are 7 minus, with an increase of those discharged relieved. The numbers discharged recovered are 10 males and 19 females; relieved 9 males, and 7 females; with one of each sex adjudicated to belong to other counties, and removed to other asylums.

There have been fewer deaths than during the year 1856 by 12, being only 12 males, and 16 females; the causes being principally from paralysis, epilepsy, and exhaustion, with a large increase from dysentery and diarrhœa.

The health of the patients up to the ninth month was extraordinarily good, and perhaps might have been maintained, but from a circumstance so frequently arising in old asylums, viz., the imperfect system of drainage, by its being carried a distance through the building without a requisite fall, and from this alone may be traced the origin of the dysentery in the autumn; it occurred in a part of the house less liable to give rise to like diseases from the superiority of the building. It is worthy of remark that not one patient was attacked with the disease after the removal of the cause.

In two cases Coroner's Inquests were held; the first on a feeble man 80 years of age, who was found dead in his bed, lying to all appearance in a placid sleep, death not having distorted a feature or altered the position of a limb. The second on a young man, epileptic, and formerly suicidal, who had wound his shirt around his neck; and although the verdict returned was in accordance with the general opinion that he had died from strangulation, a subsequent post mortem examination disclosed another feature, as a large coagulum of blood was found on the surface, and between the convolutions of the brain.

There have been two cases deserving of special remark; one J. A., 82 years of age, 24 of whose life had been spent in this institution, and well known to all who visited the asylum, from his mental disease evincing the most perfect specimen of incoherence, as in no instance was he ever found to connect more than two sentences on the same subject, merging in most instances from an affectionate strain, to that of the vilest and most degrading that could issue from human tongue. The second, E. P. aged 59, a female striking in appearance, from being nearly six feet in height, and well proportioned, weighing 16 stone, whose exalted notions and dignity of carriage, with language of the most extraordinary character; who from time to



time in her volubility coined words most unmeaning in their nature, yet with an amount of effect almost inconceivable. She had for years enjoyed uninterrupted good health, but was suddenly seized with paralysis of the whole of the left side, without any of the usual concomitant symptoms, not having for one moment lost her consciousness, apparently feeling only her transposition from that of aiding, to that of requiring aid; as in her case, from her immense weight, any movement was not only difficult to others, but most painful to herself. What was most to be feared, came at last with all its vehemence, *a very large* abcess of the cellular tissue formed over the region of the sacrum; and in a short time another, extending almost up to the lower angle of the scapula. The water bed afforded but transient relief, as the effort used in moving her, (it being absolutely necessary to employ six strong women) was dreaded from the time of being performed, until it was again necessary, and her strength daily failed. This led me to construct a lift for raising the body above the bed, in lieu of removing it, as seen in the sketch on the foregoing page, which had the effect of relieving her from a vast amount of suffering, and also the attendants of a very exhausting duty. She was henceforth, from day to day raised by *two* nurses, her bed made, the applications used for her back without trouble, or uneasiness to herself; on the contrary, it became a source of amusement, and with it her unbounded thanks for the immense relief it afforded her. With the exception of the paralysed side, she may be said to have recovered, her back healed, her strength returned, and she had began to sit up, when she was attacked with apoplexy, and survived but a few hours.

One patient, only, has made his escape, he having done so on several previous occasions; he took a circuitous route to his home, and was brought back the following morning.

Of casualties there have been but three that call for remark. A female aged 80 years, in descending the stairs slipped and fell upon her hand, dislocating the humerus at the shoulder joint, the reduction was effected without difficulty.

The second, was a male employed as a bricklayer; who to clean out a small cespool, placed a piece of stone across the top, that he might be nearer his work, in stepping down the stone gave way, and his right leg was doubled under him, dislocating the thigh bone on to the dorsum of the ilium, this was also easily reduced. But what adds to the interest of his case, is the circumstance, that in moving in bed some six hours after, the head of the bone was again thrown out, on re-examination a fracture through the trochanter was distinctly perceptible, another attempt to replace the bone was deemed inadvisable. Notwithstanding his having suffered from a severe attack of dysentery, he has so far recovered as to be able to walk, and although the leg is very much shortened, the characteristic marks of the dislocation are lost, the toe pointing at a direct angle from the body.

The third, a case of minor importance, in a male patient, who in a paroxysm of excitement, threw himself across the rail while ascending the stairs to bed, and fractured a rib.

The employment of the patients has continued unabated, affording instances of interest taken in their occupation, that have been lost to them in some cases for a length of time.

Recreation, in various ways, has been resorted to for the happiness of the patients. In the fine weather walks are taken in the country, and places of amusement have been taken advantage of, when opportunity offered.

The alterations that have been made, and others that have received your sanction for carrying out, will doubtless add more and more to the comfort of the inmates, particularly the removal of the boarded partitions, which are so infested with vermin, and the substituting iron bedsteads for the wooden cribs.

The Statistical tables although carefully drawn up, are yet incomplete as a series, from the want of information on education and religious persuasion, particularly the latter, which

has been compiled with as much truthfulness as the matter obtained can be relied upon, as from the want of stability in this class of persons, vascillating as they do from time to time as situation or circumstances expose them, consequently definition would be absurd. In such may be traced the origin of mental disease.

The Commissioners in Lunacy visited the asylum, and saw all the patients, inspected the whole of the Institution, and left a record of their visit in the Visitors' Book.

The Conduct of the Establishment towards the afflicted inmates has been such as to call forth my warmest praise.

I beg in conclusion to express my best thanks for the support and uniform consideration you have always shewn towards me.

I have the honor to be,

Gentlemen,

Your very obedient Servant,

WILLIAM DENNE.

APPENDIX
[B]

REPORT OF THE CHAPLAIN.

To The Committee of Visitors of the Bedford Asylum.

GENTLEMEN,

I have to report to you, what the Chaplain's Minute book sets forth in detail, that I have regularly discharged the ordinary duties of the Chaplain during the past year.

It will be gratifying to me if these have been executed to your satisfaction, and to the advantage of the Institution to which I am attached.

I cannot forget that I am the appointed Minister of a large household, as well as of lunatic patients, and consider myself happy in being well supported by the heads of the house, the Superintendent, the Matron, the Assistant Matron, and the Steward. None of these are ever absent from the Holy Communion, always administered four times in the year. I feel myself at liberty to mention this, because it has always been so from the first, and offers an example, which, however imperfectly followed, cannot be without its beneficial results.

There are about fourteen patients who have been communicants, and the average present is about eight. A patient who has been a communicant once, and who will be one again, is not always in a fit state to be present; such persons are often conscious of their unfitness at particular times, and that this unfitness does not arise from want of devout feeling, or change of views, but from temporary mental disturbance. From such

I have heard expressions of regret for their inability to be present, with acknowledgements of the judiciousness of the Superintendent's advice on the subject.

I have continued to hold a weekly service, but during the past year on Thursday instead of Wednesday as heretofore, accompanying the reading of the lesson with a brief exposition.

The wishes of the Visiting Justices, with regard to the formation of a Bible Class, have been carefully attended to, and I hope with good results. We have assembled every Tuesday. Including two attendants and myself, the number present has been on the average about 16, with about 12 readers. Several who are unable to read aloud have been constantly present, and have taken great interest in the proceedings. One man especially, who died a few weeks ago, was a constant attendant both at the Holy Communion and at the Bible Class. This man offered a rare example of a truly religious mind. He was melancholy and depressed, but as far as I could observe, ever patient and hopeful. He knew the most important parts of the Bible well, and he drew his conclusions from them with unhesitating confidence. Although his sad malady marred his enjoyment of this world, he died with full expectation of unmixed happiness in the world to come. I never witnessed in any man a more unfaltering reliance on the goodness of God, which he was accustomed to express by saying, "He doeth all things well."

I beg to thank the Visiting Justices for their kind attention to the request which I made in my Minute Book.

I have the honor to be,

Gentlemen,

Your obedient Servant,

EDWARD SWANN,
Chaplain.

STATISTICAL TABLES.

APPENDIX
[c]

STATISTICAL TABLES

BY THE

RESIDENT MEDICAL SUPERINTENDENT.

TABLE I.

GENERAL RESULTS OF THE YEAR.

ADMISSIONS, ETC.	M.	F.	T.
Patients in the Asylum, Dec. 31st, 1856	154	157	311
Absent upon trial, on same date	0	1	1
Received during the year	33	56	89
Total under treatment	187	214	401

REMOVED DURING THE YEAR.	M.	F.	T.
Recovered	10	19	29
Relieved	9	7	16
Removed to other Asylums	31	30	61
	50	56	106
Died	12	16	28
	62	72	134

	62	72	134
Remaining in the Asylum, Dec. 31st, 1857	125	142	267

TABLE II.

NUMBER OF ADMISSIONS, DISCHARGES, AND DEATHS, DURING EACH MONTH IN THE YEAR.

Months.	Admissions.			Discharges.			Deaths.		
	M.	F.	T.	M.	F.	T.	M.	F.	T.
January	1	4	5	0	1	1	2	0	2
February	1	4	5	1	1	2	0	1	1
March	1	3	4	0	2	2	0	0	0
April	0	3	3	0	1	1	0	0	0
May	4	4	8	4	3	7	0	0	0
June	4	4	8	2	3	5	0	3	3
July	1	7	8	3	2	5	0	2	2
August	1	1	2	3	5	8	0	1	1
September	3	3	6	1	2	3	1	1	2
October	3	7	10	2	3	5	5	3	8
November	3	6	9	33	32	65	4	3	7
December	11	10	21	1	1	2	0	2	2
Total	33	56	89	50	56	106	12	16	28

*** The Seven following Tables contain the particulars of 89 cases admitted during the year.

TABLE III.

Age.	M.	F.	T.
From 10 to 20 years	3	3	6
„ 20 to 30 „	7	15	22
„ 30 to 40 „	8	10	18
„ 40 to 50 „	6	11	17
„ 50 to 60 „	3	9	12
„ 60 to 70 „	3	6	9
„ 70 to 80 „	3	2	5
Total	33	56	89

TABLE IV.

Social Condition.	M.	F.	T.
Married	10	27	37
Single	18	21	39
Widowed	5	8	13
Total	33	56	89

TABLE V.

Religious Persuasion.	M.	F.	T.
Church of England	15	33	48
Wesleyan	7	8	15
Baptist	3	9	12
Independent	2	2	4
Not ascertained	6	4	10
Total	33	56	89

TABLE VI.

No. of Attacks.	M.	F.	T.
First Attack	17	31	48
Second ditto, or more	12	22	34
Congenital	4	3	7
Total	33	56	89

TABLE VII.

Duration of Disease on Admission.	M.	F.	T.
Not exceeding 1 week	4	7	11
„ „ 2 „	0	7	7
„ „ 1 month	3	5	8
„ „ 2 „	3	7	10
„ „ 3 „	2	6	8
„ „ 4 „	1	2	3
„ „ 5 „	1	1	2
„ „ 6 „	3	5	8
„ „ 9 „	0	2	2
„ „ 1 year	2	4	6
„ „ 2 „	3	2	5
„ „ 3 „	2	1	3
„ „ 7 „	0	2	2
„ „ 15 „	1	0	1
From Childhood	4	3	7
Not ascertained	4	2	6
Total	33	56	89

TABLE VIII.

Form of Insanity.	M.	F.	T.
Mania	1	14	15
Suicidal	2	6	8
with Epilepsy	1	1	2
Suicidal	1	1	2
with Paralysis	0	0	0
and Epilepsy, Suicidal	0	1	1
with General Paralysis	1	0	1
with Delusions	4	6	10
Suicidal	1	2	3
Melancholia	3	4	7
Suicidal	3	11	14
with Epilepsy	0	1	1
with Incipient General Paralysis Suicidal	0	1	1
Imbecility	8	3	11
with Epilepsy	1	3	4
with Paralysis	0	1	1
with General Paralysis	2	0	2
Idiotcy Congenital	3	1	4
Suicidal	1	0	1
with Epilepsy	1	0	1
Total	33	56	89

TABLE IX.

STATION OR OCCUPATION.

Males.	No.	Females.	No.
Groom	1	Servants	10
Basket-maker	1	Lacemakers	3
Labourers	9	Plaiters of Straw	11
Shoemakers	2	Wives of Labourers	7
Carpenters	3	Dressmakers	2
Bricklayer	1	Bonnet Sewers	4
Tailor	1	Sempstress	1
Gardeners	2	Knitter	1
Law Writer	1	Wife of Sawyer	2
Straw Cutter	1	,, Wheelwright	1
Bonnet Presser	1	,, Tailor	2
Journeyman Maltster	1	,, Husbandman	1
Shepherd	1	,, Blacksmith	1
Farmer	1	Char-woman	2
Brickmaker	1	Shopkeeper	1
Horse Keepers	2	Innkeeper	1
Not ascertained	4	Daughters of Labourers	4
		Not ascertained	2
Total	33	Total	56

TABLE X.

TABLE OF MORTALITY DURING THE YEAR.

No. on Regr.	Form of Disease.	Age. M.	Age. Y.	Cause of Death.	Duration of Disease. (Mental.)	Time under Treatment.
1160	Imbecility with gen. paralysis	58	..	Gen. paralysis	14 mths.	2 months
879	Imbecility	78	..	Exhaustion arising from old age	Unknown	4 years
185	Ditto	..	44	Apophexy	Ditto	12 years
1066	Ditto with gen. paralysis	..	31	Diarrhœa, general paralysis	1 year	18 mnths.
1194	Ditto ditto	..	42	Paralysis	13 mths.	6 weeks
653	Mania with Epilepsy	..	39	Epilepsy	Unknown	7 years
1210	Mania	..	58	Exhaustion	3 weeks	15 days
1122	Ditto with Paralysis	..	51	Caralysis	1 yr. 7m.	13 mnths.
1188	Mania	..	20	Congestion of brain	Unknown	5 months
969	Ditto with Epilepsy	42	..	Epilepsy	3 yrs. 8m.	2 yrs. 8m.
864	Mania	..	27	Exhaustion	Unknown	4 years
54	Ditto	..	41	Diarrhœa	Ditto	17 years
1163	Imbecility	..	63	Fever after mania	1 year	11 mnths.
1224	Ditto with gen. paralysis	24	..	Dysentery	7 months	1 month
1107	Melancholia with ditto	..	67	Gen. paralysis	1 yr. 7m.	1 yr. 5m.
1129	Idiotcy with Epilepsy	..	27	Dysentery	10 years	3 months
1195	Mania with gen. paralysis and Epilepsy	..	28	Congestion of brain after epilepsy	8 weeks	5 months
719	Mania with Epilepsy	34	..	Epilepsy	Unknown	6 yrs. 6m.
998	Mania	..	72	Dysentery	2 yrs. 8m.	2 yrs. 6m.
583	Incoherence	..	59	Paralysis	9½ years	7 years
1223	Imbecility	..	76	Gradual exhaustion	Unknown	2 months
5	Incoherence	..	82	Exhaustion after Dysentery	Ditto	24 years
1225	Mania	..	57	Diarrhœa	11 mnths.	2 months
1242	Imbecility	..	17	Ditto	Birth	9 days
1207	Mania	..	67	Ditto	11 mnths.	5 months
1027	Ditto with gen. paralysis	42	..	Gen. paralysis	2 yrs. 7m.	1 yr. 7m.
989	Ditto ditto	..	34	Ditto	3 yrs. 5m.	2 yrs. 7m.
991	Ditto with Epilepsy	..	35	Exhaustion after Epilepsy	3 yrs. 2m.	2 yrs. 8m.
	Total	12	16			

TABLE XI.

STATION OR OCCUPATION.

Males.	No.	Females.	No.
Labourers	3	Wives of Labourers	2
Sadler	1	,, Maltster	1
Cordwainer	1	Laundress	1
Carriers	2	Dressmaker	1
Baker	1	Char-woman	1
Carpenter	1	Lacemakers	2
Jobbing Gardener	1	Plaiters	4
Coachman	1	Bonnet Sewer	1
Bricklayer	1	Retailer of Beer	1
		Not ascertained	2
Total	12	Total	16

TABLE XII.

Social Condition.	M.	F.	T.
Married	4	5	9
Widowed	4	3	7
Single	4	8	12
Total	12	16	28

TABLE XIII.

FORM OF DISEASE IN THE CASES OF THE 267 PATIENTS REMAINING IN THE ASYLUM DECEMBER 31st, 1857.

Form of Disease.	M.	F.	T.	M.	F.	T.
Mania	22	42	64			
Suicidal	6	11	17			
with Epilepsy	7	1	8			
Suicidal	2	3	5			
with Paralysis	1	2	3			
and Epilepsy	1		1			
with General Paralysis	3		3			
and Epilepsy	1		1			
with Incipient General Paralysis	1		1			
with Delusions	10	13	23			
Suicidal	1		1			
with Hysteria		4	4			
Suicidal		1	1	55	77	132
Melancholia	10	7	17			
Suicidal	5	15	20			
with Epilepsy Suicidal	1	3	4			
with General Paralysis	1	1	2			
with Delusions	2		2			
with occasional Violence	1		1	20	26	46
Incoherence	1	1	2	1	1	2
Imbecility	18	13	31			
Suicidal	3	1	4			
with Epilepsy	4	6	10			
Suicidal	0	2	2			
with Paralysis	2		2			
Senile		1	1	27	23	50
Dementia	9	7	16			
with Epilepsy Suicidal	1		1			
with Paralysis	1		1	11	7	18
Idiotcy	9	7	16			
with Epilepsy	2	1	3	11	8	19
Total				125	142	267

TABLE XIV.

Age.	M.	F.	T.
From 10 to 20 years	6	4	10
„ 20 to 30 „	21	29	50
„ 30 to 40 „	35	25	60
„ 40 to 50 „	24	27	51
„ 50 to 60 „	19	27	46
„ 60 to 70 „	8	21	29
„ 70 to 80 „	7	6	15
„ 80 to 90 „	0	1	1
„ 90 to 100 „	0	1	1
Not ascertained	5	1	6
Total	125	142	267

TABLE XV.

Social Condition.	M.	F.	T.
Single	80	80	160
Married	31	40	71
Widowers	12		12
Widows		20	20
Not ascertained	2	2	4
Total	125	142	267

THIS TABLE THE YEAR.

No. on Register.	AGE. M.	AGE. F.	Social Condition.	No. of Attacks	Occup	Duration of Disease previous to Admission.	Time under Treatment.	Cured.	Relieved.	Removed by Friends or otherwise.
1022	...	31	Married	...	.....	1 month ...	1½ years ...	1	...	
1154	...	65	Ditto ...	2	Lacemak	1 month ...	3 months...	1	...	
1120	24	...	Single ...	...	Baker ...	2 months...	7 months...	1	...	
1106	..	27	Married	1	Turner's	3 months...	10 months ...	...	...	1
1178	...	60	Ditto ...	...	Labourer	2 months...	3 months...	1	...	
1181	...	25	Ditto ...	1	Sawyer's	2 weeks ...	2 months...	1	...	
1147	17	...	Single ...	1	Straw pl	2 years.....	9 months...	...	1	
1170	...	48	Married	3	Labourer	2 weeks ...	7 months...	1	...	
1181	...	25	Ditto ...	...	Straw pl	9 months...	7 months...	1	...	
1180	25	...	Single ...	...	Law writ	3 months...	7 months...	1	...	
1139	71	...	Widower	...	Carpente	1 month ...	3 months...	1	...	
1159	...	23	Single ...	...	Domestic	2 months...	6 months...	1	...	
1131	50	...	Married	1	Carpente	1 week	10 months.	1	...	
1071	...	15	Single ...	...	Dressmal	2 weeks ...	1½ year.....	1	...	
731	40	...	Married	...	Sawyer ...	not known	6 years.....	1	...	
850	71	...	Ditto ...	...	Carpente	ditto.....	4 years.....	1	...	
1032	...	57	Ditto ...	2	Labourer	2 weeks ...	1½ year ...	1	...	
894	...	55	Widow	1	.....	5 months...	5 years.....	1	...	
1161	30	...	Married	...	Labourer	1 month ...	8 months...	...	1	
58	66	...	Single ...	...	Shoemak	not known	17 years ...	...	1	
736	...	52	Married	...	Lacemak	ditto.....	5 years.....	...	1	
1123	56	...	Single ...	...	Groom...	18 years ...	7 months...	...	1	
1157	...	60	Widow	1	Plaiter ...	not known	8 months...	1	...	
1148	47	...	Single ...	...	Basket-m	3 months...	11 months ...	...	1	
24	81	...	Ditto ...	...	Labourer	not known	20 years ...	...	1	
503	...	40	Ditto ...	...	.....	20 years ...	8 years.....	...	1	
527	...	41	Married	...	Straw pl	5 days	8 years.....	1	...	
1060	...	32	Ditto ...	1	Lacemak	2 years.....	1 week	...	1	
1102	...	44	Widow	...	Laundres	1½ years ...	9 months...	1	...	
1294	30	...	Single ...	1	Carpente	3 weeks ...	2½ months	1	...	
1118	56	...	Married	2	Baker ...	1½ years ...	4½ year....	1	...	
518	...	68	Ditto ...	...	Labourer	not known	8½ years ...	...	1	
1173	...	41	Single ...	...	Authoress	ditto.....	10 months ...	...	1	
1207	...	66	Ditto ...	1	Shopkeep	1 month ...	4 months...	1	...	
1216	...	38	Married	1	Dressmal	1 week	3 months...	1	...	
1218	...	33	Ditto ...	...	Plaiter...	2 months...	3 months...	1	...	
1235	17	...	Single ...	1	Straw pl	6 months...	3 months...	...	1	
1149	...	25	Ditto ...	...	Domesti	.....	11 months ...	...	1	
1239	42	...	Married	...	Maltmak	1 week	2 months...	1	...	
379	58	...	Single ...	...	Labourer	not known	10 years ...	...	1	
1177	23	...	Ditto ...	1	Baker ...	1 week	11 months ...	...	1	
1138	...	32	Ditto ...	1	Servant-	6 weeks	1¼ year.....	1	...	
1175	...	28	Ditto ...	1	Schoolmi	2 weeks.....	11 months ...	1	...	
1043	68	...	Widower	2	Barge lab	2 years.....	2 years.....	1	...	
1139	...	47	Married	2	Grocer's	6 weeks ...	3 months...	...	1	
1212	...	21	Single ...	...	Sempstre	2 weeks .	5 months..	1	...	
1196	34	...	Ditto ...	...	Mason ..	1 week	13 months ...	...	...	1
	20	27								

*** This Table

isberton House,

TABLE XVI.

THIS TABLE CONTAINS THE PARTICULARS OF 47 CASES DISCHARGED DURING THE YEAR.

No. on Register.	AGE. M.	AGE. F.	Social Condition.	No. of Attacks	Occupation.	Religion.	Mental Disorder.	Combinations.	ASSIGNED CAUSES. Physical.	ASSIGNED CAUSES. Moral.	Duration of Disease previous to Admission.	Time under Treatment.	Cured.	Relieved.	Removed by Friends or otherwise.
1022	...	31	Married	...	.....	Ch.of England	Mania	.....	.....	.....	1 month ...	1½ years ...	1	...	
1154	...	65	Ditto ...	2	Lacemaker	Baptist	Melancholia.....	.....	.....	Poverty	1 month ...	3 months...	1	...	
1120	24	...	Single ...	...	Baker	Ch.of England	Mania	.....	Blow on the head	.....	2 months...	7 months...	1	...	
1106	..	27	Married	1	Turner's wife	not ascert. ...	Melancholia.	.....	.....	Jealously.....	3 months...	10 months ...	...	...	1
1178	...	60	Ditto ...	...	Labourer's ditto ...	Ch.of England	Melancholia	.....	Hereditary	Domestic trouble...	2 months...	3 months...	1	...	
1184	...	25	Ditto ...	1	Sawyer's ditto.....	Ditto	Melancholia.	.....	.....	Illtreat. by husband	2 weeks ...	2 months...	1	...	
1147	17	...	Single ...	1	Straw plait cutter	Do.	Imbecility.	.....	Hereditary, fever.	.....	2 years.....	9 months...	...	1	
1170	...	48	Married	3	Labourer's wife ...	Do.	Mania	.....	.....	.....	2 weeks ...	7 months...	1	...	
1181	...	25	Ditto ...	...	Straw plaiter	Do.	Mania, delusions...	.....	.....	.....	9 months...	7 months...	1	...	
1180	25	...	Single ...	...	Law writer	Do.	Melancholia.....	.....	Hereditary	Disappointment ..	3 months...	7 months...	1	...	
1189	71	...	Widower	...	Carpenter	Baptist.....	Melancholia.....	.....	.....	Poverty	1 month ...	3 months...	1	...	
1159	...	23	Single ...	...	Domestic servant	Ch.of England	Mania	.....	.....	.....	2 months...	6 months...	1	...	
1131	50	...	Married	1	Carpenter	Ditto	Mania	Paralysis	Intemperance (Hereditary)	.....	1 week	10 months.	1	...	
1071	...	15	Single ...	...	Dressmaker.....	Baptist	Mania	.....	Puberty	.....	2 weeks ...	1½ year.....	1	...	
731	40	...	Married	...	Sawyer	Ch of England	Mania	.....	Fever	Jealousy	not known	6 years.....	1	...	
850	71	...	Ditto ...	...	Carpenter	Baptist	Mania	.....	.....	.....	ditto.....	4 years.....	1	...	
1032	...	57	Ditto ...	2	Labourer's wife ...	Ch.of England	Mania	.....	.....	Jealousy	2 weeks ...	1½ year ...	1	...	
894	...	55	Widow	1	.....	Ditto.	Melancholia.....	.....	Hereditary	.....	5 months...	3 years.....	1	...	
1161	30	...	Married	...	Labourer.....	Do.	Melancholia.....	.....	Hereditary	Disappointment ..	1 month ...	8 months...	...	1	
58	66	...	Single ...	...	Shoemaker	Do.	Mania	Epilepsy	Epilepsy	.....	not known	17 years ...	...	1	
706	...	52	Married	...	Lacemaker	Do	Mania	.....	.....	.....	ditto.....	5 years.....	...	1	
1172	56	...	Single ...	...	Groom.....	Not ascert. ...	Mania	.....	.....	.....	18 years ...	7 months...	...	1	
1157	...	60	Widow	1	Plaiter	Ch.of England	Mania	.....	Influenza.....	.....	not known	8 months...	1	...	
1148	47	...	Single ...	...	Basketmaker	Baptist	Melancholia.....	.....	.....	.....	3 months...	11 months	...	1	
24	81	...	Ditto ...	...	Labourer	Ch of England	Dementia.....	.....	.....	.....	not known	20 years ...	...	1	
503	...	49	Ditto ...	...	.....	not ascert. ...	Dementia.....	Epilepsy	Epilepsy	.....	20 years ...	8 years.....	...	1	
577	...	41	Married	...	Straw plaiter	Baptist.	Melancholia.....	.....	.....	Religion	5 days	8 years.....	1	...	
1050	...	32	Ditto ...	1	Lacemaker	Ch.of England	Mania	Epilepsy	Epilepsy	.....	2 years.....	1 week	...	1	
1162	...	44	Widow	...	Laundress	Wesleyan.....	Melancholia.....	.....	Over work	.....	1¾ years ..	9 months...	1	...	
1204	30	...	Single ...	1	Carpenter	Ditto.	Mania, delusions...	.....	Blow on the head, intemperance	.....	3 weeks ...	2½ months	1	...	
1118	56	...	Married	2	Baker	Ch.of England	Mania	Paralysis	Intemperance	.....	1¼ years ...	1¼ year.....	1	...	
518	...	68	Ditto ...	...	Labourer's wife ...	Ditto	Mania	Epilepsy	.....	.....	not known	8½ years ...	...	1	
1173	...	41	Single ...	...	Authoress	Ditto	Mania, delusions...	.....	.....	Loss of Property..	ditto.....	10 months	...	1	
1207	...	66	Ditto ...	1	Shopkeeper	Baptist.	Mania	... .	.....	Anxiety	1 month ...	4 months...	1	...	
1216	...	38	Married	1	Dressmaker.....	Not ascert. ...	Mania, delusions...	.....	Intemperance	.....	1 week	3 months...	1	...	
1218	...	33	Ditto ...	...	Plaiter.....	Wesleyan	Melancholia.....	.....	Superlactation. ...	.....	2 months...	3 months...	1	...	
1205	17	...	Single ...	1	Straw plaiter	Ch.of England	Imbecility	.....	Hysteria	.....	6 months...	3 months...	...	1	
1149	...	25	Ditto ...	...	Domestic servant	Baptist.	Mania	.....	Hysteria, heredit.	.....	.....	11 months	...	1	
1219	42	...	Married	...	Maltmaker	Independent.	Mania, delusions...	.....	Intemperance	.....	1 week	2 months...	1	...	
379	58	...	Single ...	...	Labourer.....	Ch.of England	Mania	.....	.....	.....	not known	10 years ...	...	1	
1177	23	...	Ditto ...	1	Baker	Ditto	Mania, delusions...	.....	Inflammation of the brain (Herdtry.)	.....	1 week	11 months.	...	1	
1138	...	32	Ditto ...	1	Servant	Do.	Mania	.....	.....	.....	6 weeks.....	1¼ year.....	1	...	
1175	...	28	Ditto ...	1	Schoolmistress ...	Do.	Mania	.....	Hysteria, Herdtry	Over study	2 weeks.....	11 months .	1	...	
1043	68	...	Widower	2	Barge labourer ...	Do.	Mania	.....	Intemperance	.....	2 years.....	2 years.....	1	..	
1139	...	47	Married	2	Grocer's wife	Do.	Melancholia.....	.....	.....	Domestic trouble..	6 weeks ...	3 months...	...	1	
1212	...	21	Single ...	...	Sempstress	Wesleyan.....	Mania	.....	Hereditary	.....	2 weeks .	5 months..	1	...	
1156	34	...	Ditto ...	...	Mason	Ch.of England	Mania	Epilepsy	Intemperance, blow on the head	.....	1 week	13 months.	...	...	1
	20	27													

*** This Table does not contain the particulars of the 30 males removed to the Worcester Asylum, and 29 females to Fisherton House.

GENERAL TABLE OF ADMISSIONS.

INCLUDING ALL RE-ADMISSIONS FROM THE OPENING OF THE ASYLUM IN 1812, TO DEC., 31ST, 1857.

	1854.			1855.			1856.			1857.								
	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.
Admissions & Re-admissions...	980	1009	1989	39	56	95	1019	1065	2084	57	54	111	1076	1119	2195	33	56	89	1109	1175	2284
Deduct Re-admissions.....	61	70	131	3	10	13	64	80	144	6	9	15	70	89	159	5	12	17	75	101	176
TOTAL.....	919	939	1858	36	46	82	955	985	1940	51	45	96	1006	1030	2036	28	44	72	1034	1074	2108

LE OF ADMISSIONS.

PENING OF THE ASYLUM IN 1812, TO DEC., 31ST, 1857.

		1856.			1857.								
F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.
065	2084	57	54	111	1076	1119	2195	33	56	89	1109	1175	2284
80	144	6	9	15	70	89	159	5	12	17	75	101	176
985	1940	51	45	96	1006	1030	2036	28	44	72	1034	1074	2108

DIETARY TABLE. No. XVII.

DAYS OF THE WEEK.	BREAKFAST. Males.			Females.			DINNER. Males.								Females.							SUPPER. Males.				Females.		
	Bread.	Milk Porridge		Bread.	Butter.	Tea.	Beer.	Bread.	Cooked Meat.	Plum Pudding.	Fish.	Soup.	Stew.	Vegeta-bles	Beer.	Bread.	Cooked Meat.	Plum Pudding.	Fish.	Soup.	Stew.	Vegeta-bles	Beer.	Bread.	Butter.	Cheese.	Tea.	Bread.	Butter.	Plum Cake.	Tea.
	oz.	pt.	oz.	oz.	oz.	pt.	pt.	oz.	oz.	oz.	oz.	pt.	pt.	oz.	pt.	oz.	oz.	oz.	oz.	pt.	pt.	oz.	pt.	oz.	oz.	oz.	pt.	oz.	oz.	pt.
Sunday, ..	7	1½		6	2	1	½	16	6	....	....	....	....	16	½	12	10½	12	10	1	....	1	3	49	1	9	1	36	3	8	1
Monday ..	7	1½		6	1	....	....	2	6	....	....	....	....	....	....	2	6	....	....	....	....	....	....	7	½	....	1	....	....	8	....
Tuesday ..	7	1½		6	1	....	....	8	....	....	1½	....	....	....	....	6	....	....	....	1	....	....	12	7	....	1½	....	6	½	....	1
Wednesday	7	1½		6	1	....	....	....	6	....	....	....	....	16	....	....	6	....	....	....	....	....	12	7	....	1½	....	6	½	....	1
Thursday..	7	1½		6	1	....	....	....	....	....	....	1	....	....	....	4	....	....	....	....	....	1	....	7	....	½	....	6	½	....	1
Friday	7	1½		6	1	....	....	....	6	....	....	....	16	....	....	....	6	....	....	....	....	....	....	7	....	1½	....	6	½	....	1
Saturday ..	7	1½		6	1	....	....	....	....	1½	....	....	4	....	....	....	....	1½	....	10	....	....	4	....	7	....	1½	....	6	½	....	1
Totals....	49	10½		42	3½	7	1	16	19½	16	10	1½	1	32	½	12	16½	12	10	1	1	40	3	49	1	9	1	36	3	8	1

N.B.—Scale per Gall. for Porridge..... Twelve ounces Oatmeal, One pint New Milk.
" Tea..... One ounce Tea, Four ounces Sugar, One pint New Milk.
" lb. for Plum Pudding.... Eight ounces Flour, One ounce Raisins, and One ounce Treacle.
Soup, for 300 Patients.....The liquor of the Meat the previous day, 75lbs. Legs and Shins of Beef, 14lbs. Peas, 56lbs. Carrots, 28lbs. Onions, 14lbs. Oatmeal, Salt, Pepper, Herbs, &c.
Stew for 300 Patients. ..... The liquor of the Meat the previous day, 40lbs. Meat, 112lbs Potatoes, 28lbs. Onions, 14lbs. Oatmeal,
EXTRA.—All Male Patients Employed, Two ounces Bread, 1oz. Cheese, and ½-pint Beer at 10 a.m., and ½-pint Beer at 4 p.m.
Women employed at the Wash-house and Laundry.—Six ounces Meat and Vegetables for Dinner on Mondays. Bread and Cheese and ½ pint of Beer a 10 a.m. and at 4 p.m.
Helpers in the Wards and Needlewomen—Bread and Cheese and ½-pint Beer at 10 a.m.
Snuff and Tobacco to be given as indulgences to the workers, &c.

JOHN BARNES, *Steward.*

TABLE XVIII.

ATTENDANT'S AND SERVANT'S RATIONS.

MALES.		FEMALES.	
Weekly.	Daily.	Weekly.	Daily.
4oz. Coffee ½lb. moist Sugar ½lb. Cheese ½lb. Butter, or 1lb. Bacon Fruit and other Puddings twice.	1lb. Bread 1lb. cooked Meat 3 pints Beer ½-pint new Milk Vegetables according to season	3oz. Tea ½lb. loaf Sugar or ½lb. moist ditto ½lb. Cheese ½lb. Butter, or 1lb. Bacon Fruit and other Puddings twice	1lb. Bread ½lb cooked Meat 1½-pints Beer ½-pint new Milk Vegetables according to season.

TABLE XIX.

A RETURN OF MATERIAL AND CLOTHING IN STORE, DEC. 31ST, 1857.

MATERIAL.		CLOTHING.	
Calico	436yds.	Aprons	147
Cotton Print	420 „	Bonnets	18
Coburg	300 „	Boots and Shoes	47
Corduroy	10 „	Braces	201
Drabbette	53 „	Caps (men's fustian)	25
Fustian	95 „	Caps (women's)	73
Flannel	49 „	Chemises	120
Holland	47 „	Drawers	8
Jean	117 „	Flannel Shirts	51
Linen Check	67 „	Flannel Chemises	47
Lindsey	220 „	Gloves	17
Leather	204lbs.	Handkerchiefs	169
Moreen	5yds.	Neckerchiefs	80
Pilot Cloth	84 „	Waistcoats	9
Slate Lining	165 „	Trousers	13
		Night Caps	37
		Ditto Gowns	62
		Petticoats	220
		Pinafores	6
		Shawls	51
		Shirts	156
		Stays (pairs)	16
		Stockings (ditto)	360
		Women's Gowns	51

JOHN BARNES, STEWARD.

TABLE XX.

A RETURN OF CLOTHING AND OTHER ARTICLES MADE AND REPAIRED IN THE ASYLUM DURING THE YEAR 1857.

MALES.	MADE.	REPD.	FEMALES.	MADE	REPD.
Bed ticks	2		Aprons	233	730
Boots and shoes	548	518	Bed ticks	42	218
Caps	135		Blankets		74
Coats and jackets	116	157	Ditto Infant's	15	
Waistcoats	121	114	Bed gowns ditto	18	
Trousers	148	344	Blouses	50	
Flannel drawers	6		Bonnets (straw)	167	
Overalls	2		Boots & shoes bd. (prs.)	90	
Ticken dresses	4		Caps (women's)	256	764
Bolsters	15		Caps (infant's)	12	
Carpets	2		Chemises	339	2785
Mattrasses	7		Dusters	236	
Quilted rugs	1	4	Flannel Shirts	12	52
ATTENDANTS AND SERVANTS.			Frocks	84	
			Gowns	209	2472
			Handkerchiefs	440	
Coats	36	3	Hats (straw)	55	
Waistcoats	33	4	House flannels	1244	
Trousers	34	11	Holland jackets	11	
			Lace (yards)	65	
			Mangling cloths	3	
			Mattrass cases	37	
			Night Caps	46	32
			Ditto Gowns	31	
			Ditto Jackets	76	
			Petticoats	180	2045
			Pinafores	164	142
			Pillow ticks	15	84
			Ditto cases	123	212
			Pudding cloths	90	
			Rugs		120
			Shirts	450	1156
			Ditto (baby's)	48	
			Sheets	466	3241
			Shrouds	24	
			Straw plait (score)	196	
			Stockings (pairs)		6421
			Table cloths	14	
			Towels	89	
			Trousers (boy's)	18	
			Velvet stocks	36	
			Window blinds	15	
Total	1210	1155	Total	5690	20548

JOHN BARNES, STEWARD.

APPENDIX
[D]

ABSTRACT OF ANNUAL RETURNS,

16 & 17 Vict., Cap. 97, Schedule D.

Name of Union.	In County Asylum.		In Licensed Houses or other Asylums.		With Friends and in Workhouses.		Total of both Sexes	Persons not in confinement.			
								Dangerous to self or others.		Of Dirty Habits.	
	M.	F.	M.	F.	M.	F.		M.	F.	M.	F.
Bedfordshire.											
Ampthill	7	12	..	..	8	8	35	..	..	..	1
Bedford	12	19	3	4	6	9	53	..	..	..	1
Biggleswade	11	12	1	3	12	18	57	..	..	..	..
Hitchin, part of	..	..	..	..	..	..	..	..	..	..	..
Leighton Bus., pt. of	6	..	..	..	2	1	9	..	..	..	..
Luton, part of	11	10	3	1	6	9	40	..	..	..	1
Neots St., part of	1	2	..	1	1	9	14	..	..	..	..
Wellingboro,' part of	..	1	..	..	2	1	4	..	..	..	..
Woburn	6	10	..	..	5	8	29	..	..	..	..
Totals	54	66	7	9	42	63	241				3
Hertfordshire.											
Albans St.	10	10	..	2	12	32	66	..	..	..	..
Amersham, part of	..	..	..	..	..	..	..	..	..	..	..
Barnet, part of	2	3	..	1	1	1	8	..	..	..	1
Berkhampstead pt. of	3	1	1	..	3	8	16	..	..	..	..
Bishop Stortford pt of	6	7	2	1	10	12	38	..	..	..	..
Buntingford	2	3	..	..	2	7	14	..	..	..	..
Edmonton, part of	2	1	2	4	2	2	13	..	..	..	..
Hatfield	4	8	2	1	2	6	23	..	..	..	..
Hemel Hempstead	4	5	..	..	3	2	14	..	..	..	..
Hertford	8	4	..	..	3	4	19	..	..	..	1
Hitchin, part of	12	7	3	3	16	11	52	..	..	..	..
Luton, part of	..	..	..	..	1	..	1	..	..	..	..
Royston	1	1	..	..	3	3	8	..	..	..	..
Ware	6	6	2	1	10	10	35	..	..	1	..
Watford	9	5	..	4	7	10	35	..	..	1	1
Welwyn	..	3	..	..	..	..	3	..	..	..	..
Totals	69	64	12	17	75	108	345			2	3
Huntingdonshire.											
Caxton, part of	1	..	..	..	1	..	2	..	..	..	..
Huntingdon	7	13	..	..	2	4	26	..	..	..	1
Ives, St., part of	8	13	..	..	2	..	23	1	..	..	..
Neots, St., part of	6	3	3	..	4	7	23	..	..	..	..
Oundle part of	..	..	..	..	1	..	1	..	..	..	..
Peterboro,' part of	5	3	..	..	2	5	15	..	..	..	..
Stamford, part of	..	..	..	..	..	1	1	..	..	..	..
Thrapston, part of	..	..	..	..	1	1	* 2	..	..	..	..
Totals	27	32	3		13	18	93	1			1
Grand Totals	150	162	22	26	130	189	679	1		2	7

APPENDIX
[E]

County Lunatic Asylum,
February 9th, 1858.

REPORT
OF THE
COMMITTEE OF VISITORS
UPON THE AUDIT OF ACCOUNTS
OF THE
TREASURER AND CLERK TO THE ASYLUM,
PURSUANT TO 16 & 17 VICT. CAP. 97.

The Committee of Visitors having audited the accounts of the Treasurer and Clerk of the Asylum, as directed by section LX of "The Lunatic Asylums' Act, 1853," do hereby report the same to the General Quarter Sessions of the united Counties, and append hereto an Abstract of such accounts accordingly.

The Committee according to their usual practice, accompany such Report with the following succint observations, in order to a more complete elucidation of the accounts.

	£.	s.	d.
The total Receipts for the year (exclusive of Balances) have been	8139	1	11
The total Payments for the year (exclusive of Balances) have been	8390	7	11
Making the Payments in excess of the Receipts	£251	6	0

The Balances due to the Asylum December 31st, 1857, are

From Counties and Unions	51	0	9
„ Steward	50	0	0
„ County of Bedford, repairs	52	18	9½
„ Maintenance Account	12	14	11½
„ Northey Reformatory, for clothing	57	9	2
Total	£224	3	8½

The Balances due from the Asylum on the 31st of December, 1857, are as follows

To Counties and Unions	115	12	7¼
„ Treasurer	108	11	1
	£224	3	8¼

On the Maintenance Account there was a surplus Balance of £311. 6s. 4¼d., on the 31st of December 1856, whilst at the termination of the last year, there was a deficient Balance on this account of £12. 14s. 11¾d. This however may be explained by the fact that the rate of Payment has been eight shillings and nine pence per week only, although the actual net cost of each Patient was nine shillings and two pence three farthings. Further, that the extra rate of payment for the patients in the Worcester and Fisherton House Asylums, as well as their conveyance to those Institutions, have been paid out of the current Maintenance Account.

The Cash Receipts for the Garden and Farm have been	404	8	6
Add the Value of Vegetables and other produce consumed in the Asylum	216	9	8
	£620	18	2
The Payments amount to	131	10	4
	£489	7	10
Add increase of Live and Dead stock compared with last year	17	2	6
Net profit on the year	£506	10	4

This result shows a diminution of £20. 3s. 6d. in the net profit of the Garden and Farm, notwithstanding the diminution in prices compared with the last year. The Committee consider the statement altogether, to be highly satisfactory.

(Signed) THO. CHA. HIGGINS, *Chairman*,
G. RUST,
MARLBOROUGH PRYOR,
CHAS. MOORE,
W. ST. QUINTIN,
JAMES LINTON,
P. TILLARD,
HENRY LITTLEDALE.

APPENDIX
[x]

RECEIPTS & PAYMENTS
ON ACCOUNT OF THE
BEDFORD LUNATIC ASYLUM,
IN THE YEAR ENDING 31st DECEMBER, 1857.

RECEIPTS.

FROM SALES.	£.	s.	d.	£.	s.	d.
Produce of Garden and Farm	404	8	6			
Sundries, old stores, bones, &c.	21	17	11			
				426	6	5

From Unions and Parishes in the United Counties of Beds., Herts., and Hunts., viz :—

COUNTY OF BEDFORD.

	£.	s.	d.
Ampthill Union	440	0	0
Bedford Union	889	18	9
Biggleswade Union	605	3	5
Leighton Buzzard Union	93	5	10
Luton Union	578	16	6
Wellinborough Union	43	13	4
Woburn Union	299	10	0

COUNTY OF HERTFORD.

Alban's St. Union	374	10	5
Barnet Union	86	5	1
Berkhampstead Union	99	0	4
Bishop Stortford Union	257	6	8
Buntingford Union	151	18	1
Edmonton Union	87	3	4
Hatfield Union	288	2	6
Hemel Hempstead Union	210	17	10
Hertford Union	282	14	8
Carried forward	£4788	6	9

COUNTY OF HERTFORD, *(continued.)*

	£.	s.	d.	£.	s.	d.
Brought forward	4788	6	9	426	6	5
Hitchin Union	475	11	1			
Royston Union	22	16	2			
Ware Union	323	4	4			
Watford Union	352	6	7			
Welwyn Union	68	8	6			

COUNTY OF HUNTINGDON.

Caxton Union	22	16	2			
Huntingdon Union	370	3	10			
St. Ives Union	450	6	4			
St. Neots Union	260	1	10			
Peterborough Union	125	14	10			
				7259	16	5

From the County, Liberty, and Borough Treasurers, in the United Counties, for Vagrants, Paupers, & Criminal Lunatics, respectively, viz.:—

Albans St. Liberty	34	9	0			
Bedford County	129	1	4			
Hertford County	34	9	0			
Huntingdon County	79	11	4			
				277	10	8

From the following Counties for the excess in the weekly sums paid for Criminal Lunatics, chargeable to parishes beyond the sums charged for maintenance of Patients in this Asylum.—(16 & 17 *Vict. cap.* 97, *s.* 42) *viz.*:—

Bedford County	11	14	0			
Hertford County	23	8	3			
				35	2	0
From the County of Bedford.						
For ordinary repairs				134	8	0
From out County and non contributory districts viz.:						
Milton Union, Kent	2	10	9			
Newport Pagnel Union	3	7	8			
				5	18	5
Total Receipts				£8139	1	11

PAYMENTS.

PROVISIONS.	£.	s.	d.	£.	s.	d.
Arrowroot, 79lbs. @ 8d. ℔ lb.	2	12	8			
Bacon, 1278¾ lbs. @ 8¾d. to 9d. ℔ lb	45	12	9			
Baking	10	9	9			
Beer, 16758 gals. @ 7¾d. ℔ gal. *viz:*—						
Malt, 1088 bus. @ 8s. 10½d. to 9s. 3d. ℔ bus.	497	10	9			
Hops, 1434 lbs. @ 7½d. to 9d. ℔ lb.	49	16	8			
Yeast	1	5	6			
				548	12	11
Bread, 31964 loaves @ 5d. to 6d. ℔ loaf				734	10	8
Buns				2	10	4
Butter, 4958¾ lbs. @ 85s. to 112s. ℔ cwt. and 12d. to 15½d. ℔ lb.				239	1	9½
Cheese, 7574 lbs. @ 73s. to 76s. ℔ cwt.				249	15	2
Coffee, 328 lbs. @ 1s. 2d. to 1s. 3½d. ℔ lb.				20	19	1
Currants, 462 lbs. @ 7½d. to 8½d. ℔ lb.				15	14	1
Eggs, 160 @ 1s. 6d. & 2s. ℔ score				0	15	0
Fish				0	5	1
Flour, 58 sacks @ 39s. 6d. to 46s 6d. ℔ sack				122	17	6
Fruit				2	3	4
Meat, 53637 lbs. @ 2½d. to 6½d. ℔ lb.				1325	9	8
Milk, 3659 gals. @ 7d. ℔ gal.				106	14	5
Oatmeal, 18 sacks @ 52s. 4d. to 59s. per sack				50	7	11
Peas, 12 bus. @ 8s. to 8s. 4½d. ℔ bus.				4	18	7
Rabbits				0	6	9
Raisins, 1456 lbs @ 6d. to 7¾d. ℔ lb.				41	15	0
Rice, 321 lbs. @ 17s. to 22s. 6d. ℔ cwt.				2	15	9
Sugar, (loaf) 294 lbs. @ 6¾d. to 8d. ℔ lb.	30	2	3½			
„ (moist) 4480 lbs. @ 56s. & 63s. ℔ cwt.	115	17	0			
				145	19	3½
Carried forward				£3674	7	6

NOTE.—The cost of the Vegetables and Meat consumed from the produce of the Garden and Farm during the year, amounts to £216 : 9 : 8, and has been calculated in the cost per head, per week accordingly.

PROVISIONS, *(continued.)*	£.	s.	d.	£.	s.	d.
Brought forward	3674	7	6			
Tea, 1057 lbs. @ 3s. 4d. and 3s. 6d. ℔ lb.	176	19	10			
Treacle, 728 lbs. @ 3d. ℔ lb.	9	2	0			
Vinegar, mustard pepper, salt, lard, and spices	20	11	9			
Wine	0	8	0			
				*3881	9	1
NECESSARIES.						
Candles, 354 lbs. at 6s. 9d. to 11s. per doz.	10	13	11			
Coals, 382¼ tons @ 12s. 11d. to 23s. per ton	271	13	6			
Gas, 335800 cubic feet at 6s. 2d. ℔ thousand feet	103	11	9			
Mortars	0	17	6			
Soap, (hard) 58 cwt 3 qrs. 4 lbs. @ 40s. to 42s. ℔ cwt. 120 6 5						
„ (soft) 9 firkins @ 25s. ℔ firkin 11 5 0						
	131	11	5			
Soda, 44 cwt. 3 qrs. 8 lbs. @ 6s. 9d. to 8s. 6d. ℔ cwt.	16	17	4			
Starch and blue	9	1	1			
Wood	5	10	0			
				549	16	6
CLOTHING.						
Alpaces	3	2	10			
Belts	2	3	2			
Braces and gloves	6	18	0			
Calico	19	3	9½			
Cord	13	0	10			
Flannel	18	6	8			
Fustian	11	5	9			
Grey cloth	66	11	3			
Handkerchiefs	6	3	0			
Jean	6	0	0			
Lindsey woolsey	14	19	1			
Carried forward	£167	14	4½	4431	5	7

* In calculating the cost per head, per week, £1112 : 15 : 0, for maintenance of household, is deducted from this sum, and added to salaries & wages.

CLOTHING, *(continued.)*	£.	s.	d.	£.	s.	d.
Brought forward	167	14	4½	4431	5	7
Linen	38	6	8½			
Moleskin	7	10	0			
Muslin	2	14	9			
Pocketting	6	11	0½			
Print	26	19	6			
Serge	13	8	0			
Shawls	9	1	2			
Shirting cloth	37	7	3½			
Shoemaking (without wages)	155	9	8			
Stays	10	15	0			
Stockings	25	2	0			
Thread, tape, cotton, buttons, worsted, &c.	44	7	5			
Tweed	17	1	11			
Wrappering	1	8	0			
				563	16	10
SURGERY AND DISPENSARY.						
Drugs	39	14	0			
Surgical Instruments	0	12	3			
Wine and spirits	43	4	0			
				83	10	3
SALARIES AND WAGES.						
Visiting Surgeon	85	0	0			
Resident Medical Superintendent, £200, Gratuity £50	250	0	0			
Matron	100	0	0			
Clerk to the Visitors	100	0	0			
Chaplain	80	0	0			
Steward, £80, gratuity £15	95	0	0			
Assistant Matron	26	0	0			
Storeman	30	0	0			
Head Male ward attendant, (pt. year)	31	5	0			
Ten Male ward attendants from £24 to £30	259	8	8			
One Male night attendant	29	5	0			
Two Gardeners	53	10	0			
Ten Female ward attendants from £12 to £18	137	7	1			
Supernumerary attendant	12	0	0			
Night Nurse (part of year)	5	9	0			
Superintendent's servant	11	0	0			
Carried forward	£1305	4	9	5078	12	8

SALARIES, ETC., *(continued.)*	£.	s.	d.	£.	s.	d.
Brought forward.....	1305	4	9	5078	12	8
Housemaid	9	15	0			
Cook	16	10	0			
Kitchen maid	8	5	0			
Head Laundress	18	5	0			
Two under Laundresses	25	11	5			
Porter	16	0	0			
Two Trades Instructors	62	0	0			
Clothing for male ward attendants...	59	14	4			
				1521	5	6
MISCELLANEOUS.						
Baskets, and repairing same	6	17	0			
Blacking	1	2	7			
Books and publications	19	12	0			
Boot locks	5	4	0			
Brushes and mops	18	17	0			
Charcoal	7	17	3			
Chimney sweeper	2	4	8			
Chimney sweeping machine.....	10	11	6			
Clock cleaning	0	2	9			
Coir	7	0	3			
Combs	8	15	0			
Cooperage.....	11	19	9			
Corks	0	16	1			
Earthenware.....	31	0	6			
Easter offering	0	10	0			
Expenses of retaking patient	0	6	6			
Glazier	7	10	9			
Gratuity to patient	1	5	0			
Hearthstones	1	14	2			
Insurance	14	7	6			
Ironmongery.....	46	9	8			
Matches	1	10	0			
Mats	1	4	6			
Mincing machine.....	3	4	4			
Musical instruments and music	3	10	0			
Oil.....	1	1	3			
Postage and carriage	16	9	4			
Posting bills.....	0	15	0			
Printing, Stationery, and Advertisements	73	12	1			
Rates and taxes	26	17	6			
Razors	0	19	4			
Carried forward .....£	333	7	3	6599	18	2

MISCELLANEOUS, *(continued.)*	£.	s.	d.	£.	s.	d.
Brought forward	333	7	3	6599	18	2
Register office for servants.....	1	6	0			
Recreation for patients	1	2	0			
Removal of patients.....	97	6	11			
Sand	0	6	8			
Snuff and Tobacco	83	17	6			
Straw.....	41	3	9			
Sundries	5	8	8			
Travelling expenses of officers.....	1	15	0			
Waterproof sheeting	4	18	3			
				*570	12	0
FUNERAL EXPENSES.						
Ordinary Repairs, account for coffins .....*(a)*				14	6	0
REMOVAL OF PATIENTS.						
Expenses of removals .....*(a)*				7	6	7
CONVALESCENT PATIENTS.						
Allowance to patients absent on trial .....*(a)*				18	1	9
FURNITURE, BEDDING, FIXTURES, AND FITTINGS.						
Bedsteads	33	18	0			
Blankets	20	5	0			
Clocks	6	0	0			
Counterpanes	51	6	6			
Ironing stove	5	15	0			
Matting	6	15	9			
Sheeting	52	4	9			
Tick	17	8	10			
Upholsterer	53	19	6			
	247	13	4			
Building account, viz :—						
Carpenter 43 11 6						
Ironmonger 13 9 4						
Materials for padded room 18 19 8						
Smith 23 8 4						
	99	8	10			
				347	2	2
Carried forward.....£				7557	6	8

* In calculating the cost per head, per week, £10 : 16 : 0, for straw consumed from produce of Garden and Farm, has been added to this amount.

(a) These sums have been added to the charges for the maintenance, &c. of the respective Patients for whom the expenses were incurred.

BUILDING ACCOUNT, ORDINARY REPAIRS.	£.	s.	d.	£.	s.	d.
Brought forward				7557	6	8
Conquest, J., timber	3	6	9			
Elger, T. G. Exors., lime	1	17	0			
Green, J. & T., timber and slates	28	14	2			
Howard, J., lime	0	11	3			
Howard, J. & F., ironmongers	11	1	9			
Kilpin, W. W., ironmonger	16	13	2			
Manton, F., plumber and glazier	4	5	5			
Page, E. & Co., ironmongers	19	11	9			
Palgrave, C. F., admor., paint	20	8	7			
Slater, J., bricklayer	6	6	9			
Sheppard, S., plumber and glazier	14	8	6			
Steers, William, carpenter	54	8	6			
Steward, sundries as per bill	54	15	4			
Whittal & Son, timber	11	8	3			
Wing, J. T., cement	1	2	6			
	£248	19	8			
Less—funeral expenses, transferred	14	6	0			
Furniture, fittings, and fixtures, transferred	99	8	10			
	113	14	10			
				135	4	10
MAINTENANCE OF CRIMINAL LUNATICS.						
Dr. Finch, for Maintenance of Patients from Dec. 21, 1856, to Dec. 21, 1857				284	6	0
MAINTENANCE OF PAUPER PATIENTS IN OTHER ASYLUMS.						
Dr. Finch, for 29 patients from Nov. 12, to Dec. 31, 1857, at 13s. per wk.	134	12	9			
Committee of Visitors of Worcester Asylum, for 30 patients from Nov. 3, to Dec. 31, 1857, at 11s. 6d. per week, and Dr. Sherlock, travelling expenses £1:19:10	147	7	4			
				282	0	1
GARDEN AND FARM						
Orders on Treasurer at various times during the year				131	10	4
Total Payments				£8390	7	11

THE RATES OF PAYMENT DURING THE YEAR HAVE BEEN AS FOLLOWS, *viz* :—

	£.	s.	d.
First Quarter	0	9	0
Second Quarter	0	9	0
Third Quarter	0	9	0
Fourth Quarter	0	8	0
	£1	15	0
Average	0	8	9

THE ACTUAL WEEKLY COST OF THE PATIENTS AVERAGES AS FOLLOWS *viz* :—

	s.	d.	£.	s.	d.
Provisions	3	8¼			
Necessaries	0	8			
Clothing	0	8¼			
Salaries and Wages	3	3			
Surgery and Dispensary	0	1			
Fittings and Furniture	0	5			
Other Expenses	1	2¾			
			0	10	0¾
Less from Miscellaneous receipts			0	0	9½
Net cost			0	9	2¼
Average weekly cost of Household			0	10	8¾

Daily average of Patients 312

Daily average of Household 40

STATEMENT OF THE RECEIPTS & PAYMENTS

Between the 1st of January

RECEIPTS.

		£.	s.	d.
	To Balance in Steward's hands 31st Dec., 1856	50	0	0
	Ditto, Treasurer's, ditto	142	14	11
	Receipts under the following headings, *viz* —			
PAGE,				
45	Sales.—Produce of Garden, Farm & Sundries	426	6	5
45	Unions and Parishes in the United Counties of Bedford, Hertford, and Huntingdon	7259	16	5
46	County and Borough Treasurers in United Counties	277	10	8
46	Counties of Bedford and Hertford, excess paid for maintenance of criminal lunatics chargeable to parishes (16 & 17 Vict. c. 97, s. 42)	35	2	0
46	County of Bedford, for ordinary repairs	134	8	0
46	Out County, and non contributory districts	5	18	5
		£8331	16	10
	Balance due to Treasurer 31st Dec., 1857	108	11	1
		£8440	7	11

SAMUEL WING,

Clerk to the Committee of Visitors.

ON ACCOUNT OF THE BEDFORD LUNATIC ASYLUM.

and the 31st of December, 1857.

PAYMENTS.

		£.	s.	d.
PAGE.				
47	By Provisions	3881	9	1
48	„ Necessaries	549	16	6
48	„ Clothing	563	16	10
49	„ Surgery and Dispensary	83	10	3
49	„ Salaries and Wages	1521	5	6
50	„ Miscellaneous	570	12	0
51	„ Funerals	14	6	0
51	„ Removal of Patients	7	6	7
51	„ Allowance to Convalescent Patients	18	1	9
51	„ Furniture, Bedding, Fixtures, & Fittings	347	2	2
52	„ Building Account—Ordinary repairs	135	4	10
52	„ Maintenance of Criminal Patients	284	6	0
52	„ Maintenance of Patients in other Asylums	282	0	1
52	„ Garden and Farm	131	10	4
		£8390	7	11
	Balance in Steward's hands 31st December, 1857	50	0	0
		£8440	7	11

9th February, 1858, *Examined & allowed*,

THO. CHA. HIGGINS,

Chairman.

ABSTRACT OF THE RECEIPTS & PAYMENTS

For the year ending

RECEIPTS.

	£	s.	d.	£.	s.	d.
To Cash for sale of Pigs	122	15	1			
" " Potatoes	87	6	1			
" " Onions	98	0	5			
" " Wheat	48	17	6			
" " Mangel Wurzel	3	18	0			
" " Tares	13	0	0			
" " Cabbages	7	12	2			
" " Brocoli	2	2	0			
" " Savoys	8	0	0			
" " Carrots	2	4	6			
" " Parsnips	1	10	0			
" " Lettuce	0	3	8			
" " Eggs	1	16	7			
" " Poultry	0	4	0			
" " Vegetables	0	2	0			
" " Seeds (various)	6	16	6			
				404	8	6
Orders on Treasurer at various times during the year				131	10	4
Provision Account, value of Vegetables consumed in the Asylum during the year				216	9	8
Miscellaneous Account,—value of Straw				10	16	0
Estimated Rent of old Garden				6	0	0
Value of Grains, Wash, and Straw, consumed on the Garden and Farm during the year				54	14	4
				£823	18	10

SAMUEL WING,

Clerk to the Committee of Visitors.

ON ACCOUNT OF THE GARDEN AND FARM,

31*st of December*, 1857.

PAYMENTS.

	£	s.	d.	£.	s.	d.
By Cash for Rent and Taxes	77	19	0			
" Pigs	1	10	2			
" Garden Seeds	1	14	9			
" Pollard	12	15	1			
" Ironmongery	0	18	8			
" Rope	0	6	9			
" Matting	0	2	6			
" Sheep	27	14	3			
" Sacks	2	8	0			
" Scuttles	1	19	5			
" Tares	2	5	0			
" Thrashing Wheat	1	11	3			
" Sundries	0	5	6			
				131	10	4
Cash to Treasurer at various times during the year				404	8	6
Maintenance Account, value of Vegetables consumed in the Asylum during the year				216	9	8
Straw consumed				10	16	0
Garden Account,—Estimated Rent and value of Grains, Wash, and Straw, consumed on the Garden and Farm during the year				60	14	4
				£823	18	10

9*th February*, 1858, *Examined & allowed*,

THO. CHA. HIGGINS,

Chairman.

STATEMENT OF THE VALUE OF LIVE AND DEAD STOCK,

On the 31st of December, 1856, and 1857, respectively.

1856.

	£.	s.	d.
Dec. 31. Estimated value of live and dead stock, as per last year's account	315	12	0
Increase 1857 compared with 1856	17	2	6
	£332	14	6

SAMUEL WING,

Clerk to the Committee of Visitors.

1857.

	£.	s.	d.
Dec. 31. Estimated value of live and dead stock this day, *viz* :—			
Growing Crops	72	3	6
Manure	10	0	0
Pigs	70	11	0
Poultry	10	0	0
Produce of store	137	0	0
Sheep	33	0	0
	£332	14	6

February 9th, 1858, *Examined & allowed*,

THO. CHA. HIGGINS,

Chairman.

Of the Year ending December 31st, 1857.

NAMES of COUNTIES, &c., AND UNIONS.	BALANCES. Balances due from Guardians, &c., and Cash last Year.			GRAND TOTALS.			BALANCES. Balances due to Guardians, &c., this Year.			BALANCES. Balances due from Guardians, &c., this Year.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
Albans St. Liberty ...			0	34	9	0	0	1	10			
Albans St. Union ...			1	858	12	8				0	2	4
Ampthill Union ...	24	7	10	490	12	8	7	1	3			
Barnet Union ...			7	86	8	7				0	3	6
Bedford County ...	0	9	3	139	13	7	1	1	9			
Bedford Union ...			7	886	3	7	7	13	8			
Berkhampstead Union			8	91	4	8	9	0	9			
Bishop Stortford Uni			0	609	1	10	13	0	12			
Buntingford Union ...			4	354	14	14	14	18	12			
Caxton Union ...	3	7	1	121	15	3	1	4	5			
Edmonton Union ...	23	13	4	102	18	10				15	15	6
Hatfield Union ...	2	2	8	287	3	0	0	19	6			
Hemel Hempstead Un	21	11	6	217	16	6				6	18	8
Hertford County ...			0	57	7	0						
Hertford Union ...			4	280	7	4	0	2	6			
Hitchin Union ...	0	8	3	453	1	4	10	16	3	6	13	0
Huntingdon County ...			10	57	4	4						
Huntingdon Union ...			1	379	10	11	2	11	3			
Ivel St. Union ...			11	457	12	11	2	8	0			
Leighton Buzzard Uni	2	13	0	89	19	2	2	6	8			
Linton Union ...			3	671	12	3	7	9	5½			
Newport Union ...	3	7	6	264	2	0				4	0	2
Peterborough Union			0	128	0	0	1	9	0			
Royston Union ...			4	72	13	0				0	9	2
Ware Union ...	58	12	10	323	16	10	0	7	6			
Watford Union ...	2	19	10	253	8	8				6	2	1
Wellingborough Union	3	17	2	43	12	7						
Welwyn Union ...			6	68	8	6	0	0	9			
Woburn ...	2	5	2	201	6	4	1	1	10	1	16	4
Totals ...	149	14	11	7591	2	8	115	12	7½	51	0	9
Compared with last year, Increase	50	17	11				32	7	2			
Decrease												
	811	16	3							97	6	2

Annual Abstract.

(MAINTENANCE, ETC., ACCOUNT.)

Of the Receipts and Expenditure of the BEDFORD LUNATIC ASYLUM, and of the Balances for the Year ending December 31st, 1857.

NAMES of COUNTIES, &c., AND UNIONS.	No. of Collective Days Patients have been in Asylum.	RECEIPTS.			EXPENDITURE.					BALANCES.	
		Balances due to Counties, &c. and Unions last Year.	Amounts received this Year.	Total Receipts.	Proportions of Maintenance, &c.	Proportions of other Expences.	TOTALS.	Balances due from Counties, &c. and Unions last Year.	GRAND TOTALS.	Balances due to Counties &c., and Unions this Year.	Balances due from Counties, &c., and Unions this Year.
		£. s. d.	£. s. d.	£ s. d	£. s. d.	£. s. d.	£. s. d.	£. s. d	£. s. d.	£, s. d.	£. s. d.
Albans St. Liberty		0 1 10	34 9 0	34 10 10		34 9 0	34 9 0		34 9 0	0 1 10	
Albans St. Union	5335		374 10 5	374 10 5	334 2 8	25 2 3	359 4 11	24 7 10	383 12 9		9 2 4
Ampthill Union	6925		440 0 0	443 13 11	433 7 2	3 5 6	436 12 8		436 12 8	7 1 3	
Barnet Union	1380	3 13 11	86 5 1	86 5 1	86 1 7	0 7 0	86 8 7		86 8 7		0 3 6
Bedford County	780		140 15 4	140 15 4	48 16 8	90 7 8	139 4 4	0 9 3	139 13 7	1 1 9	
Bedford Union	14060	3 17 6	889 18 9	893 16 3	878 15 10	7 7 9	886 3 7		886 3 7	7 12 8	
Berkhampstead Union	1460	1 5 1	99 0 4	100 5 5	91 4 8		91 4 8		91 4 8	9 0 9	
Biggleswade Union	9160	34 18 7	605 3 5	640 2 0	572 7 9	27 14 1	600 1 10		600 1 10	40 0 2	
Bishop Stortford Union	4018	11 8 7	257 6 8	268 15 3	251 18 1	2 16 3	254 14 4		254 14 4	14 0 11	
Buntingford Union	2287		151 18 1	151 18 1	143 1 10	6 13 0	143 14 10	3 7 1	147 1 11	4 16 2	
Caxton Union	365	1 4 5	22 16 2	24 0 7	22 16 2		22 16 2		22 16 2	1 4 5	
Edmonton Union	1261		87 3 4	87 3 4	79 2 0	0 3 6	79 5 6	23 13 4	102 18 10		15 15 6
Hatfield Union	4492		288 2 6	288 2 6	281 13 1	3 7 3	285 0 4	2 2 8	287 3 0	0 19 6	
Hemel Hempstead Union	3138		210 17 10	210 17 10	196 5 0		196 5 0	21 11 6	217 16 6		6 18 8
Hertford County		0 2 6	57 17 0	57 19 6		57 17 0	57 17 0		57 17 0	0 2 6	
Hertford Union	4470	8 8 11	282 14 8	291 3 7	279 1 4	1 6 0	280 7 4		280 7 4	10 16 3	
Hitchin Union	7684		475 11 1	475 11 1	480 0 1	1 15 9	481 15 10	0 8 3	482 4 1		6 13 0
Huntingdon County	730	0 10 0	79 11 4	80 1 4	45 12 4	34 9 0	80 1 4		80 1 4		
Huntingdon Union	5903	2 18 4	370 3 10	373 2 2	368 9 3	2 1 8	370 10 11		370 10 11	2 11 3	
Ives St. Union	7330	9 14 7	450 6 4	460 0 11	457 12 11		457 12 11		457 12 11	2 8 0	
Leighton Buzzard Union	1408		93 5 10	93 5 10	87 6 2		87 6 2	2 13 0	89 19 2	3 6 8	
Luton Union	9072	0 5 2¼	578 16 6	579 1 8¼	566 14 1	4 18 2	571 12 3		571 12 3	7 9 5¼	
Neots St. Union	4157		260 1 10	260 1 10	259 10 6	1 4 6	260 15 0	3 7 0	264 2 0		4 0 2
Peterborough Union	2038	3 14 2	125 14 10	129 9 0	127 13 0	0 7 0	128 0 0		128 0 0	1 9 0	
Royston Union	373		22 16 2	22 16 2	23 5 4		23 5 4		23 5 4		0 9 2
Ware Union	3856		323 4 4	323 4 4	240 16 0	23 8 0	264 4 0	58 12 10	322 16 10	0 7 6	
Watford Union	5675		352 6 7	352 6 7	354 15 10	0 13 0	355 8 10	2 19 10	358 8 8		6 2 1
Wellingborough Union	632	1 1 10	43 13 4	44 15 2	39 8 5	0 7 0	39 15 5	3 17 2	43 12 7	0 0 9	
Welwyn Union	1095		68 8 6	68 8 6	68 8 6		68 8 6		68 8 6	1 1 10	
Woburn	4789		299 10 0	299 10 0	299 1 2		299 1 2	2 5 2	301 6 4		1 16 4
Totals	113873	83 5 5¼	7572 9 1	7655 14 6¼	7117 7 5	324 0 4	7441 7 9	149 14 11	7591 2 8	115 12 7½	51 0 9
Compared with last year. Increase	2195							50 17 11		32 7 2	
Compared with last year. Decrease		6 11 5	674 3 6	680 14 1	758 18 1	3 16 1	862 14 2		811 16 3		97 6 2

60] Comparative Table shewing the total Annual Receipts and Expenditure under separate headings, from the year 1848, to 1857, both inclusive.

[Ordered August Quarterly Meeting, 1852.]

Years ending Dec. 31	RECEIPTS.			EXPENDITURE.									Daily Average number of Patients	Average Weekly Rate of Payment for maintenance &c of Patients
	Maintenance, &c. of Patients.	From all other Sources.	TOTAL RECEIPTS.	Provisions.	Necessaries	Clothing.	Surgery and Dispensary	Salaries and Wages.	Furniture and Bedding.	Building and Repairs.	All other Payments.	TOTAL EXPENDITURE		
	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.		s. d.
1848	4642 1 5	4838 17 7	9480 19 0	2173 16 5	349 15 5	420 2 0	59 12 10	746 2 11	180 18 8	4569 10 7	374 13 11	8874 12 9	224	7 6
1849	4896 16 10	1427 14 3	6324 11 1	2199 9 0	470 2 9	483 5 11	71 16 1	879 0 9	124 16 3	1952 10 7	512 19 7	6694 0 11	251	7 6
1850	4922 11 4	78 4 5	5000 15 9	2129 15 10	445 7 10	444 1 11	62 0 7	914 14 1	124 3 3	363 15 5	527 5 7	5011 4 6	258	7 3
1851	4752 10 1	931 15 4	5684 5 5	2313 12 7	507 12 9	487 5 3	58 16 8	926 6 11	125 11 10	1193 8 11	728 1 1	6340 16 0	267	6 9
1852	5357 2 3	463 1 11	5820 4 2	2375 16 0	518 2 7	512 2 2	35 0 3	993 17 8	303 5 7	307 1 5	599 13 5	5644 19 1	275	7 4½
1853	5700 19 4	476 0 0	6176 19 4	2858 0 6	558 19 10	500 3 1	47 19 3	1007 13 10	164 18 11	301 15 8	783 6 8	6222 17 9	271	7 10½
1854	7634 10 11	523 6 0	8157 16 11	3568 14 1½	611 19 3	760 12 3	51 6 5	1086 9 0	387 3 6	357 9 10½	1290 4 2	8113 18 7	284	9 9
1855	8059 5 9	660 8 7	8719 14 4	4086 15 0	607 13 4	638 4 3	62 15 9	1432 6 11	614 13 7	217 8 9	1176 8 10	8836 6 5	293	10 0
1856	8245 4 1	743 2 0	8988 6 1	4282 12 2	571 6 11	498 18 9	76 14 0	1367 19 2	354 3 10	169 13 6	973 2 2	8294 10 6	307	10 0
1857	7572 9 1	566 12 10	8139 1 11	3881 9 1	549 16 6	563 16 10	83 10 3	1521 5 6	347 2 2	135 4 10	1308 2 9	8390 7 11	312	8 9

nd Expenditure under separate headings,
th inclusive.

1852.]

ITURE.												Daily Average number of Patients	Average Weekly Rate of Payment for main-tenance of Patients
s.	d	Furniture and Bedding.			Building and Repairs.			All other Payments.			TOTAL EXPENDITURE				
		£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.		s. d.
11		130	18	8	4569	10	7	374	13	11	8874	12	9	224	7 6
9		124	16	3	1952	10	7	512	19	7	6694	0	11	251	7 6
1		124	3	3	363	15	5	527	5	7	5011	4	6	258	7 3
11		125	11	10	1193	8	11	728	1	1	6340	16	6	267	6 9
8		303	5	7	307	1	5	599	13	5	5644	19	1	275	7 4½
10		164	18	11	301	15	8	783	6	8	6222	17	9	271	7 10½
0		387	3	6	357	9	10½	1290	4	2	8113	18	7	284	9 9
11		614	13	7	217	8	9	1176	8	10	8836	6	5	293	10 0
2		354	3	10	169	13	6	973	2	2	8294	10	6	307	10 0
6		347	2	2	135	4	10	1308	2	9	8390	7	11	312	8 9

CONTENTS.

GENTLEMEN,

As my Official Report contains but a brief description of the LIFTING BEDSTEAD, for the use of Invalids, the following explanation and illustrations will, I think, more clearly convey a general idea of its construction.

The power applied is upon the simple principle of the lever. Three of these levers are fastened to the bedstead on either side, being attached by moveable joints to a bar of iron, on which is screwed a frame of wood, with cross pieces at the head and foot.

To the frame is strapped or laced bands or sheets of slightly elastic India-rubber, or air-cushions, or water-cushions, whichever may be desired, to carry the patient, which may be either kept under the body or applied when required. One person generally is enabled to raise the frame, and when the levers are about an inch and a quarter beyond the vertical position they are caught by stops, *where it may be left until such time as all surgical appliances are used, the bed made, the stool used, and the necessary ablutions performed*, (as shown, Figs. No. 2 and 4,) and the patient again lowered into bed without the slightest fatigue from the operations.

Of the Engravings,

Fig. I. represents the old Trough Bedstead with the lift down, and although the most simple, it is perhaps the most difficult of use, from the body being generally somewhat below the level of the rail. As all the side fastenings cannot be performed at the same time, there is consequently some inequality in the position of the body; but Hooper's Water Bed on an ordinary bedstead entirely obviates this, and is decidely preferable.

Fig. II. is the same Bedstead with the lift raised up, shewing the supporting bands or cushions as they should be placed.

Fig. III. represents the same as Fig. IV., with the lift in disuse.

Fig. IV. The lift is here attached to an Iron Bedstead, and as such may in the ordinary way be used by any one, with or without Hooper's Water Bed, as circumstances require. There is the greatest security to the safety of the patient with an equivalent ease in the use. To this is also affixed a frame for the purpose of sitting up when the lift is raised. The supports up to the knees being removed, a very comfortable easy chair is formed, with this advantage, that the patient can recline at a moment's notice.

These Bedsteads have been tested as to strength and adaptation, upwards of thirty-six stone weight (14 lbs.) having been raised by one man and woman without any apparent deflexion of the levers.

Having, in conformity with almost every medical man, experienced a great deficiency in our lifts for bed-ridden and other patients, I have for many years been trying various arrangements, but I have found none equal to the simple lever, without any pullies, cranks, or wheels.

In giving the result of my experience to the Profession and to the Public, I do so with the greatest pleasure, having no pecuniary interest in it whatever. I have placed it in the hands of Mr. Hooper, No. 7, Pall Mall East, London, who is well-known, and who has undertaken to supply them and to give his attention to their full development.

They are exceedingly portable, and peculiarly applicable for India and military use.

I have the honour to be,

Gentlemen,

Your very obedient Servant,

WILLIAM DENNE.

THIRTY-SEVENTH

ANNUAL REPORT

BY

THE DIRECTORS

OF

James Murray's Royal Asylum

FOR LUNATICS,

NEAR PERTH.

JUNE, 1864.

PERTH:
PRINTED BY ORDER OF THE DIRECTORS, BY JAMES DEWAR,
MDCCCLXIV.

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1864-5.

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ANNUAL REPORT

BY THE DIRECTORS OF

JAMES MURRAY'S ROYAL ASYLUM

FOR LUNATICS.

13th JUNE, 1864.

It is now the duty of the Directors to submit the Thirty-seventh Annual Report of the Institution.

At the date of the last Annual Report, there were in the House 180 patients—87 males and 93 females. Since then 49 patients have been admitted—25 males and 24 females. The total number of patients under treatment during the year was 229—112 males and 117 females. Of these, 29 recovered—15 males and 14 females; 42 were removed improved—16 males and 26 females; 73 were removed unimproved—37 males and 36 females; and 12 died—9 males and 3 females. There now remain in the Asylum 73 patients—39 males and 38 females.

The large number of removals of patients *unimproved* during the past year arises mainly from the opening of the Perthshire District Asylum at Murthly, and the transfer to that place of the whole body

of Perthshire pauper patients, confined in this Institution, and which took place in the beginning of April last. At the present date there is no pauper patient left in the establishment, which has now become an Hospital for the Insane of the middle and upper classes.

Will of founder anent Beneficiaries of Institution.

It was clearly the will and design of the Founder of this Institution—as these are expounded or set forth in its Royal Charter of Incorporation, dated 5th March, 1827 — that its benefits should *not* be extended to *Paupers* as such: for it is more than once therein stipulated that "the persons to be admitted . . . shall *not have legal claims for parochical relief as Paupers*,* . . upon any Parish." When, therefore, on the passing of the 'Lunacy (Scotland) Act' of 1857, it became necessary to consider the future relation of this Institution to the District or County Asylums proposed to be erected under the said Act, its Directors, after mature deliberation, resolved that, so soon as adequate provision should be, by the County of Perth, made for its pauper insane, this Institution should cease to be open for the treatment of *pauper* patients—and *should be reserved entirely for the non-pauper or private, though not necessarily affluent, classes of the insane.* In this determination the Directors were actuated by additional, and perhaps scarcely less cogent, reasons, which have been set forth in more than one of the published reports† of the Institution, and need not be here recapitulated. The adequate provision contemplated in 1857, for the pauper insane of Perthshire, was supplied on 1st April last, by the opening of the Perthshire District Asylum at Murthly, near Dunkeld; and accordingly, on that date, our doors were closed *quoad* the admission of *paupers*. With a few exceptions, and for special reasons, *all* the paupers then in this Institution were removed therefrom on 1st and 2d April last. The exceptional cases above referred to have been removed since; and at the present date there is not a pauper patient left in the establishment. The Institution has thus now become, what the Directors had determined for the last 7 years it should become,—*an Hospital for the Insane of the Non-pauper*, or, in other words, the private (middle and upper), *or self-supporting, classes:* and therein and thereby it *differs from every other Chartered, or Public Asylum in Scotland, combining in one establishment all the advantages of a Public, with those of a Private, Asylum.*

Preference of Non-Pauper classes.

Future exclusion of Paupers.

* Printed "Warrant for Charter of Incorporation," pp. 12 and 13.

† Thirty-second Report (for 1856)—p. 28.
Thirty-third ,, (,, 1860)—p. 51.

Removal of Pauper Population: its effects.

Our pauper have stood in so large a numerical relation to our non-pauper residents that this sudden discharge or removal of the former has necessarily made in every sense an important reduction on our general population. Of a total number of 229 patients under treatment during the bygone year, no less than 144, or upwards of 60 per cent. have been discharged; whereof 125, or nearly 90 per cent. were paupers. Or, viewing the same exodus in a different light:—at the corresponding date last year, our population stood at 180: it is now 73—the reduction being at the rate of 60 per cent.—and the present residents standing to those of last year in the proportion of 40 per cent. Our present population is thus the smallest we have had since 1832, when it was 71:—the population of 1827, when the Institution was opened, having amounted to 40. It can readily be shown, however, that the arrangements of the Institution are only *adapted for a comparatively small or limited number of patients;* for we find that, on re-arranging the sleeping accommodation for our present residents, so as to secure to each an adequate cubic breathing space (which in some cases is only 500 to 600 cubic feet, instead of a minimum of 1000 as it should be): making allowance for certain contemplated alterations; and reserving certain supernumerary apartments for sick rooms and other purposes, necessary to the proper equipment of an Hospital even of the most humble class, the Institution *remains nearly full!* This circumstance affords the best measure we can offer of the *over-crowding* of the last Decennium—an overcrowding which was apparently an unfortunate necessity in the absence of other provision for the *pauper insane of Perthshire*, by whom solely it was caused.

Capacity of Institution quoad accommodation.

It is undoubtedly conducive to the permanent efficiency and prosperity of the Institution, that its aims—its organisation—its procedure—should be modified and regulated in accordance with the information and experience acquired since its foundation: with prevalent wants and views: with modern progress in science—sanitary and psychological. Such a policy is simply a commercial necessity of the times—if an Institution somewhat old is to continue, under altered and altering circumstances, to prosper: and such a policy is only what is daily being followed by all large corporations or proprietary bodies of old standing, which do not desire to succumb to their more vigorous, youthful rivals—which indeed desire at all, amidst inevitable and increasing competition on every hand, to maintain their pristine reputation, efficiency, or success. Actuated by such convictions—guided by such a policy—the Directors are losing no time in availing themselves of the favourable opportunity presented by so great

Modifications proposed by Experience, Scientific progress, &c.

Necessity for a Progressive Policy.

a reduction of our population to effect certain radical changes in the internal economy of the building, which have long been contemplated —which were indicated in our last annual report*—and which have hitherto been prevented only by the presence of our *pauper* population. These changes will imply an unavoidable amount of confusion for the space probably of about 2 years. Meanwhile, the confusion is increased by the occupation of several large and important rooms as store-rooms for the furniture and bedding used by the paupers—until this can be utilised in connection with the alterations now in progress: by commissariat and staff changes: and by the remodelling of various arrangements and apartments, all immediately consequent on the *pauper* exodus.

Concomitants of alterations.

Disposal of Pitcullen Bank estate.

The sale of Pitcullen Bank—mansion and estate—in spring last, has led to the necessity for building new official residences for the Physician and head male attendant—the site of that for the former being at Gilgal—the most elevated corner of the Asylum-farm lands—and that for the latter probably within, or near, the Asylum-grounds proper. The occupation of Pitcullen Bank by its purchaser at Whitsunday last has further necessitated the temporary residence elsewhere of both the officers in question until their respective permanent dwellings are ready for occupation. This is expected to be at Whitsunday 1865; but even should entrance be had at this minimum period, the unavoidable changes connected with a double shift of residence, and its inevitable discomforts must extend over a period embracing at least a couple of years.

New official Residence for Physician at Gilgal.

It will thus be evident that equally within and without the Institution changes of the most important kind are in progress: that the present period in its history is one evidently of *transition:* that the present position of our community is exceptional: that all our procedure must be correspondingly so: and that we cannot reasonably expect emancipation from this state of things for several years.

In consequence of the new character which the Institution has now assumed, by the entire removal of Pauper patients, and its appropriation for patients of the Middle and Upper classes, a large expenditure will be necessary to adapt the house for this purpose, and the Directors are now in the course of carrying the necessary improvements into effect.

Alterations in progress or contemplation.

It is unnecessary on the one hand, and it were tedious on the other, to catalogue *seriatim all* the alterations or innovations now in contemplation, if not in progress, within the Institution, or its out-houses and grounds, with a view to place it, so far as is, under the

* Thirty-sixth Report (for 1863), p. 14.

circumstances, possible, on a par with the best establishments of its class throughout the country. But it may be desirable here to record in general terms the more important thereof, which are as follows:—

(1.) The application of *steam* to various purposes of heating, cooking and washing, in or connected with the laundry, kitchen, and house generally.

(2.) The economization of fuel by the introduction of improved means of heating and cooking.

(3.) The economization of labour in the laundry by the introduction of modern washing and wringing machines.

(4.) The enlargement, with corresponding improvements in lighting and ventilation, of the kitchen and commissariat department, and of the laundry.

(5.) The re-construction of the great central stair-case and Tower with a view to its more efficient lighting and commodiousness.

These improvements will probably involve or imply an expenditure of about £4000: and others are in contemplation.

Accidents from Fire.

During the year two fires occurred in the laundry, both arising from the use of old and defective apparatus for the drying of clothes. Fortunately the extent of damage was limited, in the one case to £20, in the other to £80. These, however, are not the first accidents of the same kind, in the same locality, and from the same cause. The most serious fires have been traceable to the present faulty mode of heating the drying closet—a hot air flue of old construction. Our direct damage by accident has, however, not been our heaviest loss, which is to be found in the consumption of fuel in *five* fires or furnaces, where, with modern and suitable apparatus, *one*, would suffice. The proposed improvements in the laundry will not only greatly diminish the risk of accident from fire, but will lead to great economization equally of fuel and manual labour. The latter is a matter of some moment under our altered circumstances—in regard, we mean, to our smaller population, especially of patients capable of, or skilled in, the lower branches of mechanical labour. It is most undesirable to destroy the sources or objects of manual labour, which is a necessity to certain groups of patients. But it is equally undesirable to have more manual labour than our community can, with a due regard to the objects for which the Institution has been established, undertake: inasmuch as this involves the employment of expensive, skilled, *hired* labour. But the garden and farm-yard for the men, and the laundry, kitchen, and galleries for the women are likely to absorb for the future, as they do for the present, all the able-bodied, whose labour it is thus desirable to reserve for the use of

Expensiveness of antiquated arrangements.

Economization of Manual labour.

Applications of Steam power.

the departments in question. This will be attained by the introduction of steam power, which, applied to the pumping of water alone will at once relieve a group of about a dozen patients, with their attendants, whose services will then become available, where they are much wanted, in the garden, pleasure-grounds, farm-yard, and out-houses. One large steam boiler and steam engine, placed in the laundry will, it is expected, not only heat all departments of the latter, supply it with hot water, and drive washing, wringing, or other machinery, but will supply steam for cooking purposes to the kitchen, and for heating water throughout the body of the Institution: while it will also draw and pump water from the different wells and tanks distributed over the grounds.

For further particulars, in regard to the history and experience of the Institution during the past year, reference is made to the Report by Dr Lindsay, the Physician.

For some considerable time to come, great care and attention will be requisite on the part of the Directors to adapt the Institution to the new condition it has now assumed as a non-pauper establishment, and no exertions on their part will be spared to attain this end.

During the past year the Institution has lost the valuable and efficient services of Dr M'Intosh, assistant physician and superintendent, who has been elected to the important office of medical superintendent of the County Asylum at Murthly.

The Directors tender their best thanks to Dr Lindsay and the other officers of the Institution for their zealous and efficient services during the past year; and they earnestly trust that, as heretofore, the Institution may, through the Divine blessing, long continue to confer important blessings on the community.

WM. PEDDIE, *Chairman*

REPORT OF PHYSICIAN

FOR THE YEAR 1863-4.

General Results of year.

THE Admissions during the year have been 49; the mean daily number of patients under treatment 144; the recoveries 29, or nearly 60 per cent. of the admissions; the discharges, improved and unimproved, 115; the deaths, 12, or about 5 per cent. of the total number of patients under treatment during the year. About one-fourth of the admissions were characterised by the possession of suicidal or homicidal propensities, or both. Suicidal cases are always, unfortunately, too common; they seldom, however, present features noteworthy from their novelty or interest. Occasionally the *youth* of the would-be suicide is exceptional: as in the case of a herd boy of 14, whose delusions and propensities, however, were speedily dissipated by treatment, and who became, prior to his discharge recovered—a cheerful, industrious, agile, eminently boyish boy.

Suicides.

Among our residents latterly has been a most unusual proportion of patients, whose propensities render them dangerous to the lives of others: murderers, homicides, and assaulters—prone to sudden, serious, unprovoked, and unforeseen attacks on their unsuspecting fellows. In some cases, these attacks are the result apparently of delusions of suspicion—or of implacable enmities against supposed foes: in others they are the offspring of momentary, uncontrollable impulse—without cause *quoad* the person assaulted. In the one class of cases a plausible reason is assigned:—the victim is represented as having systematically annoyed, or irritated, or conspired against his assaulter, who has only been inflicting what he considers merited punishment. In the other class, the pretext is frivolous in the extreme: the assaulter "could not help it;" does not "know how it happened," nor why he did it; it "came into his head of a sudden;" he did it "for fun;" or, perhaps, he himself thought he deserved and therefore

Homicides and Assaulters.

Impulsive violence.

Assaults: their causes and effects.

wished a "thrashing," and adopted this means of securing one; or he felt "in a fighting mood," and so forth. Notwithstanding every care taken to prevent their occurrence, many unforeseen assaults have been committed during the year—not unfrequently on the attendants placed in special charge of dangerous patients. That these assaults were all comparatively harmless in their results to assaulter and assaulted alike—that they did not become, by their success, murders or homicides—is due simply to our full staff of attendants, and to their vigilance, courage, promptitude, and energy in emergency. We may add, *en parenthèse*, that such accidents would scarcely have occurred under the old régime of Manual Restraint, which, with all its faults, had its advantages, and which undoubtedly saved in more than one form many lives, that are now sacrificed to the popular creed—"Non-restraint"—absurdly so-called. The fact cannot be doubted that reaction against the errors and absurdities of the "absolute Non-Restraint" system is setting in strongly. Asylum physicians find that Mechanical Restraint is the most humane mode of treating certain exceptional phases of insanity—the only mode apparently of avoiding certain catastrophes now of common occurrence; and they are gradually re-adopting the mildest forms thereof compatible with the safety or security of their patients. But, with the present strong public feeling in favour of unqualified non-restraint—the total abolition or absence of restraint in or under all its forms or names—a feeling which is not founded on experience, but is merely the fruit of the pseudo-philanthrophic tendencies of the age—it is exceptional to find men with the moral courage necessary to the confession that their experience, if not belief, is antagonistic to the favoured creed or delusion of the time.

Fallacies and evils of absolute "Non-restraint."

Popular Pseudo-Philanthropy.

The due treatment of patients belonging to what are *par excellence* the "dangerous classes"—of suicides, homicides, and assaulters—implies not merely a material addition to the cares and responsibilities—the duties and labours of all grades of our staff:—but it involves large additional outlay—expense, unfortunately, generally disproportionate to the rate of board of the individual—on special attendance and special precautions against accident; and it would therefore only be fair and proper were such patients admitted only on payment of rates of board at least 50 per cent. above those of their less dangerous and more manageable fellows. It is not unimportant here to observe that homicidal impulse and attempts of the most persistent and dangerous kind may co-exist, and have in certain of our cases co-existed, with a perfect knowledge of right and wrong, and their bearings on human actions: with perfect ability to

Psychical peculiarities of Homicides.

manage business affairs, though of a complex pecuniary character—the patient occasionally directing relatives, bankers, and agents with unerring tact and judgment, scrupulous accuracy and method; with perfect propriety in maintaining most of the relationships, or discharging most of the social or public duties of life: with deportment generally the most polished and gentlemanly—the most considerate and kind. Patients, whose delusions and impulses are such that it is impossible to trust them at large among their companions, without imminent risk of murder or assault, have yet proved fond and exemplary husbands and parents: shrewd and exact men of business: intelligent and amusing correspondents: acceptable contributors to periodical literature: painstaking students and accomplished scholars: devotees of science—the Arts or the Muses.

Co-existence of Sanity and Insanity.

One half of our Mortality during the year may be set down as ordinary—the other half as extraordinary or exceptional. As showing the intractable, or hopeless, character of some of the cases with which we have had to deal, it may be stated that at least 4 patients, or one-third of the whole deceased, were admitted in such a condition of debility and emaciation that they may be said to have been sent here but to die. These were apparently the direct fruits of imperfect or insufficient nutrition—the patients having obstinately refused food for a time prior to admission, and no artificial means of alimentation apparently having been had recourse to. 2 deaths occurred on the third day, and 6 or one-half of the whole, within three weeks after admission—all from diseases contracted prior thereto. Again, 6, or one-half of the whole, were over 60 years of age at the time of death—2 of them, indeed, over 70. In both the latter cases, death was sudden—supervening similarly within a few minutes after a hearty breakfast—the cause apparently being heart-disease, though in both there had been an equal risk of death by apoplexy, and a strong probability of the existence of atheromatous or calcareous degeneration of the vessels of the brain. In one of these cases, however, there is every reason for believing that death was accelerated, if not directly caused, by his extreme violence, and by rough usuage at the hands of above 10 unskilled and unqualified attendants while he was at home in a state of acute mania—the numerous bruises found on his person on admission affording satisfactory evidence of the character of his Home-treatment. In cases of this class, the remarks we have made on page 12, relative to Mechanical Restraint, equally apply: the probability being that, had some means of mechanical restraint—such as the camisole or polka—been applied, the injuries whereof the bruises referred to were the indices, would not have been inflicted. It would appear, then, that

Mortality: its causes.

exceptional:

Sudden Deaths.

we are properly chargeable with only one-half the year's mortality. Some of our oldest residents were among the deaths: one patient had been, at the date of his demise, between 20 and 30 years resident; 2 between 10 and 20; and 2 also between 5 and 10; or, in other words, 5 out of 12 deaths were those of persons who had resided upwards of 5 years in the Institution. 9 out of the 12 deaths were males—an unusual and unequal proportion in relation to the opposite sex. In

Autopsies.

one-half the whole cases, no *post mortem* examination was permitted by the friends or relatives of the deceased: and we are less likely hereafter to obtain the same proportion of autopsies we have hitherto had, small though this be; firstly, because of our limited population, and its equally limited mortality: but mainly because of the prejudices of the representatives of patients in the middle and upper ranks of society in regard to a practice, which, while it cannot possibly harm the dead, promises to contribute to the welfare of the living, by improving our knowledge of practical medicine and its allied sciences. Some of the fatal cases were of great interest in a Pathological point of view; but we cannot afford space to go into detail, or even to do more than refer to the very brief vidimus or index given in our Obituary Table in the Appendix.

Relief of over-crowding.

As has been the case, for several years past, we found it necessary, during the bye-gone year, in order to relieve our over-crowded condition, to draft a certain number of our Paupers to other Asylums, to the Lunatic Wards of Poorhouses, or to private houses. These were chronic incurables of the most intractable kind. Looking, however, to the relief to be afforded by the exodus of 1st April, the number of Paupers so discharged, to relieve overcrowding, was limited to 18, most of whom were transferred to the Royal Asylum at Montrose.

Re-arrangement of Sleeping accommodation.

For the first time since our official connection with the Institution, have we found it at all possible to arrange the sleeping accommodation, so as to secure for each patient a due cubic space of air; and, even yet, the original architectural arrangements of the building are such as to render it impossible to do all we could desire in this direction. In the bedrooms of private dwellings in Perth (it is so in our own), we find the cubic breathing space per person as high as 2000 to 3000 feet; and there is no reason, but the contrary, why in an Hospital, —in a curative establishment,—in a community of invalids,—there should be only one-fourth or one-third of this amount! The minimum standard, now recognised among sanitary authorities, is 1000 cubic feet per person—a space far inferior to that allocated to each patient in many, and probably now in most, modern General

Cubic breathing space.

Hospitals.* The nearest approach to this standard, to be found in this institution, is in the gallery bedrooms—*each being intended and adapted only for a single patient*—where the cubic space is 880 feet. In certain dormitories, on the other hand, it falls as low as 550; and in the days of our overcrowding, when the Institution contained *double the number of patients for whom it was properly fitted*, half these figures may be quoted as the maximum cubic breathing space—*quoad* sleeping accommodation—per person! If the architectural arrangements of the edifice prevent our *increasing* this cubic space up to the proper minimum standard, we have it in our power, at least, by the re-arrangement of the sleeping accommodation under-noted, to prevent its being *reduced* below the figures 880 and 550 respectively.

Re-arrangement of Sleeping accommodation.

* In Hospitals of recent construction in England, the average space allotted to each Patient in the sick wards or dormitories varies from 1000 to 1800 cubic feet: the most recently erected always having the greatest amount of space. The Parisian hospitals have an average space of 1500 cubic feet: though in the newer ones, it varies from 1000 to 2300. The whole subject of the dimensions and ventilation of bedrooms and dormitories in Public Institutions is well set forth in a paper entitled "Experiments in Ventilation," by Dr Berkeley Hill, in the "British and Foreign Medico-Chirurgical Review," July 1864, pp. 166 and seq.

Ordinary accommodation.

This Table exhibits the ordinary *Gallery* accommodation; but there are sundry *Supernumerary* apartments, detached from the Galleries—superior in dimensions and in every other respect to the ordinary Gallery accomodation—and which may be used temporarily as single bedrooms or dormitories, though not without prejudice to what we conceive to be their more legitimate purposes (as these are set forth in the section which follows). *The sleeping accommodation being the only proper measure of the capacity of the Institution*, it would appear that, if we are to frame our arrangements in accordance with the "Laws of Health,"—with the principles or doctrines of Modern Sanitary Science—our total population should not exceed 80 persons; and that *any excess of this standard must be regarded as overcrowding.*

Maximum Population.

TABLE: SHOWING RE-ARRANGEMENT OF SLEEPING ACCOMMODATION.

DEPARTMENTS OF HOUSE.	No. of Patients that can be placed in separate rooms on each side of the House.	Total No. of Patients that can be accommodated.	Nature of accommodation on each side of House.	Breathing space per Patient in cubic feet.
I. Male Side. (Galleries.) 1. Fuad 2. Esquirol 3. Winslow 4. Cassidy	7 11 8 12	14 22 16 24	7 Single Bedrooms, 8 Do. 1 Dormitory for 3 patients, 8 Do. do. 3 Dormitories, each for 4 Patients,	880 650 880 In 2 Dormitories, 675 In 1 Do. 550
II. Female Side. (Galleries.) 5. Murray 6. Boston 7. Peddle 8. Malcom				
Total of both sexes, 76	Total of numbers, 38			

For the first time, also, for a long series of years at least, has it been found possible to reserve the following groups of apartments, or

kinds of accommodation, without which no such Institution as this can pretend to completeness or efficiency, viz:—

Special accommodation:

I. Sick rooms for both sexes. For the use of patients of either sex we have set apart a suite of rooms in the most salubrious portion of the Institution: in the Browne and Belshes galleries respectively. They are well lighted, ventilated, and heated: are provided with every suitable convenience: and possess the advantage of a free exposure, and an attractive panorama. One of the rooms contains about 3000 cubic feet of air, and is adapted for about 4 patients—that is 750 cubic feet per person: the other contains about 2200 cubic feet for 3 patients, or over 700 cubic feet each.

Its necessity and advantages.

II. Dormitories for the suicidal, hysterical, and timid, who require the special care of, and association with, an attendant by night as well as by day.

III. Apartments for the isolation or separation—as circumstances may require or render desirable—of the following groups of patients:—

1. The dangerous and irritable—with a view to their more efficient or appropriate treatment:—but in order more especially to the due protection and security of our community generally.
2. Epileptics, dipsomaniacs, or other special cases, which also demand, for their own benefit, as well as that of the community generally, that they should be separated therefrom.
3. The aged, feeble, and helpless—securing to them a greater degree of quietude, privacy, and domesticity than is attainable in the galleries, which are inhabited necessarily by all classes of the general insane—including the noisy and boisterous.
4. The convalescent—promoting their recovery by removal from the annoyances of their more excited and troublesome fellows.
5. The quiet and industrious—as a reward for, or inducement towards, habits of industry and order.

APPENDIX

TO

REPORT OF PHYSICIAN;

CONSISTING OF

STATISTICAL TABLES

I.—GENERAL RESULTS OF THE YEAR 1863-64.

	Males.	Females.	Total.	M.	F.	T.
Patients admitted from 1827 to 1863, ...				693	718	1411
Of these Recovered, ...	247	349	596			
,, were Removed improved,	95	82	177			
,, ,, ,, unimproved,	107	90	197			
,, Died, ...	157	104	261			
				606	625	1231
Patients remaining on 8th June, 1863, ...				87	93	180
,, admitted for first time during the year from June 1863 to June 1864, ...	23	20	43			
,, re-admitted, ...	2	4	6			
				25	24	49
Total number of Patients under treatment during 1863-4,				112	117	229
Of these Recovered, ...	15	14	29			
,, were Removed improved, ...	16	26	42			
,, ,, ,, unimproved,	37	36	73			
,, Died, ...	9	3	12			
				77	79	156
Patients remaining on 13th June 1864, ...				35	38	73

Mean daily number of Patients under treatment during 1863-4.—144.

II.—ADMISSIONS DURING 1863-4.

	M.	F.	T.
	25	24	49
1.—*Age.*			
Between 15 and 20 years,	4	—	4
,, 20 ,, 30 ,,	6	2	8
,, 30 ,, 40 ,,	8	8	16
,, 40 ,, 50 ,,	4	10	14
,, 50 ,, 60 ,,	1	1	2
,, 60 ,, 70 ,,	2	2	4
,, 70 ,, 80 ,,	—	1	1
2.—*Condition as to Marriage.*			
Married,	9	9	18
Single,	16	12	28
Widowed,	—	3	3
3.—*Form of Insanity.*			
Dementia,	4	3	7
General Paresis,	2	—	2
Mania,	8	9	17
Melancholia,	4	10	14
Monomania,	7	2	9
4.—*Co-existent Physical Diseases or Defects.*			
Amenorrhœa,	—	4	4
Debility from Abstinence,	1	4	5
,, other causes,	3	4	7
Deaf-mutism,	1	—	1
Dislocation [partial] of Astragalus,	1	—	1
Heart Disease,	1	—	1
None,	16	11	27
Suicidal wounds of Throat,	1	1	2
Ulcer, Chronic, of Leg,	1	—	1
5.—*Duration of Insanity prior to Admission.*			
Under one Week,	2	—	2
Between 1 week and 1 month,	7	8	15
,, 1 and 6 months,	9	11	20
,, 6 ,, 12 ,,	—	1	1
Between 1 and 2 years,	1	—	1
,, 2 and 5 ,,	3	1	4
,, 10 ,, 20 ,,	1	1	2
,, 20 ,, 30 ,,	1	—	1
Unknown,	1	2	3
6.—*Number of previous Attacks.*			
One,	2	3	5
Two,	2	1	3
Three,	—	2	2
Several,	—	1	1
	4	7	11
7.—*Interval since last Attack.*			
1 month,	—	1	1
1 year,	1	—	1
2 years,	1	1	2
3 ,,	1	—	1
4½ ,,	—	1	1
5½ ,,	1	—	1
6 ,,	—	1	1
7 ,,	—	1	1

II.—ADMISSIONS DURING 1863-4—[CONTINUED].

	M.	F.	T.
8 years,	—	1	1
17 ,,	—	1	1
8.—*Suicidal and Homicidal Propensities.*			
Homicidal,	2	—	2
Suicidal,	4	6	10
Homicidal and Suicidal,	1	—	1

III.—RECOVERIES DURING 1863-4.

	M.	F.	T.
	15	14	29
1.—*Age.*			
20 years or under,	4	2	6
Between 20 and 30 years,	5	2	7
,, 30 ,, 40 ,,	5	6	11
,, 40 ,, 50 ,,	—	2	2
,, 50 ,, 60 ,,	1	2	3
2.—*Condition as to Marriage.*			
Married,	3	4	7
Single,	12	9	21
Widowed,	—	1	1
3.—*Form of Insanity.*			
Erotomania,	—	1	1
Mania: acute,	8	9	17
,, chronic,	2	—	2
Melancholia,	2	4	6
Monomania,	3	—	3
4.—*Duration of Insanity prior to Admission.*			
1 week or under,	2	1	3
Between 1 week and 1 month,	3	6	9
,, 1 and 3 months,	6	2	8
,, 3 ,, 12 ,,	3	5	8
,, 10 ,, 15 years,	1	—	1
5.—*Duration of Treatment in Asylum.*			
3 months or under,	4	5	9
Between 3 and 6 months,	5	2	7
,, 6 ,, 12 ,,	4	4	8
,, 1 ,, 2 years,	2	2	4
,, 5 ,, 6 ,,	—	1	1

The Recoveries constitute
29·10 per cent. of the Admissions.
29·13 ,, ,, Mean daily number of Patients under treatment.
12·66 ,, ,, Total number under treatment during the year.

IV.—OBITUARY FOR 1863-4.

No.	Sex.	Age at Death.	Form of Insanity.	Duration of Residence in Asylum.	Duration of Fatal Illness.	Apparent immediate Cause of Death.	RESULTS OF *POST MORTEM* EXAMINATION. Prominent or exceptional Pathological lesions or conditions: Weight of Viscera in ounces Avoirdupois. Head and Spinal Column.	Thorax.	Abdomen.	Other parts of Body.	Additional Remarks.
1.	M.	64	Chronic Dementia: Paroxysmal Mania: Homicidal.	13½ years	2 months	Congestive Apoplexy.	No	*POST MORTEM*	EXAMINATION.		Obscure Hemiplegia of left side present before death: cancerous tumour over spine of right scapula: similar tumour over sternal end of left clavicle.
2.	M.	42	Chronic Dementia Delusions: Gesticulator.	5 years.	2 weeks.	Pyæmia.		Pus in, and adhesions of, Pleura of both sides. Left Lung, 23½ oz.: right Lung, 27 oz. Heart, 13 oz.	Depôts of Pus in cortical layer of both kidneys. Hyperæmia of ascending & transverse colon, and of cardiac end of stomach. Left Kidney, 7½ oz. Right Kidney, 6¾ oz. Liver 56 oz. Spleen, 6 oz.	Large diffuse abscess, containing 3 to 4 pints of Pus, surrounding greater part of left femur, laying the bone, and communicating with the knee-joint. Ostitis and Periostitis [femur]: Arteritis [thigh.]	Original lesion was probably injury to the fibres of certain muscles, and to the coats of certain vessels—of the thigh—produced by his habit of violent stamping on, or kicking supposed enemies or devils.
3.	M.	45	General Paresis.	11 days.	3 months	Congestive Apoplexy.	No	*POST MORTEM*	EXAMINATION.		Latterly a habitual tippler: death produced by convulsions.
4.	M.	51	Melancholia, suicidal.	10 days.	2 months at least.	Exhaustion of Melancholia: Inanition.	No	*POST MORTEM*	EXAMINATION.		Imperfectly treated at home—especially as to food and sleep: hence admitted in a state of extreme emaciation and debility.

IV.—OBITUARY FOR 1863-4—[CONTINUED].

No.	Sex.	Age at Death.	Form of Insanity.	Duration of Residence in Asylum.	Duration of Fatal Illness.	Apparent immediate Cause of Death.	RESULTS OF *POST MORTEM* EXAMINATION. Prominent or exceptional Pathological lesions or conditions: Weight of Viscera in ounces Avoirdupois. Head and Spinal Column.	Thorax.	Abdomen.	Other parts of Body.	Additional Remarks.
5.	M.	77	Monomania of suspicion	7 years.	Death sudden.	Valvular disease of heart.	Skull verythick: texturecompact. Cerebral atrophy: softening of central portions of brain. No lesion of cerebral vessels.	Pleuritic adhesions (recent) and effusion on left side: latter such as to compress lung against spine. Emphysema of both lungs. Calcareous degeneration of aortic valves.	Hyperæmia of both kidneys: texture soft, friable.	Marked fatty development of body generally: abdominal walls had a fatty layer 1½ inches thick.	No complaint nor apparent suffering preceded death, which occurred suddenly soon after a hearty breakfast. Tendency to heart-disease apparently hereditary—a sister having died about same age, and under similar circumstances.
6.	F.	60	Acute Mania	3 days.	3 weeks.	Meningeal Exhaustion: Inanition.	No	*POST MORTEM*	EXAMINATION.		Admitted in a condition of extreme debility—almost moribund. Mis-treated at home, especially as regards food, which she had obstinately refused for some time.
7.	M.	61	Chronic Dementia: Delusions.	16 years.	1 month.	Diarrhœa.	Skull verythick: no trace of Diploe. Sub-arachnoid effusion: lymph on arachnoid.	Emphysema of both lungs. Walls of right side of heart somewhat atrophied.	Great distension of Gall bladder. Intestinal Hyperæmia.	Great general emaciation of body.	Insanity originally induced apparently by coup de soleil or other climatic influences in India.

IV.—OBITUARY FOR 1863-4—[Continued].

No.	Sex.	Age at Death.	Form of Insanity.	Duration of Residence in Asylum.	Duration of Fatal Illness.	Apparent Immediate Cause of Death.	RESULTS OF *POST MORTEM* EXAMINATION. Prominent or exceptional Pathological lesions or conditions: Weight of Viscera in ounces Avoirdupois. Head and Spinal Column.	Thorax.	Abdomen.	Other parts of Body.	Additional Remarks.
8.	M.	63	Chronic Dementia.	22½ years.	3 weeks.	Pyæmia: Pleuro-pneumonia.	Scalp closely adherent to skull. Hyperæmia of cerebral membranes.	Considerable pleural effusion on both sides: recent adhesions of left Pleura. Lower part of left lung in first stage of Pneumonia. Hyperæmia of thoracic aspect of Diaphragm on left side. Pericardial effusion: cardiac hypertrophy	Hyperæmia of liver, kidneys, and intestines.	Large sinus surrounding greater part of right inferior maxilla, which was bared of periosteum, and partly carious.	Illness began with abscess of the cheek and chin,—apparently secondary and depending on a carious tooth.
9.	F.	58	Melancholia, suicidal.	19 days.	2 months at least.	Inanition.	Œdematous softening of central portions of brain: hyperæmia of its membranes. Brain, 3 lbs. 3 oz.	Upper lobes of both lungs emphysematous. Heart empty, 8½ oz: right Lung, 15½ oz.: left, 16 oz.	Liver soft and friable: 2 lbs. 14 oz.: cysts in both kidneys: small abscess in left: 4½ oz. each. Spleen, 3½ oz.	Extreme emaciation.	Apparently improperly attended at home: imperfectly nourished [having refused food for some time prior to admission, and probably no means of artificial alimentation having been resorted to.]

IV.—OBITUARY FOR 1863-4—[Continued].

No.	Sex.	Age at Death.	Form of Insanity.	Duration of Residence in Asylum.	Duration of Fatal Illness.	Apparent Immediate Cause of Death.	RESULTS OF *POST MORTEM* EXAMINATION. Prominent or exceptional Pathological lesions or conditions: Weight of Viscera in ounces Avoirdupois. Head and Spinal Column.	Thorax.	Abdomen.	Other parts of Body.	Additional Remarks.
10.	F.	47	Melancholia, suicidal.	14 days.	2 months at least.	Inanition.	Œdematous softening of central portions of brain: hyperæmia of its membranes. Brain, 2 lbs. 13 oz.	Pulmonary emphysema on both sides: right Lung, 15 oz.: left 15½. Calcareous radiating cords in right pleura. Heart small—empty: 3 oz	Hyperæmia of liver and kidneys: texture of liver soft: 2 lbs. 10 oz: kidneys, 5½ oz: each. Spleen, 3½ oz.	Extreme emaciation: prominence and unusual size of thyroid gland.	Like the preceding—hopelessly feeble on admission. Both patients came within a few days of each other, from the same parish, and both in a condition indicating apparently neglect of due nutrition and medical care.
11.	M.	26	Chronic Dementia.	5½ months	3 months	Phthisis pulmonalis.	No	*POST MORTEM*	Examination.		
12.	M.	79	Acute Mania	3 days	Death sudden.	Heart disease.	No	*POST MORTEM*	Examination.	Body covered with bruise marks—the results partly of rough usage by 10 unskilled attendants in his own house. Excellent muscular and fatty development.	Said to have been subject for some years to attacks having the character of *Angina pectoris*. Death sudden, a few minutes after a hearty breakfast.

The Deaths constitute 9·33 per cent. of the Mean daily number of Patients under treatment.

" " 5·24 " Total number under treatment during the year.

V.—DISCHARGES OF *PAUPER* PATIENTS.

	M.	F.	T.
	57	68	125
1. *Recovered*, ...	8	10	18
2. *Non-Recovered*—			
Improved, ... 15 22 37	—	—	—
Unimproved, ... 34 36 70	—	—	—
	49	58	107
1. Transfers to—			
a. Perth District Asylum at Murthly,	28	30	58
b. Other Public Asylums :—			
Royal Asylum, Montrose, ...	3	11	14
Do. Edinburgh, ...	1	—	1
c. Private Asylums :—			
Millbolm House, Musselburgh, ...	1	2	3
Hallcross House, Musselburgh, ...	1	—	1
d. Lunatic Wards of Poorhouses :—			
Perth, ...	7	3	10
Stirling, ...	1	—	1
e. Private Houses, ...	7	12	19
2. *Physical Condition,			
a. Bodily health and condition on the whole good,	45	53	98
b. Do. do. bad,	1	1	2
c. Labouring under Specific Affections :—			
Bronchitis, ...	—	1	1
Bronchocele, ...	—	1	1
Chronic Cystitis, ...	1	—	1
Paralysis, ...	2	—	2
Phthisis Pulmonalis, ...	—	2	2
3. *Form of Insanity :—			
Congenital Imbecility, ...	—	1	1
Dementia, ...	23	24	47
General Paresis, ...	2	—	2
Mania : acute, ...	2	1	3
,, chronic, ...	4	12	16
Melancholia, ...	5	11	16
Monomania, ...	13	9	22
4. *Recent or Acute Cases, ...	4	11	15
Chronic or Confirmed Cases, ...	45	47	92
Probably Curable	10	14	24
,, Incurable	39	44	83
Dirty and Degraded, ...	6	7	13
Violent and Destructive, ...	6	7	13
Quiet, but Idle, ...	7	6	13
,, and Industrious, ...	30	38	68
5. †Duration of Residence in Asylum—			
Under 3 months, ...	2	2	4
Between 3 and 6 months, ...	1	5	6
,, 6 ,, 12 ,, ...	8	5	13
,, 1 ,, 2 years, ...	1	5	6
,, 2 ,, 5 ,, ...	19	13	32
,, 5 ,, 10 ,, ...	11	17	28
,, 10 ,, 15 ,, ...	1	3	4
,, 15 ,, 20 ,, ...	3	4	7
,, 20 ,, 30 ,, ...	3	3	6
,, 30 ,, 40 ,, ...	—	1	1

* At date of Discharge.

† Calculating from the Date of last Admission, when a Patient has been admitted more than once.

VI.—PRESENT POPULATION.

	M.	F.	T.
	35	38	73
I. Recent or Acute Cases, ...	2	4	6
Chronic or Confirmed, ...	33	33	66
Congenital, ...	—	1	1
Probably Curable, ...	2	4	6
,, Incurable, ...	33	34	67
	5	12	17
II. Suffering from bodily Ailments, viz. :—			
a. General Infirmities of Age, ...	—	4	4
b. ,, Debility,*	1	2	3
c. Specific Affections :—			
Amenorrhœa and its Concomitants, ...	—	2	2
Paralysis and Pseudo-Paralysis,† ...	3	—	3
Epilepsy, ...	—	1	1
Fractures or Dislocations, ...	—	1	1
Cutaneous Eruptions, ...	—	1	1
Hæmorrhoids, ...	1	—	1
Cornelitis [Strumous], ...	—	1	1
III. Refractory, Turbulent, or Irritable,‡ ...	9	10	19
Have Effected, Attempted, or Threatened Escape, ...	5	3	8
Destructive to Property, ...	2	5	7
Dangerously Violent to the Person, ...	3	—	3
Of Wet or Dirty Habits, ...	—	7	7
Masturbators, or having other Vicious Habits, [*e.g.* Ordure eating or smearing, &c.]	3	—	3
Deaf, ...	2	2	4
Deafness, ...	17	16	33
IV. Attending Asylum Chapel, ...	18	14	32
,, ,, Recreations, ...	6	6	12
,, Amusements in Town, ...	13	11	24
Taking Exercise beyond Asylum grounds, ...	33	37	70
Dining in Association, ...			

* Frequently, if not generally, associated with the Strumous Diathesis.

† Including Muscular Atrophy and Contraction from Disuse of Limbs.

‡ In some cases, only during paroxysms of Periodic or Recurrent Acute Mania.

CHAPLAIN'S REPORT.

In again respectfully presenting to the Directors a brief record of his work during the past year, the Chaplain cannot claim to have anything of special interest to report, beyond the regular and uninterrupted discharge of the duties of his office. These, not without a deep feeling of his responsibility, he has endeavoured to perform with his best ability and diligence, and with an anxious desire to make them really conducive to the good of those whose spiritual interests are entrusted to his care. It is unnecessary to dwell upon the peculiar difficulties attaching to such a work, as these are too sadly obvious to require even a passing reference; and he can only say that, without suffering them unduly to discourage him, he has sought to cope with them with as much wisdom and tenderness as he could command. If they are such as to preclude in many cases any sanguine expectation of positive results, they do not at least forbid the hope of being in some degree servicable in ministering to minds diseased, and soothing them with the hopes and consolations of religion. The cloud, though not wholly removed, may yet be tinged with a silver lining, and the music of Gospel truth may help, like the harp of David, to charm the troubled spirit to repose.

During the greater part of the year, the attendance at the various services, both on Sabbath and week-days, has been on the whole satisfactory. At morning prayers, which are held twice in the week—on Tuesdays and Fridays—it has averaged more than a fourth of the inmates of the House, and at the Sabbath morning service, fully a third.

At the latter especially, the chapel, on the male side, has usually been full to overflowing. The recent changes have, as may be conceived made a very considerable reduction in the actual numbers, but the proportion is still more than maintained, the attendance on week-days averaging about a third, and on Sundays nearly a half of those in the House. The quietness and decorum of those in attendance have, as usual, been all that could be desired, a result largely attributable to the care manifested in the selection of those who are capable of the requisite self-control, but in no small degree also due to a sense of the sacredness of the exercises in which they are engaged. The capacity and amount of attention, doubtless, greatly vary, and it is difficult to ascertain the degree of intelligence, in different cases, with which the services are followed, but while to most it is evidently a pleasing if somewhat fitful exercise, there are always a number who are seriously attentive, and, it is hoped, really benefitted. Special discourses are not seldom selected for remark, as having imparted profit and consolation, and it is manifest, to say the least, that these services are instrumental in keeping alive some sense of Divine things in the minds of not a few, who, for themselves, could hardly originate a religious thought.

In addition to these services, the Chaplain has maintained a course of constant visitation, by which he is enabled to come into personal contact with most of the patients. He has endeavoured, as far as possible in these visits, to blend the minister with the friend, and, without forcing or formal teaching, to turn the conversation to profitable account whenever it could judiciously be done. He cannot say that in any case he has found the subject of religion received with repugnance, and there are always those with whom it is a pleasure to converse upon it, and who appear to give a cordial and devout response to the remarks that may be made. Altogether, he has had fully as much comfort and satisfaction in this department of his work as he could reasonably expect. He has pleasure in again recording his sense of the courtesy and co-operation of the officials and attendants, who never fail to afford him every facility and aid in the performance of his duties.

He has only to add that the usual classes have been kept up during the winter, viz. : the class for the practice of psalmody, conducted by the Matron, on Monday evenings ; that for writing and arithmetic on Tuesday evenings ; and the Bible class, superintended by the House-keeper and one of the upper class patients, on Sunday evening. At the last of these, select portions of the Old and New Testament are read, varied with extracts from approved religious authors. The attendance, especially at the singing and Bible classes, has been good, and the interest and progress of the pupils continue to afford satisfaction and pleasure.

In conclusion, the Chaplain begs to tender his grateful acknowledgment to the Directors for the confidence they have reposed in him, and to express a hope that, with the diminshed numbers in the House, he may be able to bestow a still more careful and particular attention in the discharge of his delicate and important trust. May the blessing of God continue to crown every effort put forth for the amelioration of the saddest of all earthly calamities with abundant success.

WM. D. KNOWLES, *Chaplain.*

TWENTY-NINTH

ANNUAL REPORT

OF THE

DIRECTORS

OF THE

DUNDEE ROYAL ASYLUM

FOR

LUNATICS;

SUBMITTED, IN TERMS OF THEIR CHARTER,

TO A

General Meeting of the Directors,

18TH JUNE 1849.

WITH THE

REPORT OF THE MEDICAL OFFICERS.

DUNDEE:
PRINTED BY M'COSH, PARK, & DEWARS.

1849.

TWENTY-NINTH ANNUAL REPORT

OF

THE DIRECTORS

OF THE

DUNDEE ROYAL ASYLUM FOR LUNATICS,

FOR THE YEAR ENDING 18TH JUNE 1849.

In accordance with their usual practice, the Directors of the Dundee Royal Asylum submit to their constituents and the public, an account of their proceedings for the bygone year. Without fear of being considered extravagant in their language, they would assert, that by the active and judicious management of their predecessors in office, and the continued fidelity of their office-bearers, this institution has, in comparatively a short time, acquired an honourable name among the first of the kind in Britain. They not only feel that this increases their own responsibility in the solemn trust committed to their charge, but are persuaded that to the maintenance of this high position, nothing more is needed than the continued and persevering application of those judicious principles which have hitherto regulated the establishment.

The labours of the Directors during the preceding year have been comparatively easy. They had, indeed, one painful duty to perform, a duty, however, rendered imperative by a becoming regard to the health and comfort of those already entrusted to their care, that of declining a number of applications for admission into the Asylum, in consequence of the want of adequate accommodation for their reception. To this precaution—of never overcrowding the establishment—they have no hesitation in attributing, under Providence, the immunity of the inmates from those epidemic scourges which have occasionally visited the town and its vicinity. While they would refer to the statistical tables in the

accompanying Medical Report for details, they would here merely express in general terms that the number of patients during the year were as follows :—

Remaining in Asylum 19th June 1848,	196
Admitted during the above period,	39
Re-admitted,	7
Total,	242
Dismissed Cured,	23
Do., Relieved,	6
Do., by desire,	4
Died,	12
Total,	45
Remaining 18th June 1849,	197
Total,	242
Daily average number of patients,	198

In referring to the number of those who have happily been restored to their families in soundness of mind, or so improved as to be perfectly harmless, and capable of enjoying the company of their friends and acquaintances, as satisfactory proofs of the efficiency of the Institution, the Directors have no desire to conceal or disguise the fact, that there are necessarily in it,—as in every other of the kind,—many cases so confirmed in their nature, as to preclude any hope of a speedy recovery. But if they can indulge no other expectation in regard to this unfortunate class of patients, it is at least so far gratifying to know, that they are living in the enjoyment of every comfort to which their social position in life entitles them, and are under the watchful superintendence of those whose ability and experience eminently qualify them to mitigate the evils of their lot. The Directors, however, cannot

allude to those chronic cases, without adverting to one fact connected with them ; and it is one which they feel cannot be too strongly impressed on the public mind, viz., that in the great majority of instances the evil so much to be deplored resolves itself into one or other of the following causes.

First, That the friends or curators of the patient neglected to remove them in the earlier stages of the malady from all its exciting causes, and to place them at once under the most favourable circumstances for arresting its further development ; or

Secondly, That they injudiciously withdrew them from a curative course of treatment before sufficient evidence had been exhibited of even a probable recovery. In either case it is easy to see that the chances of recovery are, humanly speaking, seriously diminished. In the former case, the impediments in the way of restoration become too great for medical skill to contend against ; and, in the latter, there is a moral certainty that the patients shall return into the Asylum with less reasonable prospect of recovery than when they first entered within its walls. The Directors take leave to say, when these suggestions are more fully appreciated by the public, and acted on by the guardians of the insane, a very decided increase in the proportion both of speedy and permanent cures may be confidently anticipated.*

The Directors have much pleasure in referring to various improvements which have been carried into effect during the year, and which contribute greatly both to the welfare of the patients and prosperity of the institution. An agreement has been entered into with the Water Company for supplying the establishment

* An eminent writer on Insanity (Burrows) reports from his own experience a proportion of 91 per cent. of recoveries in recent cases. This is an unusually high rate, but the testimony of all authors on the subject goes to establish the fact, that the number of cures likely to be effected is nearly proportional to the duration of the malady prior to its treatment. It has been observed, that those who recover from insanity generally do so within the first twelvemonths, and in some Asylums (Bethlem and St Luke's) all patients who have suffered beyond this period are excluded as being utterly incurable. This is perhaps taking an extreme view of their case, but it obviously shows the fallacy of the prevalent opinion, "that there is no harm in keeping lunatics at home so long as they are not dangerous."

with this necessary domestic element, at the charge of £37, 10s. per annum. Besides the importance of this arrangement for domestic and sanitary purposes, it was calculated that the soft quality of the water would be the means of effecting some saving in the consumption of soap, but they understand that this is likely to be more successfully accomplished by the new mode of washing recently introduced by the Matron, Mrs Kilgour.

Another great improvement they would refer to is the thorough drainage of the premises. Bad and unsavoury smells were complained of in certain apartments, which led to a suspicion that some channel in the sewerage might be obstructed. A sketch of the course of the sewers was kindly furnished by the Chairman, and, that it might be retained in perpetuity, it was ordered by the Committee of Management to be lithographed. The architect was instructed to inspect the state of the drainage, and, if any cause of obstruction existed in its course, to remove the same. Those unwholesome odours may now be said to be nearly banished from the Asylum. This is a most gratifying fact, for experience has proved that, of all deleterious agents, few are more destructive, either to the physical or mental health, or to the comfort of those in a crowded establishment, than malarious effluvia arising from defective or badly constructed sewers.

In the construction of the Asylum, due regard had been paid to its proper ventilation, but, when the Institution was honoured by a visit from that excellent nobleman, Lord Ashley, his Lordship suggested that one or two of the wards might be improved in this respect by the introduction of the Arnot ventilator. When carried into effect, it did not fail to realize anticipated success, and the Directors feel that, to omit the present opportunity of thanking Dr Arnot, not only for this ingenious and beneficent discovery, but for the courtesy of his frank and interesting communications, would be injustice both to him and to science.

Several other improvements and alterations of a minor description,—but all of them conducive to the comfort of the inmates,—have likewise been introduced. In short, the Directors, in justice

to themselves, may be permitted to state, that they have endeavoured in every respect to uphold and increase the efficiency of the Institution so far as the resources at their command would allow.

The following Abstract of Accounts will show the state of the financial affairs of the establishment :—

INCOME.

Board from Patients,		£4660	1 9
Patients' Labour, Profit on Store and on Straw,		184	17 6
		£4844	19 3
Legacy,		100	0 0
		£4944	19 3

EXPENDITURE.

Salaries,		£ 454	7 0
Servants' Wages, Coal, Gas, Taxes, Interest, Advertising, Soap, Fire Insurance, Incidents, Feu-duty,		1641	16 1
Butcher Meat, Bread, Sugar, Tea, Groceries, Butter, Cheese, Meal, Barley and Pease, Potatoes, Beer, Fish, Eggs, Milk, Medicines, Water,		2127	5 6
Furniture, Mason, Plumber, Painter, Plaster, Slater, Smith, and Wright Work,		357	11 3
Excess of Receipts for the Year, including Legacy of £100,		363	19 5
		£4944	19 3

VIEW OF THE PROPERTY AND DEBT OF THE ASYLUM.

	Dr.			*Cr.*		
Expenditure on Property and Furniture to 31st March 1848,				£33,301	4	1
Debt at 31st March 1848,	£9124	12	0			
Deduct excess of Receipts this year, £263 19 5						
Deduct Legacy received, 100 0 0	363	19	5			
Debt 31st March 1849,	£8760	12	7			
Stock, being Expenditure on Buildings under Deduction of Debt,	24,540	11	6			
	£33,301	4	1	£33,301	4	1

The excess of receipts, it will be seen from the above vidimus, is £363, 19s 5d. This includes a legacy—the only one which has been received during the year, but it is a liberal one—amounting to the sum of £100 sterling. It is owing to the liberality of the late Miss Soutar, and does honour to her memory. The Directors, while they gratefully record this handsome donation, would fondly indulge the hope that so praiseworthy an example will be frequently followed by others.

Since the Poor-law Bill came into operation in Scotland, it was expected that an increased number of pauper lunatics would be sent into the Asylum from the various parochial boards in the surrounding counties. This, to a certain extent, has occurred, but, by referring to previous reports, it will be seen that the number of rejected applications is not so great above that of former years as was anticipated. While the Directors are gratified to state that the patients in the higher ranks are as numerous as hitherto, they would attribute the increasing demands on the part of the middle and industrious classes to a twofold cause. 1st, The extensive reputation the institution has acquired; and, 2d, The low rate of board charged for such patients.

Looking to the number of applications which they were reluctantly obliged to decline, and the confidence which they have in the increasing prosperity of the Institution, the Directors would have had much pleasure in recommending to the consideration of their successors the propriety of extending the accommodation. Elevating the east wing, so as to render it conformable to the one on the opposite side, would not only give the building a finished and more elegant appearance, but, what is of more importance, afford accommodation to nearly sixty additional patients. This could be accomplished at the expense of a few thousand pounds. But a glance at the Debtor side of the Abstract will show, that such a proposition cannot well at present be entertained. The excess, however, of income over the expenditure is so far encouraging, and were it not for the heavy amount of debt which hangs over the Institution, the Directors would be enabled to extend the blessings

which it is so well fitted to confer, and to render it what they are desirous that it should be, comparatively speaking, a charitable one.

Moderate as are the rates of board,—compared at least with those of similar institutions,—they would earnestly desire to make a still farther reduction, in favour of a certain class of patients. They are fully sensible, that there are many persons just removed from pauperism by their industry, and whose income is contingent on their continued health and strength, who, rather than allow their relatives to associate with those on the lowest rate, either struggle to maintain them at home, or, by placing them on a higher one, materially abridge the comforts of the other members of their families. Would not a husband and parent in receipt of £60 or £80 a-year, striving to maintain a respectable position in society, feel degraded at the thought of his wife or child being the daily companion of paupers? And yet, in justice to the other members of his household, how can he help himself? The place of the natural guardian of his family may have to be supplied by a stranger, whose services he must pay, and who, besides, may be, in a great measure, regardless of that prudence and economy which are essential to the management of a household, supported by so limited an income. To meet cases of this painful nature, which are far from being few, the Directors would have been delighted to reduce the board to the lowest possible amount, but in the meantime they feel that this cannot with propriety be effected until the heavy amount of debt is lessened. They would, therefore, urge on those in opulent circumstances the strong claims which this Institution has on their charity. Sickness combined with poverty is a great evil, but insanity conjoined with it is still more dreadful. The pauper lunatic, if his condition was ever over-looked in Scotland, is now provided for by compulsory charity; but there is a nobler kind of charity, which spontaneously sympathizes with the moral heroism of the man who struggles hard by honest industry to keep himself and his dependents above the degradations of pau-

perism. It is on this ground that the Directors would appeal to public liberality, and it is one which embraces within the range of its benevolence not merely the victims of insanity themselves, but the physical comfort and mental satisfaction of their industrious relatives. They will rejoice to find, that this appeal to the sympathy of the wealthy, has not been ineffectual, and that it may place in the hands of their successors, the means of accomplishing an object of no small moment, both to many of the inmates and their natural guardians without the walls.

The Lord Advocate's Lunacy Bill, recently before Parliament, having been considered highly prejudicial to the interests of Asylums in Scotland, the Directors, in common with those of similar institutions, sent a deputation of their number to London to remonstrate against it. The deputation, consisting of William Thoms, Esq., one of the members of Committee of Management, and John Sturrock, jun., Esq., the Treasurer to the Asylum, accordingly went, and have reported as follows:—

"From the general opposition manifested throughout Scotland to the Lord Advocate's Lunacy Bill of last year, it was thought unlikely that he would introduce a similar measure this session. A bill, however, was brought forward by his Lordship resembling in many respects the measure of last year, but even more objectionable in some important features. On a careful consideration of this bill, it was the unanimous opinion of the Directors, that it became their duty to offer the most decided opposition to it. They considered, that no necessity had been shown for the introduction of such a measure. No Parliamentary enquiry had taken place, and it was not even alleged that abuses existed in the management of asylums in Scotland. The principle of the bill was also considered highly objectionable, in so far as it was calculated to supersede district and local management, and to centralise the control of asylums in an irresponsible Commissioner resident in Edinburgh. The effect of this would inevitably have been to destroy all local exertion. It proposed to vest in this Government Commissioner the power of deciding upon the amount of accommodation to be provided, and

the money to be raised in each district. No Government Commissioner could have the same interest in the good management of asylums as gentlemen residing in the district. Besides, the effect of such a measure would be to extinguish all motive for the foundation or endowment of Lunatic Asylums by benevolent individuals, and to throw upon the property of Scotland a large and unnecessary expense, both in the original erection and in the subsequent maintenance of the proposed asylums. Impressed with the force of these and other objections, the deputation, on their arrival in London, where they were joined by other deputations, gave the most decided opposition to the bill, and they had the gratification to find that the members of the House of Commons connected with Scotland, of all shades of political opinion, entered most readily into their views. The deputation were also favoured with interviews by some of the most influential of the English members, who seemed all to consider that, if passed at all, the measure would require to undergo very great modifications. The deputation left London under the impression that their opposition had been effectual, and that the Lord Advocate would be induced, by the universal opposition indicated to his bill in Scotland, to abandon it, if not entirely, at least for the present session; and they have now the pleasure to state that Lord John Russell has publicly announced the withdrawal of the bill for the present session."

The Directors have great pleasure in recording, as in previous years, the high sense entertained by them of the services rendered to the establishment by its office-bearers. They feel that they cannot express in too strong terms the sentiments of approbation with which they regard their exertions. To Dr Nimmo, therefore, their Consulting Physician, and to Mrs Kilgour, the Matron, they tender their thanks for the assiduity and kindness with which the duties of their respective offices have been performed; they present the same to Mr Sturrock for his attention to the trust consigned to him, to Rev. Mr Stirling for his fidelity as Chaplain, and to Mr Robertson for his conduct as Secretary.

The Directors regret to mention that the Institution is soon to be deprived of the invaluable services of Dr Mackintosh, whose name has been so long associated with it. They cannot condescend to use the language of adulation, but in justice to Dr Mackintosh, they feel themselves called on to state, that to his devotedness and exertions, the reputation of the Dundee Royal Asylum is in no small degree to be attributed. His valuable services have been no less useful in the treatment, and to the comfort of the inmates, than to the maintenance of that order and regularity which have at all times prevailed throughout the establishment, since his connection with it; and, while they express their unqualified approbation of his character, exemplary conduct, and ability, and their warmest wishes for his future success and welfare in life, they would congratulate the Directors of the Glasgow Royal Asylum on the fortunate choice they have made from amongst the candidates who aspired to the responsible trust of Superintendent Physician to that large establishment.

In supplying the vacancy created by Dr Mackintosh's resignation, the Directors felt that a very onerous and responsible duty was imposed on them. There can be no question that the character and efficiency of this—or any similar institution—depend very much on the proper management of its local head. The gentlemen who submitted testimonials for the office appeared to possess nearly equal claims for it. So nearly, indeed, were these balanced, that after an impartial investigation, it was difficult to decide between them. In fact, all of them appeared admirably qualified to discharge the duties of the situation, both with credit to the Institution and honour to themselves. While the Directors did not overlook professional merit, they at the same time could not forget, that there was another qualification needful on the part of the candidate, viz., his ability to govern and regulate the secular affairs of the establishment.

The successful candidate, Dr Wingett, besides his high professional attainments, has had much experience in the management of asylums. For the period of four years he was the resident

medical assistant to the Crichton Institution, Dumfries. He afterwards held the office of Assistant Physician to the Morningside Asylum for upwards of two years, during which he had the management, in the absence of the Visiting Physician, of all the pauper lunatics, and the principal control over the domestics of the establishment. The Directors confidently anticipate that they will have much reason to congratulate themselves on their selection.

The Committee appointed Drs Nimmo and Mackintosh to revise the rules applicable to the offices of Physician and Superintendent, with the view of bringing them more in conformity with the practice of the house; and to propose such alterations as they might deem necessary to accomplish this purpose. These gentlemen suggested various alterations, which will be duly considered by the Directors.

In conclusion, the Directors feel it incumbent on them to add, that a very great amount of gratitude is due to their respected Chairman, whose name is associated with the rise and subsequent progress of this Asylum, and who, by his judicious conduct in the capacity of its Chairman, has largely contributed not only to its efficiency, but to render the task of its direction comparatively easy. It is their earnest desire that he may be long spared to advance the welfare of an Institution which at its commencement he did so much to rear, and over which, from the time of its foundation until now, he has watched with a zeal as discreet in its exercise as beneficent in its tendency.

Among the benevolent individuals who took a laudable interest in the design of this Institution, few now survive to witness the deep importance their labours have become to the community in which they lived. It is within the memory of those who have not reached even to half the promised days of man, that the wretched lunatic was driven from society, and by common consent forced to become a "solitary wanderer on the world's highways." Living in a region created by his own morbid imagination, he became the object,—now of fear and hatred, now of mirth or

mockery,—according as the peculiarity of his delusion might be intruded on; when, in return, he became the ready and sometimes murderous avenger of the wanton insults heaped on him by those who perhaps might claim to themselves the possession of reason, but were, in reality, in a less enviable condition of mind than he. Among the few who are still privileged to behold their labours conferring blessings on the most helpless and friendless of their race, the Directors would not forget to make grateful mention of the name of the Rev. James Thomson, who aided in the formation of this Institution,—who has ever since been one of its devoted friends, and to whose feelings it must be a gratification to know that his well-timed exertions were instrumental in providing a comfortable retreat for those who had few to sympathise with them.

ABSTRACT

OF THE AFFAIRS OF THE

DUNDEE ROYAL LUNATIC ASYLUM,

For the year ending 31st March 1849.

INCOME.

Boards from Patients,			£4660 1 9
Patients' Labour,			87 18 5
Profit on Store,			81 4 9
Profit on Straw,			15 14 4
			4844 19 3
Legacy from Miss Sontar,			100 0 0
			£4944 19 3

EXPENDITURE.

Salaries—			
Superintendent,			£200 0 0
Matron,			90 0 0
Physician,			100 0 0
Chaplain,			40 0 0
Secretary,			30 0 0
Treasurer,			50 0 0
			£510 0 0
Less Fees from Patients,			55 13 0
			£454 7 0
Interest,	£446 11 7		
Servants' Wages,	503 10 0		
Soap,	42 0 0		
Carried forward,	£992 1 7		454 7 0

Brought forward,	£902 1 7	£434 7 0	
Taxes,	32 18 6		
Advertising, Books, Printing, and Stationery,	55 9 5		
Coals and Firewood,	183 16 9		
Fire Insurance,	13 19 6		
Feu duty,	67 1 0		
Gas,	38 8 0		
Old Debts, written off as irrecoverable,	109 18 8		
Incidents,	127 16 6½		
Patients' Extras,	20 6 7½		
		1641 16 1	
Butcher Meat,	£535 7 1		
Butter,	99 19 10		
Beer,	68 15 0		
Bread,	451 0 7		
Barley and Pease,	43 11 9		
Cheese,	15 18 10		
Eggs,	7 11 8		
Fish,	34 7 6		
Groceries,	37 13 3½		
Milk,	328 1 0		
Meal,	254 2 3		
Medicines,	33 17 6½		
Potatoes,	47 18 10		
Sugar,	65 17 6		
Tea,	68 8 6		
Water,	34 14 4		
		£2127 5 6	
		4223 8 7	
Furniture,	£118 16 4		
Grounds,	31 15 2		
Mason Work,	31 5 7		
Plumber do.	33 17 6		
Painter do.	41 7 2		
Plaster do.	2 9 2		
Slater do.	9 14 10		
Smith do.	48 1 8		
Wright do.	40 3 10		
		357 11 8	
Excess of Income from Patients,	£263 19 5		
Legacy from Miss Soutar,	100 0 0		
		363 19 5	
		£4944 19 3	

VIEW OF THE PROPERTY.

Loans,		£9136 0 0
Legacies—Grieve and Riddoch,		841 19 3
		£9,977 19 3
DEDUCT—		
Arrears of Boards and other Debts due to the Asylum,	£949 14 2	
Provisions and Stores in the House,	267 12 6	
		1,217 6 8
Balance, being Debt due by the Institution at 31st March 1849,		£8,760 13 7
NOTE.—The Debt at 31st March 1848 was	£9,124 12 0	
From which deduct excess of Income this year,	363 19 5	
Debt at 31st March 1849, as above,	£8,760 1 2	
Stock, being expenditure on the Buildings and Furniture, under deduction of the Debt, at 31st March 1849,		24,540 11 6
Total amount expended on Buildings and Furniture at 31st March 1849,		£33,301 4 1

AT THE

ANNUAL COURT OF DIRECTORS

OF THE

DUNDEE ROYAL LUNATIC ASYLUM,

Held in the Town Hall of Dundee, on Monday the 18th June 1849,

PATRICK SCOTT, ESQ., IN THE CHAIR,—

Dr Moon read the Annual Report of the Directors.

George Thoms, Esq., seconded by Alexander Balfour, Esq., moved "That the Report be approved, and the thanks of the Directors given to Dr Moon for drawing it up;" which were delivered to him from the Chair accordingly.

The following parishes, having contributed twenty pounds or upwards to the funds of the Asylum, are entitled to have their pauper patients admitted into class first, and are charged the lowest rate of board; but no other parish, since 1824, can claim this privilege. The parish of St Andrews was privileged, in 1837, to have one patient only in the Asylum at the lowest rate of board.

Airlie.
Alyth.
Arbroath.
Auchterhouse.
Brechin.
Dundee.
Dunnichen.
Forfar.
Glammiss.
Guthrie.
Inverarity.
Kirriemuir.
Kinnettles.
Kettins.
Liff and Benvie,
Longforgan.
Mains and Strathmartine.
Monifieth.
Monikie.
Murroes.
Newtyle.
Rescobie.
St Andrews, one patient only.
Tannadice.
Tealing.

ABSTRACT

OF THE

REPORT OF THE MEDICAL OFFICERS.

AGREEABLY to use and wont, the Medical Officers of the DUNDEE ROYAL LUNATIC ASYLUM respectfully beg leave to present their Annual Report to the Directors, containing a general view of what has occurred under their superintendence during the year; and they also add some Statistical Tables which have reference both to 1848 and 1849.

ADMISSIONS.—These will be found to be less numerous than last year, and to include several suicidal patients; but we regret to say that many of the cases were of a very hopeless character before the patients were brought to the Asylum, and of course this circumstance left us little room to look forward to an ultimate cure of their malady. Some of them, too, when admitted, were covered with bruises, greatly exhausted, and almost dying. In fact, a few of them did not long survive. The account given in answer to our queries respecting the bodily health of these patients, just before admission, was, in general terms, that they were labouring under *no disease except insanity, and that nothing particular was wrong in their general health*, or something equally vague and equivocal, and this, too, although the

unfortunate being consigned to our charge was perhaps unable to walk, and had, in some instances, to be carried out of the carriage in which he was conveyed, only to die shortly within the walls of the Asylum.

Dismissions and Cures.—Under this head we have simply to state that the number for this year is about the usual average. But we think it right to record, that the ordinary effect of dismissions on other patients was very conspicuous. Lunatics who are impatient of confinement, or anxious about obtaining their liberty, become far more excited than usual when they find others discharged as cured or convalescent. Even the rumour of patients being about to leave the Asylum has a similar effect. This simple fact shows pretty clearly how pernicious the old system of rigid restraint must have been, and how little we need be surprised at its being now almost everywhere exploded.

Deaths.—We have much pleasure in stating that the mortality this year has considerably diminished. Last year the deaths were nineteen. During the present year there have only been twelve. In that number is included the first patient ever admitted to the Asylum. He was far advanced in life, and expired after a short illness. The loss of this venerable inmate was very much regretted within the walls of the establishment, as he was an amiable old gentleman, and very generally beloved.

General Treatment.—Since personal mechanical restraint was given up in this Asylum, it has scarcely been necessary to refer to it in our Reports, except by way of compliment, and especially to the illustrious Pinel who so humanely and judiciously led the way to its almost total abandonment in Europe and America. Here for many years past its use has never once been thought of, nor is the want of it ever felt to be of the slightest inconvenience.

Blessed be the memory of that enlightened Frenchman who

thus banished from medical science its greatest reproach, and instead of chains, manacles, and stripes, gave to the unhappy maniac the most soothing indulgences and a comparative Elysium!

Although, in many cases, all hope of a final cure may be said to be vain, yet in such cases much may be done to ameliorate the condition and give temporary relief to the unfortunate patient. In this respect regular systematic treatment is of great use. For instance, to keep the patient quiet and uniformly engaged, in some cases to walk in the open air for several hours daily, and in almost all cases that they shall be so placed that no causes of irritation or excitement may act upon them.

We have said so much before in favour of employment that we need scarcely add anything about it here. It carries the mind, as it were, away from the contemplation of its own ills, and for a time, at least, secures that happy oblivion of self, which seems to be the highest enjoyment of the insane. In this Asylum the employment is generally adapted to the former habits of the patient. Among the male paupers there are many who ply their respective handicrafts almost as industriously as they were accustomed to do at home; while the females of the same class are not less industriously occupied in performing tasks fitted for their various conditions in life. Two of these patients, before being discharged this year, had been taught to weave in the establishment. They are now doing well, and earning a livelihood at weaving in the country. We may here observe that the bustle and business occasioned by our sort of manufacturing, seems to do some good to a few of the patients of a better rank in life.

Another method of soothing the more restless class is occasionally resorted to with satisfactory results; that is, by giving them small extra indulgences as a reward for good behaviour, or for extra work done, such as a little snuff, tobacco, tea, or confectionery. The effects thus produced are often surprising.

With regard to the indulgences allowed to our higher class patients, these are such as the patients' previous habits, fortune, and rank in society have commanded; and it must be obvious

that while such patients are here, it would be cruel to deny them any innocent or reasonable luxury which their means can afford. In that respect the first-class patients in this establishment have never had anything to complain of. They have always been paid the strictest attention to that was consistent with the sanitary rules which their medical treatment prescribed. They are allowed every delicacy of the season in regular succession as these appear in the market. And all the literary and political periodical publications are placed at their command the moment they reach the Asylum.

The female paupers find themselves exceedingly comfortable in the Asylum. It is a rule for which the Matron is held responsible, that this class of patients, as well as the others, shall all be decently clad. Accordingly, they are all made to wear either bonnets or caps. And in the summer as well as winter even the worst of them have stockings, with boots and shoes; and gloves, when the weather requires it, are always given to them.

Games of chance, short excursions to the country, and music, form other means of amusement. Little, in short, is awanting to make them feel their condition comfortable and happy, but that darling liberty, which some of them ever call for, and which, were it granted, would be in every instance their greatest misfortune.

As nothing ought ever to supersede vigilance in an establishment like ours, the airing courts, which are at once a source of health and recreation, are never left without attendants so long as the patients remain in them.

The religiously inclined portion of our inmates derive great pleasure from having their sentiments freely indulged in their day rooms. The attendants in the kindest manner read with them in the Scriptures, and accompany them in singing psalms and hymns —the usual morning and evening task in this way being always closed by the reading of a prayer by the attendant. The regular discharge of this duty seems to afford some of them infinite consolation.

General Health of the Patients.—With the exception of the paralytics and epileptics, whose cases are always bad as well as precarious, the patients have this year been tolerably well. In fact, both the Town and the Asylum were without almost any cause of complaint in sanitary matters, after the revival of trade in February last. Several cases of diarrhœa had occurred in September, but they were not alarming, and easily yielded to the ordinary remedies. Cholera, it is too true, has recently broken out in several quarters of the town, but fortunately it has not reached the Asylum. Upon the whole, it may be fairly stated, that the general health of the establishment during the year has been very good.

General Characteristics.—Under this head we may notice a few cases and peculiarities.

Some of our patients labour constantly under the most extravagant delusions. They imagine that they hear voices abusing and threatening them; whereupon they immediately retaliate, by uttering still more violent abuse and threats, and then offer to fight with their imaginary assailants.

On the other hand, many patients are calm and placid in their general demeanour, and shew nothing but a kind and uniformly gentle disposition in every thing they say or do. This class are often very friendly and well-disposed towards their neighbours. One female, in particular, makes herself exceedingly useful in consequence of this disposition. She often acts as a sort of substitute for the housemaid to the Matron, and nothing affords her greater pleasure than to be so employed. Several well educated patients carry on a constant epistolary correspondence with their relatives at home and abroad. This is at once the means of occupation and amusement, and they take much pleasure in it. Nothing can exceed their delight, when they receive letters written in a kindly strain in return. The soft and soothing answer operates delightfully. In their case it seems to be always "*balm to the hurt mind.*" The intercourse, when thus gently and judiciously

conducted, generally contributes either to the relief of the patient's malady for a time, or to its ultimate cure. On the other hand, there are patients whom letter-writing would injure, and in their cases, we need scarce add, it is not allowed. Among the epistolary gentlemen, there is one who distinguished himself this year by drawing up the report of our last festal anniversary for the newspaper. We have still amongst us, too, the three gentlemen who were referred to in last year's report, as having contributed so much both to their own happiness and the amusement of the establishment, by their diverting and witty facetiæ. One other case may be noticed here. He was admitted about six years ago, in consequence of having nearly destroyed himself. He was a shoemaker by trade, and in every relation of life an exemplary and meritorious person. He recovered from his suicidal attack, but it was by very slow degrees, and for a long time he continued without confidence in himself. At length, about twelve months ago, a knife was put into his hands, and he was entreated to begin his old trade again. He consented, and the experiment answered our expectations. He got quite well, although he still complained that the idea of facing the world again gave him the greatest alarm. This feeling, however, also wore gradually away, and after a few months more had elapsed, he was fit to leave the Asylum with safety. He is now in the list of those who have been this year discharged as cured. We have the pleasure to add, that he continues well, and that his cure promises to be permanent.

The male patients of every class exhibit a trait in reference to Mrs Kilgour, the Matron, which is very honourable to that lady. As if by common consent, they make it matter of special request that she shall visit them almost daily, and nothing can equal their disappointment if she happens, accidentally or otherwise, to be prevented from overtaking that duty.

Among the patients of the year we have had, as usual, several volunteers from the ranks of our former inmates. They came entirely of their own accord, and, of course, were at once admitted.

Several females—new cases—have entreated to be admitted, and have actually presented themselves at the Asylum gate for that purpose, but the want of room prevented us from acceding to their request.

Among the anomalous symptoms which have occurred from year to year, there is one that we do not remember to have referred to before. It is that of more composure or less excitement on the periodical return of the Sabbath. On that day, in particular, the patients' disease may be said to be in general less violent or perplexing to us.

There is one patient to whom we may here allude. She was a mild monomaniac, and made herself generally useful. An eruption, however, appeared upon her skin; this was somehow repelled, and the consequence was an attack of violent mania. It has continued for a considerable time, and without abatement.

Another peculiar case occurred, in which the patient could not receive either of the physicians, nor suffer any male to see her for a long time, so sunk and prostrate were all her faculties. Never was there a more complete case of nerveless depression. We waved the point of admission with her till she became slightly better, and by that means only did we prevent the unfortunate patient from all mischief.

Another patient declined for a long time to take almost any food. In his case, also, we exercised the utmost forbearance. He could not be coerced to take it by any means. Rather suddenly his dream assumed a different phasis, and by slow degrees he came to take food again, and he now eats most irregularly, but as well as others.

Religious Service.—The ministrations of the Chaplain this year have been conducted in the usual prudent and exemplary manner, their effects on the patients being soothing and satisfactory.

We have one full service every Sunday, according to the forms of the Established Church. It is begun about eleven o'clock in

the forenoon, and generally lasts in the average an hour and a quarter. To lengthen it out so as to exceed that time would be apt to weary the patients, and perhaps unseemly provoke symptoms of impatience, and therefore the chance of its producing that effect is carefully avoided by the Chaplain.

We do not find that either the hour of assembling, or the time occupied in the service, interfere with the ordinary duties or Sabbath privileges of the servants. At least, we have never heard of any complaint on that head. Clergymen and ministers of every denomination are at all times freely admitted to the patients of their own persuasion, and the Rev. Mr Stirling waits upon patients, if specially requested to do so.

Some of the patients in a convalescent state have been occasionally allowed this year to attend their own church service in town, as well Roman Catholic as Protestant.

This custom we have never found attended with any bad effects, and it affords great satisfaction to the patients.

Medical Visit.—This regular and indispensable duty is daily discharged much more easily as well as more agreeably by the exercise of a little patient tact in getting the restless and unruly patients to keep quiet, and conduct themselves in an orderly manner while the visit lasts. Even with the worst and most clamorous of them, with a few exceptions, a small piece of bread or some confections succeeds most effectually. At an early hour in the morning, the day-rooms having been prepared as speedily as possible, the pauper patients and those of a class or two above them are found sitting on forms or chairs all ready. The male attendant of the Ward accompanies the Resident Physician, and answers the necessary questions, and they are then prescribed for. The patients who require a more minute examination are afterwards separately examined. The matron of course always accompanies him to the female patients, where the female attendants, like the males, are responsible for, and ready to report as to the state of their patients. The latter immediately after go to their work, or into the airing

courts, when they are again seen by Dr Mackintosh occasionally during the day.

The Matron then accompanies him to the males. But the former visit is the principal visit of the day, and is always looked to with much interest.

Dr Nimmo, in addition, most punctually visits three times a-week before eleven A.M. As it is of great importance that order and regularity should be paramount in a house of this kind, it is but just to add that in his case such could not be exceeded by any officer whatever.

Directors' Visits.—Three Directors are appointed every year to visit the House. It is gratifying to be able to state that these gentlemen pay marked attention to their weekly duties, and often bring little presents to the patients, who eagerly look for them, as well to state all their complaints, as receive the tokens of kindness and regard. This Institution is also frequently visited by the other Directors, some of whom take a deep interest in its welfare, and know every patient or case individually. We need not add that this system of local and continuous visitation is of the greatest importance to the patients, and should never be superseded by any other.

Airing Courts.—The number of our Airing Courts, with the cheerful elevated mounds which they contain, are of great advantage to the Asylum as a means of recreation and cure for its patients. They enable us also more conveniently to make such a classification of the inmates, as more effectually preserves the power of exercising that constant and minute supervision which is so essential to the comfort as well as the safety of the lunatic. The fine view of the Tay, with its variegated banks, the shipping and ferry boats, all as seen from the mounds, are a source of never-failing pleasure to the patients; and this, when combined with other circumstances, not only contributes to preserve their

bodily health, but greatly promotes the cure of their malady within.

TABLES.—We add copy of our Daily Return, which we have had in use for some years. It answers well.

SUICIDE.—No case of suicide (or homicide) has occurred during the year, nor since 1829.

In conclusion, we would respectfully suggest to the Directors that an enlargement of the Asylum is now essential for the accommodation of a greater number of *female* patients.

The increase annually would have been much greater during the last few years, if there had been room to receive them. In fact such enlargement we think absolutely indispensable.

During last autumn, Dr Mackintosh again visited the Parisian Asylums, where he had the pleasure to observe the humane system of treatment in full operation, and a great improvement in this respect since he first visited France.

This being the last Report in which the present Superintendent can participate officially, a brief summary of the progress of the Institution since its commencement may not perhaps be thought inappropriate here.

About the beginning of the present century, the want of an Asylum for the insane was generally felt in this district of the country. Prompted by humanity, one or two public-spirited gentlemen undertook to pave the way for supplying this want by means of a general subscription. The authorities of Dundee took a decided lead in so praiseworthy a movement, and as money and humanity were the only means by which the desired object could be obtained, they availed themselves of the kind and liberal spirit

which has always distinguished their townsmen; and in 1805 set on foot a subscription, to which the latter, with their accustomed good feeling and patriotism, largely contributed. Some delay necessarily occurred in the progress of the subscriptions, which was not completed for a considerable time, but when the subscription lists, which had been extensively circulated, were called in, a committee was formed for the purpose of carrying out the original design of the projectors. This Committee accordingly had the pleasure to find that such an amount had been subscribed as enabled them not only to begin the present buildings, but to look forward with confidence to their speedy completion. They then proceeded to make the necessary contracts, and the foundation stone was laid in 1812. Subsequently the Directors were advised not to open the Asylum till they knew the result of a measure then before the House of Commons, and the benevolent projectors were unable to open the Institution to the public till 1820. The buildings, as originally erected, being necessarily undertaken upon a prudent scale, were but of very limited dimensions, and as they were soon found to be inadequate to the demand caused by a rapidly increasing population, a considerable enlargement of them was begun in 1825. In the years 1830, 1837, and 1839, still farther additions were made to them, and thenceforward the Dundee Asylum, if not the best and largest, might fairly be numbered among the most commodious establishments in the kingdom.

It has hitherto answered the purpose of its original projectors, whose design probably never extended beyond the accommodation of a hundred patients. For many years, however, that number has been far short of the actual number accommodated, and as the demand for room increases annually, it must obviously become once more incumbent on the Directors to make another appeal to the generosity of a benevolent community, to enable them to enlarge and adequately complete the present establishment. A few thousand pounds so expended would do still greater honour to Dundee, and render the people of it as renowned for benevolence and humanity as they have always been for their industry,

their skill, and their enterprise in trade, commerce, and manufactures.

Like the plan pursued in rearing the Asylum itself, and bringing it to its present enlarged and excellent condition, the mode of treatment in reference to the unfortunate inmates confined in it has been prudently progressive. At first, the most prompt and vigorous system of restraint and coercion was practised in every instance, because that system was in universal use, and everywhere had the sanction of the faculty. No other mode of treatment had yet been heard or thought of, at least in this country; and, at that period, the superintendents of asylums, even although they had projected an opposite system, would scarcely have ventured to introduce it on their own responsibility. It was in France that a change was first projected and carried into effect to a certain extent; but even there, although an eminent and experienced physician was the author of the change, it met with considerable opposition. So slow is the progress of improvement in science, when opposed by long-rooted custom, prejudice, and error. In this Asylum, the new system as pursued by the French was begun to be carried into effect on the very day Dr Mackintosh came into office. The experiment was made gradually and with due caution, as every experiment ought where there is the slightest doubt of its utility. Happily the first results were answerable to the Superintendent's most sanguine aspirations for success, and, in a very short time, he had the happiness to find that so great was the efficacy of the new system, considered both medically and otherwise, that it seemed almost as much a blessing to himself as to his unfortunate patients. He still remembers with pleasure the gratifying effects which so remarkable a change of treatment produced in some of those who were then under his charge. Lunatics are rarely beyond the reach of kindness, and they often feel it very sensibly. During his first experiments he had proofs of this feeling most expressively demonstrated on the part of several patients. When the hapless beings found themselves no longer

under the fear of threats and coercion, but on the contrary set freely at large, and treated with indulgence and kindness, they were often unable to express their sense of so wonderful a change in words, but the uplifted eye and the pressed hand spoke eloquently as to the delight, astonishment, and gratitude which they felt within. The present age has been fruitful of discoveries in science and philosophy. In this respect the triumphs of medical science have been great, and perhaps the humane and non-restraint systems in the treatment of lunacy are the noblest of them all. Humanity almost every where hails them as such, and humanity is always in the right.

In tracing the progress of the Institution, it ought not to be forgotten how much of its past efficiency is to be ascribed to the tact, skill, good feeling, and excellent management of our much respected Matron, Mrs Kilgour. Ever since her appointment took place, the improvements in every thing connected with the female department have been regularly progressive. The duties of the Physician and Superintendent were thenceforward greatly lightened, as well as rendered agreeable in every respect, while the harmonious working of all departments necessarily contributed to increase the general cordiality and efficiency that have so long prevailed in the establishment. Perhaps it is the total absence of jealousy and distrust in the management of this Asylum—the united family—that constitutes one of its finest features; and, accordingly, we would respectfully impress upon the Directors how important it will be hereafter to foster and perpetuate a similar good understanding between the various officers, since it is in fact so essential to efficiency of management, both sanitary and otherwise, that no lunatic asylum can thrive without it, or become entitled to the confidence of the public.

Another consideration of primary importance is the choice of subordinate servants, because upon their judicious selection depend many comforts and advantages to the patients, as well as the general order, vigilance, and regularity that ought to prevail

in an asylum. At present, our set of servants is exceedingly good. The Superintendent and Matron alone engage and dismiss them, and they are always hired by the half-year. As the duties of subordinate servants with us are arduous and sometimes painful, we necessarily sympathise with them, and of course never refuse them any reasonable indulgence. Most of them are therefore allowed the whole of every second Sabbath to themselves, and one afternoon every week besides. The male portion of our present set being, with one exception, married, they are, on that account, allowed also two nights a-week to themselves in addition. No unmarried servant is ever permitted to remain without the walls of the Asylum after ten o'clock at night. It has rarely been found necessary to discharge a servant for misconduct; consequently several of those who are now in the establishment have been there for many years. This circumstance has been favourable for the Asylum, since nothing is more prejudicial to the patients than the frequent changing of their attendants. In the hiring of our servants, one thing in particular has always been attended to, as far as possible, and that is, their natural disposition. Whatever be their professions in point of religious principle, or the opinions they entertain on matters of lesser importance, it is indispensable that their natural disposition should be good, and their affections and propensities kindly. Servants in asylums should also be active, willing to do anything lawful that may be required of them, attentive and zealous in the discharge of their regular duty, and, above all, promptly as well as respectfully obedient. They have, no doubt, in most cases an exhausting and wearying-out task on hand, their vigilance being ceaseless, their minds always on the stretch to guard against accidents and mischief, while their tempers are, at the same time, often severely tried by the violence and wanton ill-usage which they sometimes receive from the patients under their charge. Hence, however, it is but reasonable that they should be amply remunerated, and, accordingly, the wages allowed here have

always been upon a pretty liberal scale. On festal occasions, some of our old servants resident elsewhere are generally invited to share in the festivities of the day. To them it is always a real holiday, and nothing can be more delightful than to see with what cordiality they greet one another on thus meeting again with old friends. It is like the affectionate re-unions which sometimes distinguish the happier class of families in private life.

The services of Dr Mackintosh as Superintendent being now about to terminate, in consequence of his appointment to the important situation of Chief Medical Superintendent in the Royal Glasgow Asylum, he feels bound, both from gratitude and affection, to express the strong sense he entertains of the merit of all and every one of the official persons with whom he has been connected in the general management of the establishment here. Without their zealous and friendly co-operation in every thing that came within the sphere of their respective duties, he is conscious that the performance of his own duties must have often come far short of what either the Directors or the public had a right to expect. But as to the Directors themselves, both of the past and present time, how can he adequately express the gratitude which he owes to them for the long and uninterrupted course of civilities that he has uniformly experienced at the hands of every one of them with whom he has come in contact? Or how can he do justice to their worth as public men, except by here stating his conviction that no class of gentlemen ever chosen to fulfil duties similar to theirs could possibly discharge such duties in a more faithful, judicious, and honourable manner? In thus estimating the value of their labours for the amelioration of suffering, he will not, he believes, be accused either of flattery or of undue partiality, since he does nothing more than echo the public voice which has always most willingly conceded an ample portion of the applause which is so justly due to their well-meant and laborious efforts, not only to promote the good of the Asylum, but also the general good of the community at large. His own feelings towards them

cannot be expressed in words. They have always had his highest respect and esteem, but they are now entitled to the strongest expression of his gratitude. He owes it to them both collectively and individually on many accounts, but chiefly on account of the long and unvarying confidence which they reposed in him. It was the highest compliment they could have paid to him as a public servant. Nothing ever occurred to shake or interrupt it. In every situation of life hereafter, this consideration must, to him at least, be either a consolation or a pleasure. Nay more, he feels that it may at all times be the subject of just and honourable pride.

In the immediate prospect of being permanently separated from his colleagues, it would be unseemly, as well as ungenerous, were he to omit expressing his esteem and regard for them individually. To the worthy Physician, his colleague and friend, his warmest thanks and best wishes are due for a most harmonious professional co-operation of fourteen years. Nothing has ever for a moment interrupted their mutual confidence, and he earnestly trusts that their mutual good-will shall only terminate with life.

To the excellent Matron of the establishment, Mrs Kilgour, still more is due than a mere expression of thanks. He owes her also a large debt of gratitude, not only for official co-operation and aid, but for her kind and generous anxiety for his welfare, displayed ever since her appointment in 1840, and in such a way as to lighten his professional labours and rid him of much anxiety about the state of the female patients. Of her merit as a public officer, therefore, he cannot speak too strongly. That merit has been often acknowledged in his annual reports, but on no occasion has more than simple justice been done to her worth. Her ceaseless activity, her judicious and most successful treatment of the patients, and the entire prudence of her general management, were all too conspicuous not to be valued and acknowledged; and hence every successive year saw them duly reported by the Medical Officers. Here the Superintendent but feebly expresses what

he thinks when he states his belief, that nowhere as the Matron of a Lunatic Asylum does her superior exist.

A warm expression of thanks is also due to the worthy Chaplain of the establishment, for the uniform prudence and discretion displayed by him in the discharge of his very delicate and important duties. At all times the exercise of his functions was distinguished by propriety, and did honour to his discrimination and judgment.

Thanks are also due to the Treasurer and Secretary of the Institution, for with them as with others, the Superintendent has always lived and consorted on the most harmonious and friendly terms. As gentlemen, worthy of his regard, he must ever remember them with respect and esteem.

From the subordinate servants, too, he cannot withhold an expression of his sincere and heartfelt regard. He has often reported their excellent general conduct; but thanks, as well as approbation, are more especially due to them for their humane and kindly treatment of the patients committed to their charge, their invariable respectful behaviour to their official superiors, and also their constant attention, as well as implicit obedience, to every order that emanated from himself.

One last duty incumbent on the Superintendent yet remains to be performed. It is that of bidding the Asylum, and all who are connected with it, an affectionate farewell. He has looked forward to this final parting with feelings which he cannot describe. It is often with reluctance that we bear even a short separation from a single old friend. His case in the present instance is just so much the more affecting, that he is about to be separated from many old and sincere friends, his dear patients included, and perhaps for ever. The only consolation he has is the certainty, that among those friends there are not a few who not only rejoice in the approaching separation, because it is in consequence of his advancement to a higher and more lucrative situation, but also

because some of them have generously been instrumental in promoting that advancement, and accordingly look upon it with justice, as equally fortunate for him and honourable to themselves. To such kind and disinterested friends what does he not owe for their exertions in his behalf! The remembrance of what they have done for him, and the gratitude with which it fills his heart, will only cease when he himself ceases to exist.

(Signed) PATRICK NIMMO, M.D.
ALEXANDER MACKINTOSH, M.D.

Asylum, 18th *June*, 1849.

EXTRACT

FROM

MINUTES OF ANNUAL COURT.

"Dr Mackintosh read his Medical Report for the year.

"Thomas Erskine, Esquire of Linlathen, seconded by William Thoms, Esquire, moved that the thanks of the Meeting be given to the Medical Officers for their services, and to Dr Mackintosh for drawing up the Medical Report.

"It was remitted to the Weekly Committee to get those portions of this document printed which should be communicated to the public."

MEDICAL STATISTICAL TABLES,

FOR THE

YEAR ENDING 18TH JUNE 1849.

(The year ending on the third Monday of June, agreeably to Charter.)

TABLE I.

YEARLY RETURN OF LUNATICS IN THE DUNDEE ROYAL LUNATIC ASYLUM,

From 19th June 1848 to 18th June 1849.

	Males.	Females.	Total.
Remained 19th June 1848,	101	95	196
Admitted during the above period,	17	22	39
Ditto, re-admissions,	5	2	7
Total,	123	119	242
Discharged cured,	11	14	25
Ditto, improved,	2	4	6
Ditto, by desire,	1	3	4
Died,	7	5	12
Total,	21	26	47
Remaining 18th June 1849,	102	93	195
Total,	123	119	242
Daily average number of patients in the House,	104	94	198

II.

TABLE OF ADMISSIONS ACCORDING TO THE CAUSES OF INSANITY, SO FAR AS THEY CAN BE ASCERTAINED.

PHYSICAL CAUSES.

	Males.	Females.	Total.
Hereditary,	6	2	8
Drunkenness,	4	2	6
Predisposition from previous attack,	0	1	1
Fever,	1	1	2
Childbirth,	0	1	1
Influenza,	1	0	1
Night-watching,	0	1	1
Total,	12	8	20

III.

MORAL CAUSES.

	Males.	Females.	Total.
Misfortunes,	1	0	1
Grief,	0	3	3
Fright,	0	1	1
Loss of property,	0	1	1
Want of employment,	1	0	1
Domestic trials,	0	1	1
	2	6	8
Unknown,	8	10	18
Total,	10	16	26

IV.

TABLE OF ADMISSIONS RELATIVE TO AGES.

	Males.	Females.	Total.
From 15 to 20 years of age,	1	2	3
... 20 to 25 ...	3	3	6
... 25 to 30 ..	5	1	6
... 30 to 35 ...	1	3	4
.. 35 to 40 ...	0	6	6
... 40 to 45 ...	3	3	6
... 45 to 50 ...	3	2	5
... 50 to 55 ...	3	2	5
... 55 to 60 ...	3	1	4
... 60 to 65 ...	0	0	0
... 65 to 70 ...	0	0	0
... 70 to 75 ...	0	1	1
Total,	22	24	46

V.

TABLE OF ADMISSIONS RELATIVE TO AGES AND SEXES, CLASSED ACCORDING TO THEIR FREQUENCY.

	Males.
From 25 to 30 years of age,	5
... 20 to 25 ...	3
... 40 to 45 ...	3
... 45 to 50 ...	3
... 50 to 55 ...	3
.. 55 to 60 ...	3
... 15 to 20 ...	1
... 30 to 35 ...	1
Total,	22

VI.

	Females.
From 35 to 40 years of age,	6
... 20 to 25 ...	3
... 30 to 35 ...	3
... 40 to 45 ...	3
... 15 to 20 ...	2
... 45 to 50 ...	2
.. 50 to 55 ...	2
... 25 to 30 ...	1
... 55 to 60 ...	1
... 70 to 75 ...	1
Total,	24

VII.

TABLE OF ADMISSIONS RELATIVE TO THE VARIETIES OF INSANITY.

	Males.	Females.	Total.
Mania,	7	12	19
Monomania,	12	9	21
Dementia,	3	3	6
Idiocy,	0	0	0
Total,	22	24	46

VIII.

TABLE OF ADMISSIONS RELATIVE TO THE CIVIL CONDITION.

	Males.	Females.	Total.
Married,	12	10	22
Unmarried,	8	10	18
Carry forward,	20	20	40

	Males.	Females.	Total.
Brought forward, . .	20	20	40
Widows, . . .	0	4	
Widowers, . .	1	0	1
Total, . . .	21	24	45
Unknown, . .	1	0	1
Total, . .	22	24	46

IX.

TABLE OF ADMISSIONS RELATIVE TO THE MONTHS OF THE YEAR.

	Males.	Females.	Total.
From June to July, . .	0	3	3
... July to August, . .	6	0	6
... August to September, . .	2	3	5
... September to October, .	3	2	5
... October to November, . .	2	1	3
... November to December, .	1	1	2
... December to January, 1849, .	2	1	3
... January to February, .	2	3	5
... February to March, . .	2	3	4
... March to April, . .	0	5	5
... April to May, . . .	1	3	4
... May to June 18th, .	1	0	1
Total, . .	22	24	46

X.

TABLE OF ADMISSIONS RELATIVE TO FORM OF RELIGION.

	Males.	Females.	Total.
Protestants, . .	20	24	44
Roman Catholics, . .	2	0	2
Total, . .	22	24	46

XI.

TABLE OF ADMISSIONS RELATIVE TO PLACE OF BIRTH.

	Males.	Females.	Total.
Born in Scotland, . .	20	24	44
... England, . . .	1	0	1
... Ireland, . .	1	0	1
Total, . .	22	24	46

XII.

DURATION OF THE DISORDER IN THE 46 CASES ADMITTED DURING THE YEAR ENDING 18th JUNE 1849.

Duration.	Males.	Females.	Total.
Not exceeding 1 month, . .	6	5	11
... 3	2	3	5
... 6	1	2	3
... 9	1	1	2
... 1 year, . .	0	1	1
... 2	6	4	10
.. 3	3	1	4
... 4	0	1	1
... 5	1	2	3
... 6	1	0	1
... 8	1	0	1
... 16	0	1	1
... 21	0	1	1
... 29	0	1	1
.. 52	0	1	1
Total, . .	22	24	46

XIII.

TABLE OF ADMISSIONS RELATIVE TO SUICIDE ADMITTED DURING EACH MONTH OF THE YEAR.

	Males.	Females.	Total.
From June to July, . .	0	0	0
... July to August, . .	3	0	3
... August to September, .	1	2	3
... September to October, . .	2	1	3
... October to November, .	0	0	0
... November to December, . .	1	0	1
... December to January 1849, .	0	0	0
... January to February, . .	1	0	1
... February to March, .	0	0	0
... March to April, . .	0	2	2
... April to May, . .	0	0	0
... May to June 18th, . .	0	0	0
Total, . .	8	5	13

XIV.

TABLE OF ADMISSIONS IN EACH MONTH OF THE YEAR ENDING 18TH JUNE 1849, CLASSED ACCORDING TO FORM OF DISEASE.

Form of Disease.	From June 18, 1848.		July 1848.		Aug. 1848.		Sept. 1848.		Oct. 1848.		Nov. 1848.		Dec. 1848.		Jan. 1849.		Feb. 1849.		Mar. 1849.		April 1849.		May 1849.		June 1849.		Total 1849.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Mania,	0	0	2	2	1	0	1	2	0	0	0	1	0	0	1	1	1	2	0	2	0	2	1	1	0	0	7	12
Monomania,	0	0	2	2	0	2	1	2	3	1	1	0	0	0	1	1	1	0	1	0	2	0	2	1	0	0	12	6
Dementia,	0	0	0	1	0	0	0	0	0	0	2	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	3	2
Idiocy,	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total,	0	0	4	5	2	1	3	3	3	1	3	2	0	0	2	2	3	3	1	4	0	4	2	1	0	0	22	20

XV., XVI., XVII., XVIII.

XV.

FORM OF THE DISEASE—DURATION OF THE DISEASE—AGE—AND LENGTH OF TIME UNDER TREATMENT IN THE DUNDEE ASYLUM, IN THE CASES OF 25 PATIENTS, DISCHARGED CURED, DURING THE YEAR ENDING 18TH JUNE 1849.

	Males.	Females.	Total.
Mania, ...	5	7	12
Monomania, ...	6	6	12
Dementia, ...	0	1	1
Total, . .	11	14	25

XVI.

DURATION OF DISEASE—

	Males.	Females.	Total.
Not exceeding 3 months, . .	1	0	1
... 6	3	2	5
... 9	0	1	1
... 1 year, . . .	2	2	4
... 2	3	1	4
... 3	1	3	4
... 4	0	2	2
... 6	1	1	2
Total, . .	11	14	25

XVII.

AGE—

	Males.	Females.	Total.
From 15 to 20 years of age,	0	1	1
... 20 to 25 ...	1	1	2
... 25 to 30 ...	2	2	4
... 30 to 35 ...	0	2	2
... 35 to 40 ...	1	1	2
... 40 to 45 ...	2	1	3
... 45 to 50 ...	2	2	4
... 50 to 55 ...	2	3	5
... 55 to 60 ...	1	0	1
... 70 to 75 ...	0	1	1
Total,	11	14	25

XVIII.

TIME OF TREATMENT IN DUNDEE ASYLUM—

	Males.	Females.	Total.
Not exceeding 3 months,	6	6	12
... 6 ...	0	4	4
... 9 ...	2	2	4
... 1 year,	1	1	2
... 2 ...	1	1	2
... 5 ...	1	0	1
Total,	11	14	25

XIX., XX., XXI., XXII.

SIMILAR TABLES IN THE CASES OF THE TWELVE PATIENTS WHO HAVE DIED IN THE YEAR ENDING 18th JUNE 1849.

XIX.

FORM OF DISEASE—

	Males.	Females.	Total.
Mania,	1	4	5
Monomania,	4	0	4
Dementia,	2	1	3
Total,	7	5	12

XX.

DURATION OF DISEASE—

	Males.	Females.	Total.
Not exceeding 1 year,	0	1	1
... 2 ...	1	1	2
... 3 ...	2	0	2
... 4 ...	1	1	2
... 5 ...	1	0	1
... 8 ...	1	0	1
.. 17 ...	0	1	1
... 38 ...	1	0	1
Not ascertained,	0	1	1
Total,	7	5	12

XXI.

AGE—

	Males.	Females.	Total.
From 20 to 25 years of age,	0	1	1
... 25 to 30 ...	0	1	1
... 30 to 35 ...	1	1	2
... 35 to 40 ...	1	0	1
.. 45 to 50 ...	2	0	2
.. 50 to 55 ...	1	0	1
.. 65 to 70 ...	0	1	1
... 70 to 75 ...	1	1	2
... 75 to 80 ...	1	0	1
Total,	7	5	12

XXII.

TIME OF TREATMENT IN DUNDEE ASYLUM—

	Males.	Females.	Total.
Not exceeding 1 month,	1	0	1
... 3 ...	1	0	1
... 9 ...	0	1	1
.. 1 year,	0	1	1
... 2 ...	3	1	4
.. 6 ...	1	0	1
... 7 ...	0	1	1
... 10 ...	0	1	1
.. 29 ..	1	0	1
Total,	7	5	12

XXIII.

CAUSES OF THE TWELVE DEATHS IN THE YEAR ENDING 18TH JUNE 1848.

	Males.	Females.	Total.
Scrofula,	0	1	1
Fever,	0	1	1
Paralysis,	1	0	1
Diarrhœa,	0	1	1
Disease of Stomach,	1	0	1
Disease within head,	3	1	4
Exhaustion,	2	1	3
Total,	7	5	12

XXIV.

CAUSE OF DEATHS.—B.

No.		From June 18th.	July 18th.	Aug. 18th.	Sept. 18th.	Oct. 18th.	Dec. 18th.	Jan. 18th.	Feb. 18th.	Mar. 18th.	April 18th.	May 18th.	June 18th.	Totals	
		S M T W T F S M T W T F S M T W T F S M T W T F S M T W T F S M T W T F S M T W T F S M T W T F S M T W T F S M T W T F S												S	F
1	Scrofula,	0 1												0	1
2	Fever,		0 1											0	1
3	Paralysis,			1 0										1	0
4	Diarrhœa,				0 1									0	1
5	Disease of Stomach,					1 0								1	0
6	Disease within Head,						1 0							1	0
7	Do. do.						0 1							0	1
8	Do. do.							1 0						1	0
9	Do. do.								1 0					1	0
10	Exhaustion,								1 0					1	0
11	Do.									0 1	0 0			0	1
12	Do.											1 0	0 0	1	0
	Total,	0 1	0 1	1 0	0 1	1 0	1 1	1 0	2 0	0 1	1 0	1 0	0 0	7	5

XXV.

TABLE OF CURES AT THE DUNDEE ASYLUM FROM 1820 TO 1849.

Admitted from 1st April 1820 to 18th June 1849.	Cured.	Per Cent.
Number of Lunatics, 1296,.....	584	45

XXVI.

RETURN of PATIENTS Annually Admitted into the Dundee Royal Asylum from its opening on the 1st April 1820, to the 18th June 1849, including Re-Admissions, together with the Cures, Discharges, and Deaths.

(The years ending on the 3d Monday of June, agreeably to Charter.)

N.B.—Under the head "Relieved, Patients discharged at the request of friends, &c., are included.

No.	Years.	Remained.			Admitted.			Total.			Discharged.									Died.			Remaining in Asylum 18th June 1849.		
											Cured.			Relieved.											
		M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.				M.	F.	T.	M.	F.	T.
1	1820				22	28	50	22	28	50	3	5	8	1	1	2				2	1	3	2	1	3
2	1821	16	21	37	12	12	24	28	33	61	5	8	13	4	2	6				1	1	2	1	1	2
3	1822	19	26	45	19	13	32	47	39	86	7	8	15	3	4	7				0	1	1	1	1	2
4	1823	26	31	57	17	18	35	64	57	121	14	15	29	10	7	17				4	2	6	1	1	2
5	1824	43	31	74	25	27	52	89	84	173	14	15	29	4	3	7				3	3	6	3	3	6
6	1825	43	38	81	25	29	54	68	67	135	15	13	28	3	4	7				1	2	3	3	3	6
7	1826	51	47	98	21	19	40	72	67	139	10	11	21	6	6	12				3	3	6	3	3	6
8	1827	59	45	104	19	19	38	78	64	142	8	8	16	3	3	6				2	2	4	3	3	6
9	1828	59	45	104	17	14	31	76	59	135	10	9	19	5	3	8				0	1	1	3	2	5
10	1829	69	56	125	15	15	30	84	74	158	13	12	25	6	4	10				4	3	7	3	3	6
11	1830	55	52	107	15	18	33	70	92	162	8	7	15	3	5	8				2	2	4	3	3	6
12	1831	55	52	107	21	16	37	76	68	144	8	8	16	3	4	7				3	3	6	3	3	6
13	1832	67	54	121	23	18	41	90	86	176	9	6	15	4	4	8				1	2	3	3	3	6
14	1833	70	58	128	19	18	37	89	76	165	9	13	22	7	6	13				2	2	4	3	3	6
15	1834	70	58	128	21	18	39	91	76	167	7	4	11	6	4	10				3	3	6	3	3	6
16	1835	70	59	129	30	18	48	100	77	177	14	5	19	7	5	12				3	3	6	3	3	6
17	1836	70	54	124	30	21	51	100	75	175	13	8	21	6	5	11				3	3	6	3	3	6
18	1837	76	50	126	30	27	57	106	77	183	14	9	23	4	3	7				3	3	6	3	3	6
19	1838	82	60	142	29	27	56	111	87	198	23	20	43	4	5	9				3	3	6	3	3	6
20	1839	82	60	142	29	27	56	111	87	198	16	16	32	3	4	7				3	3	6	3	3	6
21	1840	88	70	158	33	25	58	121	95	216	21	11	32	8	5	13				3	3	6	3	3	6
22	1841	86	74	160	34	19	53	120	93	213	16	11	27	6	2	8				3	3	6	3	3	6
23	1842	86	78	164	33	22	55	119	100	219	21	10	31	6	4	10				4	4	8	3	3	6
24	1843	94	88	182	29	22	51	123	110	233	16	9	25	7	6	13				3	3	6	3	3	6
25	1844	95	88	183	29	23	52	124	111	235	9	9	18	8	6	14				3	3	6	3	3	6
26	1845	105	91	196	29	28	57	134	119	253	15	15	30	7	8	15				6	2	8	3	3	6
27	1846	100	93	193	29	29	58	129	122	251	16	13	29	8	7	15				6	3	9	3	3	6
28	1847	105	88	193	33	31	64	138	119	257	17	13	30	11	8	19				6	3	9	3	3	6
29	1848	101	95	196	33	31	64	134	126	260	11	14	25	3	7	10				5	3	8	3	3	6
					683	613	1296				293	291	584	151	149	300				139	78	217	102	93	195

XXVII.

THE TIMES OF THE PATIENTS' DEATHS AFTER THEIR ADMISSION INTO THE ASYLUM, FROM THE OPENING OF THE INSTITUTION TO THE 18TH JUNE 1849.

Times of Deaths.	Males.	Females.	Total.
Within 1 fortnight,	10	8	18
... 1 month,	7	2	9
... 3 ...	15	10	25
... 6 ...	10	4	14
... 9 ...	9	3	12
... 1 year,	6	2	8
... 2 ...	23	11	34
... 3 ...	9	3	12
... 4 ...	11	5	16
... 5 ...	4	1	5
... 6 ...	6	4	10
... 7 ...	6	3	9
... 8 ...	2	3	5
... 9 ...	3	3	6
... 10 ...	1	3	4
... 11 ..	1	1	2
... 12 ...	2	2	4
... 13 ...	0	1	1
... 14 ...	5	1	6
... 15 ...	2	0	2
... 16 ...	1	1	2
... 17 ...	0	2	2
... 18 ...	2	0	2
... 19 ...	1	1	2
... 20 ...	0	0	0
... 21 ...	0	1	1
... 22 ...	1	0	1
... 23 ...	0	1	1
... 24 ...	1	1	2
... 25 ...	0	0	0
Carry forward,	138	77	215

Brought forward,	138	77	215
... 26 ...	0	0	0
.. 27 ...	0	0	0
.. 28 ...	0	1	1
... 29 ...	1	0	1
Total,	139	78	217

XXVIII.

ANNUAL PER CENTAGE OF DEATHS FROM 13TH JUNE 1830 TO 18TH JUNE 1849.

(The years ending on the third Monday of June, agreeably to Charter.)

Years ending 3d Monday of June.	Average number of Patients.			Number of Deaths.			Per centage of Deaths.		
	M.	F.	Total.	M.	F.	Total.	M.	F.	Total.
1830	57	44	101	2	2	4	3.51	4.52	3.95
1831	55	48	103	2	1	3	3.63	2.08	2.91
1832	61	52	113	2	5	7	3.27	9.61	6.19
1833	65	59	124	7	3	10	10.76	5.08	8.06
1834	70	58	128	6	4	10	8.57	6.89	7.81
1835	68	58	126	4	4	8	5.88	6.89	6.34
1836	70	59	129	6	2	8	5.57	3.59	6.20
1837	74	61	135	5	5	10	6.75	8.19	7.48
1838	77	60	137	7	1	8	9.09	1.66	5.83
1839	84	66	150	6	5	11	7.19	7.57	7.33
1840	87	70	157	5	2	7	5.74	2.85	4.45
1841	89	75	164	5	3	8	5.61	3.99	4.87
1842	102	77	179	8	2	10	7.84	2.59	5.58
1843	96	84	180	5	4	9	5.20	4.89	5.00
1844	97	90	187	10	2	12	10.31	2.22	6.41
1845	100	90	190	8	6	14	8.00	6.66	7.37
1846	105	96	201	6	2	8	5.70	2.08	3.90
1847	105	95	200	5	2	7	4.70	2.01	3.05
1848	103	94	197	14	5	19	13.61	5.30	9.60
1849	104	94	198	7	5	12	6.70	5.30	6.00
	1669	1430	3099	120	65	185			

Average annual mortality from 1830 to 1849, inclusive :—

Males.	Females.	Total.
7.1.	4.5.	5.90.

NOTE.—No case of suicide or homicide occurred in the above years.

XXIX.

TABLE OF ESCAPES FROM 19TH JUNE 1848 TO 18TH JUNE 1849.

	Males.	Females.	Total.
1848 to 1849,	0	0	0

XXX.

DAILY RETURN FROM THE ATTENDANTS OF WARD OF THE STATE
OF EACH PATIENT UNDER THEIR RESPECTIVE CHARGE, FROM 8 P.M.
TO 8 P.M. 184

Number of Patients,

1. With confined bowels.
2. With relaxed bowels.
3. Uncleanly by day.
4. Uncleanly by night.
5. Wet by day.
6. Wet by night.
7. Slept on straw cases.
8. Wore stockings in bed.
9. Noisy in the day time.
10. Noisy in the night time.
11. Destroyed their clothing.
12. Destroyed their bedding.
13. Refused a part of their food.
14. Refused all their food.
15. Attempted suicide.
16. Threatened suicide.

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17. Under medicinal treatment.
18. Under surgical treatment.
19. Took wine medicinally.
20. Took porter or beer medicinally.
21. Allowed extra meat.
22. Disallowed meat.
23. Forcibly fed.
24. Bathed in a warm bath.
25. Had the shower bath.
26. Washed in a warm bath.

27. Had the warm foot bath.
28. Under hired nursing.
29. Under night watching.
30. Kept their beds by day.
31. Violent in conduct by day.
32. Violent in conduct by night.
33. Orderly.
34. Disorderly.

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35. Had epileptic fits by day.
36. Had epileptic fits by night.
37. Met with accidents, &c.

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38. Capable of occupation.
39. Incapable of occupation.
40. Provided with occupation.
41. Refused to work.
42. Had active employment.
43. Had sedentary employment in
44. Employed in the garden or grounds.
45. Employed cleaning rooms, &c.
46. Employed in the laundry or wash-house.
47. Employed in the kitchen.
48. Exercised in the galleries.
49. Exercised in the courts.
50. Exercised in the grounds.
51. Exercised beyond the walls.
52. Engaged in active sports.
53. Performing on piano.
54. Performing on violin.
55. Performing on flute or Jews' harp.
56. Playing at billiards.
57. Playing at cards.
58. Playing at ball or quoits.
59. Attending chapel.
60. Weaving.

61. Winding for weavers and spinning.
62. Knitting.
63. Needle-work.
64. Breaking metal.
65. Pumping water.
66. Mat-making.
67. Attending prayers.
68. Picking rope.
69. Secluded from to

(Signed)

Attendant *Ward.*

XXXI.

RETURN I. OF SOME OF THE WORK DONE ON MALE SIDE.

Bagging wove,		yards	11952
Sheeting ,,		,,	10557
Coats, canvas,	made,	No.	1
Mattresses, canvas,	,,	,,	3
Dresses, canvas and tick,	,,	,,	5
Boots and shoes,	,,	pairs	19
Do. ,,	mended,	,,	530½
Mats, door,	made,	No.	1
Hemp and Zealand ropes,	teazed,	cwt.	64¾
Metal for roads,	broken,	tons	many

N.B.—Gardening, &c., cannot be inserted here.

RETURN II. OF SOME OF THE WORK DONE BY FEMALE LUNATICS.

Gowns,	made,	No.	56
Petticoats,	,,	,,	45
Shifts,	,,	,,	90
Slips,	,,	,,	8
Bedgowns,	,,	,,	20

Stays,	,,	pair	8
Aprons,	,,	No.	60
Pockets,	,,	,,	18
Caps,	,,	,,	186
Habit-shirts,	,,	,,	10
Handkerchiefs,	hemmed,	,,	230
Shirts,	made,	,,	79
Jackets, flannel,	,,	,,	91
Drawers plaiding	,,	Pair,	85
Stockings knitted,		,,	120
Socks	,,	,,	50
Bolster cases made,		,,	22
Pillow	,,	No.	18
Mattresses made,		No.	16
Sheets,	,,	Pair,	28
Blankets hemmed,		,,	30
Cloths per Table,	do.,	No.	18
Rugs quilted,		,,	10
Bed quilts,		,,	8
Window Blinds made,		,,	24
Towels hemmed,		,,	180
Collars worked,		,,	2
Sofa Cushions knitted,		,,	2
Polkas,	,,	,,	2
Sleeves,	,,	Pair,	4
Purses,	,,	No.	5
Tedy's,	,,	,,	3
Slippers worked,		Pair,	4
Bags of various kinds made,		No.	24
Sheeting wove,		Yds.	11,100
Winding weft for sheeting cloth,		Spds.	1276
,,	bagging ,,	Yds.	11952

In addition to the mending of all the clothes, &c., and darning the stockings of all the inmates of the house.

CONTENTS

OF THE

MEDICAL OFFICERS' REPORT.

QUANTITIES OF THE PRINCIPAL PROVISIONS, &c.,

PURCHASED FOR THE ASYLUM

IN THE YEARS 1847-48 AND 1849-50.

	1847-48.	1849-50.
Soap,	4712 lbs.	
Coals,	237 tons.	215 tons.
Butcher Meat,	20,826 lbs.	20,742 lbs.
Bread,	17,152 loaves.	17,318 loaves.
Sugar,	3304 lbs.	2800 lbs.
Tea,	396 lbs.	351 lbs.
Butter,	2289½ lbs.	2279½ lbs.
Cheese,	641½ lbs.	741½ lbs.
Meal,	224 bolls.	374 bolls.
Barley,	55 cwt.	51 cwt.
Split Pease,	8½ cwt.	7½ cwt.
Potatoes,	31¼ bolls.	33 bolls.
Beer,	1613½ doz.	1557½ doz.
Milk,	8784 galls.	8760 galls.

QUERIES.

RELATIVES OR GUARDIANS, with the assistance of the Medical Attendant, are requested to annex, according to the best of their knowledge, precise Answers to the following Queries, or to as many of them as may be applicable to the case of the Patient.

DATE OF APPLICATION.

	QUERIES.	ANSWERS.
History.	1. What is the name? Place of birth and settlement? Degree of education? and Form of religion of the patient?	
	2. Is the patient tall and powerful? And is there anything remarkable in the patient's usual appearance, as in height, gait, marks, or deformity? What is the temperament?	
	3. How long has the patient been insane? and Did the disorder come on gradually or suddenly?	
	4. If the patient has been oftener than once insane? When did the malady first occur? How often did it occur before this last attack? In what forms, and of what duration?	
	5. How long before lunacy were any such precursory symptoms observed as the following,—viz.: unusual depression or elevation of spirits, or any remarkable alteration in the temper, disposition, feelings, opinions, conduct, sleep, appetite, state of bowels, or health of the patient?	
	6. What have been, or are the prominent symptoms of the malady? Is the patient restless, sleepless, wandering, violent, destructive, or noisy, by night or day? Has the patient a desire to eat improper things? Has any obvious change in its form occurred? And does it appear to be increasing, declining, or stationary?	
	7. Are there lucid intervals, or any great remissions or exacerbations; and do such changes occur at uncertain times, or at stated periods?	

	QUERIES.	ANSWERS.
History.	8. Does the patient rave indifferently on various subjects? or chiefly on one? and What is that subject? Mention particularly any permanent or remarkable hallucinations, illusions, or delusions?	
	9. Has the patient ever threatened or attempted to commit any act of self violence? and By what means?	
	10. Does the patient manifest any disposition to injure other persons, and how? Or cherish any malicious design? Or is the morbid train of thought excited by any particular subject or event?	
	11. Is the patient prone to tear clothes, or to break windows or furniture? Or to injure the person in any way?	
	12. Since the commencement of the malady, what have been the patient's habits? State particularly whether the patient is attentive to the calls of nature?	
Causes.	13. What is the age? And what was the profession or occupation of the patient?	
	14. Is the patient married, or single, or widowed? How long since first married or becoming widowed?	
	15. Does any constitutional or hereditary disposition exist in the family of the patient to nervous affections? And, was any relative of the patient ever insane?	
	16. Before the commencement, either of the malady, or of any of its precursory symptoms, had the patient been remarkable for any degree of oddity, eccentricity, or mental infirmity? Mention natural disposition and general habits of living, predominant passions or prejudices, religious impressions, and any habitual vice or intemperance? Is the intellect good naturally?	

	QUERIES.	ANSWERS.
Causes.	17. Is the patient subject to periodical attacks of any other malady; to any unusual discharge, or to suppression or obstruction of any *customary* discharge; to sores, eruptions, rupture, epilepsy, or palsy? Specify any bodily infirmity or disease of the patient; also the present state of bodily health, as to desire for food, functions of stomach, bowels, kidneys, respiration, pulse, and state of skin, &c.	
	18. Did the present fit of lunacy occur, or has any former fit occurred, during pregnancy; or appear to have been connected with the puerperal state or lactation? If a female, state whether she has born children, their number, and the period of the birth of the last?	
	19. Was the head of the patient ever severely injured?	
	20. What is supposed to have been the exciting cause of the malady? Is it a moral cause—such as misfortune, disappointment, fright, love, &c.? Or a physical cause—such as fever, the immoderate use of opium or other medicine, or any intoxicating agent, bodily injury, serious illness, or accident affecting the nervous system, &c.?	
Treatment.	21. What has been done for the recovery of the patient? And with what effect?	
	22 Has the patient ever been treated for lunacy in any public asylum or private retreat for the insane? If so, how often, and how long on each occasion, has the patient been in any such establishment? When, in what state, and if not cured, for what reason was the patient dismissed?	
	23. What is the proposed rate of board?	

Signed,

EXTRACT

From Act of Parliament 55 Geo. III., cap. 69, anent Mad Houses in Scotland.

And, if any medical person shall sign or give any such certificate, or report, without having carefully visited and examined the person to whom it relates, and without having endeavoured to ascertain, in a proper manner, by such examination, and otherwise, that such person is a furious or fatuous person or lunatic, and proper to be confined in a house for the reception of such persons, every such medical person shall forfeit and pay for such offence or neglect the sum of Fifty Pounds, and the expenses of recovering the same.

FORMS OF APPLICATION.

The following is the present rate of board—subject, however, to such alterations as the Directors shall judge proper, and which must necessarily vary according to the state of the funds and the expenses of the Establishment. The board in all cases must be paid quarterly, and in advance. Before the entry of a patient, the board is to be paid up for one quarter.

First Class,	£0	6	0	per week.
Second Ditto,	0	8	0	„
Third Ditto,	0	10	6	„
Fourth Ditto,	0	15	0	„
Fifth Ditto,	1	1	0	„
Sixth Ditto,	1	11	6	„
Seventh Ditto,	2	2	0	„
Eighth Ditto,	3	3	0	„

The first class—paupers belonging to the parishes that have contributed to the erection of the Asylum. The second class—all other paupers. Every patient who is certified, by four respectable householders, to be unable to pay 10s 6d of board per week, or whatever rate of board may be fixed by the Directors to be paid by Class 3d, and to have no relation able to pay this rate of board, shall be considered a pauper, and admitted in Class 2d; but if the patient shall belong to any of the twenty-five parishes* that have contributed £20 and upwards to the erection of the Asylum, such patients shall be admitted into Class 1st.

A fee, on admission, is paid to the Physician by the several classes of patients as under:—

Third Class,	£0	10	6
Fourth Ditto,	1	1	0
Fifth and Sixth Ditto,	2	2	0
Seventh,	3	3	0
Eighth,	4	4	0

On the dismissal or death of a patient, after six and within twelve months, the fee is repeated; but, if any patient shall remain longer than one year, the fee is to be repeated only at the end of every successive year of his residence in the Asylum.

No fees are paid for Paupers.

The patients shall have no claim to remuneration for work done in the House.
One shilling per quarter is charged for mending clothes.

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* See list of Privileged Parishes, page 19.

Each patient, when admitted, must be provided with the articles mentioned in the following lists, an inventory of which must be given to the Superintendent; and these articles must be kept up and renewed when worn out:—

MALE PATIENTS.

Each male patient, above the third rank, must, on his admission, be provided and kept supplied with articles of apparel, according to the following list:—

5 Day-shirts,
5 Neckerchiefs,
2 Night-shirts,
2 Night-caps,
3 Flannel jackets or shirts, } if worn,
2 Pairs of drawers, }
5 Pairs of stockings,
4 Pocket-handkerchiefs,
2 Vests,
Coats, breeches, or trousers, hat, and shoes, &c.,
1 Complete set of bedding, and linen to change.

FEMALE PATIENTS.

Each female patient, above the third rank, must, on her admission, be provided and kept supplied with articles of apparel, according to the following list.

4 Shifts,
2 Flannel shifts, if worn,
2 Flannel petticoats,
3 Upper petticoats,
4 Pairs of Stockings,
4 Pocket-handkerchiefs,
4 Gowns,
2 Night-gowns,
1 Shawl,
4 Neckerchiefs,
4 Day caps,
3 Night caps,
3 Aprons,
Shoes, corsets, &c.,
1 Complete set of bedding, and linen to change.

A more ample allowance of clothes may be provided, if judged to be expedient.

Each patient ought to have a Bible, a Psalm-book, a comb, a clothes-brush, and, if used, a hair-brush, and a tooth-brush.

MALE PATIENTS.

Each male patient, boarded at the third or lowest rate of board, and each pauper, must, on his admission, be provided and kept constantly supplied with articles of apparel, according to the following list:—

3 Shirts,
2 Flannel under jackets, } if worn,
2 Pairs of flannel drawers, }
2 Night-caps,
2 Pocket handkerchie's,
2 Neckerchiefs,
3 Pairs of stockings,
1 Coat or Jacket,
1 Vest,
1 Pair of breeches or of trousers,
1 Hat,
1 Pair of shoes,
1 Complete set of bedding and linen to change.

FEMALE PATIENTS.

Each female patient, boarded at the third or lowest rate of board, and each pauper, must, on her admission, be provided and kept constantly supplied with articles of apparel, according to the following list:—

2 Shifts,
2 Flannel shifts, if worn,
2 Flannel petticoats,
2 Upper petticoats,
2 Gowns,
1 Shawl,
2 Neckerchiefs,
2 Day caps,
2 Night-caps,
3 Pairs of Stockings,
2 Pocket-handkerchiefs,
1 Pair of Corsets,
1 Pair of shoes,
2 Aprons,
1 Complete set of bedding, and linen to change.

Application must be made by letter, previous to the admission of any patient, in order to give time to procure a warrant from the Sheriff, in terms of the late Acts of Parliament. In this letter, a statement must be given of the duration of the malady and its probable cause—the means used for recovery—the circumstances of the patient,—and generally everything calculated to throw light upon the case. This application must be accompanied with a medical certificate, and an obligation from a respectable person resident in Dundee or neighbourhood—of both of which the necessary forms are subjoined. The List of Queries must be correctly answered.

Ladies or gentlemen requiring the benefit of the Institution can be accommodated with commodious apartments, distinct from the other patients, and with a servant, if necessary. The servant to be approved of by the Directors.

As the friends of patients may sometimes find it difficult to procure a proper person to conduct them to the Asylum, a careful and humane conductor will, on application, be provided; and his travelling expenses only charged, if the distance shall not exceed twelve miles.

The ordinary hours of admission are from seven in the morning till seven in the evening.

N.B.—*No part of the first quarter's board shall be returnable except in the event of a patient dying, in which case it shall be in the power of the Committee to allow a return of such proportion of the board as they shall think reasonable.*

MEDICAL CERTIFICATE.

Date, 18

I in having *this day* examined resident in the of hereby certify, on soul and conscience, that, to the best of my knowledge and belief, is insane, and a proper patient for admission into the Dundee Royal Lunatic Asylum.

The medical practitioner granting this certificate will, after prefixing the name of the place, and the date of his subscription, insert his own name, designation, and place of residence, the name of the patient, and that of the county, town, or parish in which he resides. If the practitioner be a member of the Society of Friends, let him use the form of affirmation adopted by that Society.

N.B.—*This certificate must not be more than three days old when it is presented to the Sheriff.*

FORM OF APPLICATION TO THE DIRECTORS.

To be signed by two relatives or guardians.

Date,

GENTLEMEN,—Having good cause to believe, from our own observation, and from the medical certificate herewith sent, subscribed by physician (or surgeon) in the parish and county of that has been for past disordered in mind, we beg that

may be admitted a patient in the Dundee Royal Lunatic Asylum, according to the Regulations of that Institution. We are, Gentlemen, your obedient servants,

_____

_____

To the Directors of the
Dundee Royal Lunatic Asylum, Dundee.

CERTIFICATE FOR PAUPERS.

To be signed by four Householders.

Date,

We, the undersigned householders, residing in in the parish of are acquainted with of this parish; and to the best of our knowledge and belief is totally unable to pay a higher rate of board in the Dundee Royal Lunatic Asylum than that of a pauper, nor do we know that has any relation able to pay it for

_____ _____

_____ _____

OBLIGATION BY A RESPECTABLE PERSON IN DUNDEE OR NEIGHBOURHOOD.

Date,

GENTLEMEN,—Upon your admitting into the Dundee Royal Lunatic Asylum as a patient, hereby agree to pay such board as may be fixed by you or the Committee of Management, from time to time, for the said to remove when required to do so by you; and to remain liable for the board until shall have been removed from the Asylum; to bury in case of death; to keep up a proper stock of necessaries, as required by the rules of the Asylum, and to renew them when destroyed or worn out; and if the aforesaid necessaries, or any of them, are not furnished when required, by notice, in writing, from the Secretary or Treasurer of the Asylum, the Directors or their Committee may, in ten days after such notice, order these necessaries to be provided at expense, which hereby agree to pay; and, generally, to fulfil all the obligations required by the regulations of the Institution. Gentlemen, your obedient servant,

_____

_____

To the Directors of the
Dundee Royal Lunatic Asylum, Dundee.

Harmless incurables, and persons affected with contagious fever, or in a dying state, are inadmissible; as also women in a state of pregnancy.

N.B.—Persons applying for the admission of patients are particularly requested to have the foregoing certificates and obligations correctly dated. The medical certificates must be done in duplicate.

All the Certificates to be sent under Cover to the Medical Superintendent.

FORM OF PETITION TO SHERIFF, AND WARRANT.

Unto the Honourable the SHERIFF-DEPUTE of Forfarshire, or his SUBSTITUTE.

The Petition of
Humbly Sheweth,
That
aged years,
is at present in such a state of mental derangement as to require treatment in a Lunatic Asylum, which appears from the Certificate herewith produced. But as,

by the Statutes 55 Geo. III., cap. 69, and 9 Geo. IV., cap. 34, your Lordship's warrant for the reception of any person into a Lunatic Asylum is necessary,

May it therefore please your Lordship to grant warrant to the Officers of the Dundee Royal Lunatic Asylum, to receive the said

And your Petitioner shall ever pray.

Name,_____

Address,_____

Dundee, 184

_____

The Sheriff having considered the above petition, and the Certificate under the hand of produced, grants warrant and authority to the Officers of the Dundee Royal Lunatic Asylum to receive the person of the within-designed in terms of the Statutes referred to in the Petition.

Sheriff.

Dundee, 184

THE FOLLOWING ARE THE

DIRECTORS AND OFFICE-BEARERS

FOR

THE CURRENT YEAR.

From June 1849 to June 1850.

DIRECTORS.

PATRICK SCOTT, Esq., Chairman.

EXTRAORDINARY DIRECTORS.

1. The Honourable Fox. Maule, Lord Lieutenant of the County
2. The Right Honourable Lord J. F. Gordon Hallyburton, Representative in Parliament for the County
3. James L'Amy, Esq., Advocate, Sheriff-Depute of the County

Of Forfar.

4. George Duncan, Esq., M.P. for the Burgh of Dundee.
5. The Moderator of the Synod of Angus and Mearns.

6. Patrick Scott, Esq, Dundee,
7. Thomas Erskine, Esq., of Linlathen,
8. David Blair, Esq. of Cookstone,
9. Sir John Ogilvy, Baronet, and
10. William Thoms, Esquire.

For Life.

ORDINARY DIRECTORS.

11. The Provost,
12. The Oldest Bailie, and
13. The Dean of Guild of Dundee,

Ex Officiis.

14. Mr George Soutar,
15. Mr James Mills, and
16. Mr William Lawson,

For the Nine Incorporated Trades of Dundee.

17. Mr George Ower—For the Three United Trades of Dundee.

18. Alexander Balfour, Esq.,
19. George Thoms, Esq.,
20. William Wrongham, Esq., and
21. Mr Robert Ramsay, for the Maltmen Fraternity.

For the Guildry Incorporation of Dundee.

22. Mr George Kidd—For the Fraternity of Seamen of Dundee.
23. Mr John Philp—For the Presidents of the Lodges in Dundee.
24. The Reverend James Thomson, and
25. Adam Moon, Esq.,

For the Kirk-Session of Dundee.

26. The Reverend John Robertson, Mains, and
27. The Reverend Hugh Lyell,

For the Presbytery of Dundee.

28. John Guthrie, Esq. of Guthrie,
29. Charles Guthrie, Esq. of Taybank,
30. Richard Gardner, Esq., Dudhope House, and
31. William Cobb, Esq., Mains of Fintry,

For the Freeholders and Commissioners of Supply of the County of Forfar.

32. James Guthrie, Esq.,
33. Colin Symers, Esq.,
34. James Brown, Esq.,
35. G. H. Newall, Esq.,
36. Alexander Keay, Esq.,
37. Matthew Nimmo, Esq., surgeon,
38. Robert Cocks, Esq., physician, and
39. The Reverend J. G. T. Anderson,

For the Governors of the Dundee Royal Infirmary.

OFFICE-BEARERS.

DIRECTORS.

1. The Chairman,
2. Sir John Ogilvy, Baronet,
3. James Guthrie, Esq.,
4. Colin Symers, Esq.,
5. William Thoms, Esq., and
6. Alexander Balfour, Esq.,

Committee of Management.

1. George Thoms, Esq., } *House Visitors.*
2. Alexander Keay, Esq., and } *House Visitors.*
3. Reverend J. G. T. Anderson, } *House Visitors.*

OFFICERS.

1. The Reverend Thomas Stirling, *Chaplain,*
2. Patrick Nimmo, M.D., *Physician,*
3. T. T. Wingett, M.D., *Medical Superintendent.* } *Resides in the House.*
4. Mrs Marjory Forbes Kilgour, *Matron.* } *Resides in the House.*
5. The Reverend John Robertson, *Secretary,* and
6. John Sturrock, junior, Esq., *Treasurer.*

EXCERPT MINUTES.

"At the Annual Court of the Directors of the Dundee Royal Lunatic Asylum, held in the Town Hall of Dundee, on Monday the 18th day of June 1849,—

"The CHAIRMAN proposed that the Directors shall present to Dr Mackintosh some mark of their approbation as a memorial of his long and faithful services, and that it be remitted to the Weekly Committee to carry the proposal into effect in such a way as they may consider most suitable."

"At a Meeting of the Directors, &c., &c., 28th June 1849,—

"This Meeting was called to present the Testimonial to Dr Mackintosh, agreeably to the Minutes of the Annual Court.

"The Testimonial, consisting of a Silver Salver and Jug, which bore an expressive inscription, was presented to the Doctor by the Chairman, with a very appropriate and able address, to which the Doctor made a suitable reply."

BRIEF REMARKS

AS TO

THE CAUSES AND NATURE

OF

AFRICAN "LETHARGUS."

BY

ALBERT A. GORE, M.D.

Queen's University, Ireland; Licentiate King and Queen's College of Physicians, and Royal College of Surgeons, Dublin; Staff Surgeon.

DUBLIN:
FANNIN AND CO., 41, GRAFTON STREET.

1868.

DUBLIN: PRINTED BY R. CHAPMAN, TEMPLE-LANE, DAME-STREET.

REMARKS

AS TO THE

CAUSES AND NATURE OF AFRICAN "LETHARGUS."

THE "Lethargus" of Medical writers has been ascribed sometimes to blood determination to the brain, at other times to cerebral exhaustion. Neither of these causes would seem to explain the origin of the variety of this disease as seen in Western Africa, although either of them would explain those cases described by Blanchet, under the term 'Constitutional Lethargic Slumber,' an affection characterized by sleep lasting from some weeks to months, not unlike the hybernation of animals. Blanchet's cases were brought to the notice of the French Academy of Sciences, and an account of them given in the 'Lancet' some years since.

This disease is not new to the physicians practising

in West Africa. So early as 1833 a case was described in the Military Records at Sierra Leone, by Staff-Assistant Surgeon M'Cay M'Donald, occurring in a Private of the Royal African Corps. This patient ultimately recovered. Since 1845 the term appears in the Returns of the Colonial Hospital at Kissy and Freetown, Sierra Leone; and during this period isolated cases have been noticed by the surgeons attached to the various African and West Indian Corps, but often placed under the headings Paralysis, Lethargus, Coma, Dementia, &c.

In Captain Burton's 'Western Africa' it is stated that Europeans have been the subjects of this affection. Amongst the Portuguese inhabitants of the Rio Grande, the malady is well known, and by them attributed or associated with enlargement of the lymphatic glands, chiefly of the neck. A common operation resorted to by them as a measure of prevention being the excision or destruction of these glands; and numerous scars, the result of the operation, may be observed on their skins, especially in the region of the anterior or posterior triangles of the neck.

From the Returns of the Colonial Hospital at Kissy, Sierra Leone, it would appear that for the four years ending 31st March, 1850, 112 cases of 'Lethargus' were treated, of whom 91 died and 11 recovered; and for the seven years ending 31st December, 1866, the

total number of patients treated in the Colonial Hospital, Freetown, amounted to 67, of whom 17 recovered and 41 died. The almost total suppression of the slave trade, and consequent non-introduction of slaves into Sierra Leone during the latter period, may account for the smaller number shown in the Hospital Returns.

The following case, noted by Staff-surgeon Morphew, gives a very fair idea of the general features of the disease.

"No. 165, Private J. M., 1st West India Regiment, 28 years of age, was admitted into the Military Hospital, Nassau, Bahamas, 27th of June, 1865, for 'dementia and lethargus.' Some months prior to admission he had been in a singular way. When on guard duty he was constantly in the habit of falling down in a semi-comatose state, and upon the return of consciousness he would invariably state that he had seen a 'spirit.'(!) This delusion had unquestionably something to do in bringing him to the state he was in upon admission. From his appearance I was of opinion that he would become a subject of the disease *so common among Africans* called '*Lethargus*,' and into a lethargy he fell on the 10th instant. For a few days previously he spent most of his time sleeping, but during the last *eleven* days of his life he *never awoke:* he expired about one o'clock in the morning. All medical treatment in these cases is useless, and in

this case was not tried beyond attending to the state of the alimentary canal."

Early in the present year a private of the same Regiment died of this disease while undergoing punishment in the gaol at Freetown. This delusion of having seen a spirit is a common one amongst natives of Africa, and Dr. Morphew's remarks as to the fatality of the affection is borne out by the statistics previously quoted. Many Africans, although nominally Christians, still retain their heathen superstitions, which tend to spiritual delusions of various kinds, frequently difficult to dispel.

The symptons of African 'lethargus' may be divided into three stages. During the first the pulse is slow and quiet, and a deep drowsiness, rather than sleep, is present, not continuous, but intervening upon apparent intervals of health. In the second stage the slumber is more continuous, the sufferers only awakening when roused; and in the third stage a persistent stupor is present. The patient lies quite motionless and unconscious, only appearing to notice when severely shaken, then merely lifting the eyelids and gazing vacantly. The sphincters become relaxed, the urine and fæces are passed involuntarily, and for some days previous to death the patient lies quite passive, refuses all nourishment, and dies at last speechless and much emaciated. The absence of detectable visceral disease during life, the negative appearances after death, and

the number of days those labouring under the effect of 'lethargus' remain without food previous to death taking place, are curious features in the disease.

Occasionally a rather larger amount than natural of serum in the ventricles of the brain has been observed on making *post-mortem* examinations; but these last have been so few and so unsatisfactory, that the pathology of the disease still rests in the domain of hypothetical reasoning. This disease is curiously obscure, and must stay so until its pathology is further elucidated by clinical observations.

The treatment, supporting, alterative and counter-irritant, has had scarcely any success.

We can only imagine the Portuguese idea of its cause being correct, by supposing that the lymphatic glands, when simultaneously or chronically enlarged, lying beneath the sterno mastoid, anterio scalenus or behind the carotid artery, might press upon and derange the cerebral circulation; or that their enlargement was due to that general ill health existing in leuchaemia and hypertrophy of the spleen, when lethargic symptoms are occasionally observed; but unfortunately for this supposition, enlargement of these glands is not always seen in lethargus.

Taking all the known facts relating to 'lethargus,' such as they are, it seems most probable that it is a disease of the brain. The symptoms of that convulsion of the mind, represented by melancholic attonita, or its

paralysis, as seen in acute or chronic dementia, are not unlike those seen in African "sleeping sickness," viz., impassive or motionless body, vacant stupid expression, involuntary passage of urine or fæces, and passive resistance to the action of others.

The climate naturally tending in this race to a sleepy or drowsy condition when suffering from chronic ailments, or insufficiency of nourishment, with the use of a dry farinaceous food deficient in fatty matter, might ultimately give rise to an imbecility and slow death, as it does in pellagra, simulating the sleeping sickness of Western Africa in some instances, perhaps in others giving rise to it.

THE END.

THE SULPHUREOUS BATH

AT SANDEFJORD

IN NORWAY.

BY

DOCTORS EBBESEN AND HÖRBYE,
PHYSICIANS AT THE BATH.

CHRISTIANIA.

PRINTED BY CARL C. WERNER & CO.

1862.

The Editors of this book, my friends and colleagues, have requested me to write a few lines as a preface and recommendation of their work, thinking that my name may perhaps be better known in Great Britain and Ireland than their own. Though I do not flatter myself that any words of mine would give more confidence to the authors' introduction of the bathing place at Sandefjord than their own true description of its effects, tried and proved by the experience of many years, still I give my best recommendation with much pleasure to my honoured British colleagues and to the public at large, assuring them that I do not entertain any doubt that they will find the reality responding to the fame that our bathing place at Sandefjord has earned. It is indeed a place for those who wish to be cured, not for travellers for pleasure.

F. C. Faye M. D.
Professor at the University of Christiania, and
Physician to the King.

There are extant two older works on the bath at Sandefjord, viz. one in the German language by Dr. Thaulow, one of the founders of the bath, at present proprietor of and physician at St. Olaf's steel bath at Modum — and one in the Norwegian language by Dr. Ebbesen, physician at the bath at Sandefjord, both published in 1855. But the bath has since that time been considerably enlarged and improved. Methods of cure have been developed; experience has become richer and more certain, so that a new representation of this bath and its operations will probably be welcome to many. We have preferred this time to write in the English language, in order that the bath may become known, as it deserves, in foreign countries, and particularly in England, whence in the last few years several patients have come to the bath at Sandefjord, and whence a great number of travellers come every year to our country, the magnificent scenery of which attracts the attention of foreigners more and more, so that we may expect still more numerous visitors, when the beneficial operation of the bath in many of the most commonly occurring chronic disorders shall have become sufficiently known.

The Authors.

Sandefjord.

The little town of Sandefjord, with about 1400 inhabitants, is situated in the southern part of Norway in the province of Jarlsberg and Laurvig, at the end of a little bay in 59,8 N. L., 10,14 E. L. from Greenwich, 27,53 E. L. from Ferro; about 10 English miles from the town of Laurvig, 16 from Tonsberg,

18 from Vallö, and 81 from Christiania. The country is beautiful, and as a summer residence very agreeable; it is moreover provided with excellent roads, and good opportunities of communication with Christiania and all other towns on the coast by means of steam vessels. The town lies on a low, slightly inclined strand, protected on three sides by hills, and only open towards the south where the fjord runs in to a length of 8 English miles. It is excellently adapted for a bathing place, not only by its position and the pure sea-water, but also by its cheerful country-like appearance, clean streets, small neat houses, with gardens to most of them; added to which the town is so small that in the bathing season it is quite dependent on the bathing establishment, to which it mainly owes its origin. The inhabitants are otherwise engaged in trade, navigation, ship building, and fishing.

The climate is mild and agreeable; the air remarkably pure and healthy; the warmth in summer is seldom oppressive, and is always tempered by the south wind, which rules during that season. Foreigners frequently form an incorrect idea of the summer in the south of Norway. We will therefore take the liberty of sketching a few features of it.

The fields begin usually to become green in the beginning of May, but the air is generally still cold, which is looked upon by farmers as an advantage or promise of a good harvest. The summer warmth seldom begins before the end of May, but then rapidly increases. During the whole of June and the greatest part of July one can read nearly all night by the light of the sun, and the singing birds in the woods are silent only a few hours. With these long days vegetation progresses with a rapidity which astonishes many foreigners from the south, and about Midsummer nature appears in her finest bloom. In order to give to the botanist an idea of the progress of spring, we append a note which is the result of seven years observation by Mr. Moe, gardener at the botanical gardens of Christiania, of the wild plants in the environs of that city*).

To illustrate the meteorological condition of Sandefjord during the bathing season the following observations during three years are noted — (Degrees of Fahrenheit).

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*) In the month of March the following plants flower: Saxifraga oppositifolia on the 12th: Alnus incana and glutinosa on the 23rd: Tussilago farfara on the 24th: Corylus avellana on the 28th: Populus tremula on the 30th:

In the month of April the following: in the first week, Hepatica triloba; second week, Daphne mezereum, Tussilago petasittes, Equisetum arvense, Chrysosplenium alternifolium; third week, several species of Salix, Pulsatilla vernalis, Draba verna, Arabis thaliana, Gagea lutea; last week, Carex præcox, Viola hirta, Poa annua.

In the month of May we will only name the following: In the first week, Anemone nemorosa, Primula veris, Taraxacum officinale, Myosotis collina, Fraxinus excelcior, Viola umbrosa; second week, Viola arenaria and mirabilis, Myosotis sylvatica; third week, several species of Carex, Pulsatilla pratensis, Convallaria majalis, Acer platanoides, Betula alba, Fagus sylvatica, Ranunculus auricomus, Veronica verna; last week, Prunus spinosa, Veronica serpyllifolia, Fragaria vesca, Lonicera periclymenium and xylostes, Viola tricolor, Convallaria polygonatum, Cypripedium calceolus, Prunus padus, Trollius Europæus, Pyrus malus, Trientalis Europæus.

In the month of June, among others the following: in the first week, Pinus abies and sylvestris, Trifolium pratense and repens, Berberis vulgaris, several species of Lychnis, Geranium sanguineum, Hieraceum pilosella; second week, Orchis maculata, Poa pratensis, Veronica officinalis, several species of Ranunculus, Rosa cinnamomi, Rubus idæus, Vaccinium vitis idæa; third week, Linnæa borealis, Valeriana officinalis, Urtica dioica, Rosa canina; last week, Pyrola minor, Arnica montana, Rubus chamemorus and fruticosus, and several species of Campanula and Vaccinium.

	The Air.						The Sea.							
	Means of Temperature.			Max.	Min.	Means of Temperature.			Max.	Min.	Quantity of Rain.		Rainy Days.
1859.	6 o'cl. Morn.	12 o'cl. Noon.	6 o'cl. Even.	12 o'cl.	12 o'cl.	6 o'cl. Morn.	12 o'cl. Noon.	12 o'cl. Even.	12 o'cl.	12 o'cl.			
June	57	68	66	80	55	65	67	68	72	62	½	Centim.	8
July	59	69	68	77	61	66	67	68	73	61	6	"	5
August. . . .	56	67	65	75	61	64	66	67	68	62	4¼	"	7
1860.													
June	55	62	59	77	55	59	61	62	66	55	24	"	18
July	59	68	67	77	61	65	67	67	71	57	7	"	8
August. . . .	55	65	63	73	55	62	64	64	70	60	25½	"	21
1861.													
June	59	70	69	79	60	63	65	68	70	52	21	"	4
July	59	68	66	79	59	66	67	69	69	65	14	"	16
August. . . .	56	66	64	69	56	65	66	66	66	61	12½	"	12

At Sandefjord there are a druggist's shop, a telegraph station, a well organized post; and during the bathing season four steam vessels touch there, one of them three times a week, thus establishing an easy communication with all places along the coast. In the beginning, middle, and end of the bathing season there is direct communication with Sweden and Denmark by means of the Norwegian Post steam vessels touching at Gothenburg and Copenhagen; otherwise the communication with foreign parts is as follows:

1. Sweden and Denmark. A steam vessel runs twice a week between Copenhagen, Gothenburg, Laurvig, Vallö and Christiania.
2. Denmark and Germany. Once a week a steam vessel between Kiel, Nyborg, Frederikshavn, Frederiksværn, Vallö and Christiania.
3. Germany. Every other week the steam vessel between Hamburg, Christiansand, Frederiksværn, Vallö and Christiania.
4. England. Once a week a steam vessel between Hull, Christiansand and Christiania. From Christiansand the passage is continued to Sandefjord by a coasting steamer. From Frederiksværn, Laurvig and Vallö either by a steamer or overland.

The Bathing Establishment and its Arrangements.

The bathing house was built in 1837, but has been from time to time, especially during the last ten years, considerably extended. It consists now of a long angular one storied building, which, besides a saloon, offices, corridors &c., contains 30 bathing places, wherein upwards of 350 persons can bathe daily. The ordinary bathing places consist of two rooms, one for dressing and undressing, in which are a sofa, articles of toilet &c., and the bathing room properly so called, in which

are the bath, the water pipes for cold and warm water, and apparatus for various sorts of shower baths. The water is warmed in a side building, and the pumps are worked by steam. There is a floating bathing house in the sea, containing 10 bathing places, some of them communicating with the open water for swimmers. Moreover many persons bathe from the shore or from boats. The bathing establishment is the property of a joint stock company. The management is conducted by an inspector, with about 30 bathing servants and common servants; three physicians practise at the bath. Two parks belong to the establishment, and a good musical band plays there. Numerous beautiful walks lead along the sea-shore and among the hills, affording an agreeable variety for pedestrians; and the beautiful environs are excellently adopted for greater and smaller excursions by land and water. It must not be forgotten that the Laagen,*) one of the richest rivers in Norway for salmon and trout, runs 7 English miles from Sandefjord, and that the great lake Gogsjö, abounding in fish, lies 3 Eng. miles from the town; that the fjord abounds with ordinary salt water fish; and finally that hare and duck shooting in the environs is permitted in the shooting season.

Most of the houses in the town are arranged for reception of bathers. The price for a room with bed and attendance is from Sp. 4 to Sp. 8 (18s to £ 1. 16s) per month, for several rooms together the price is relatively lower. Although there is always a great choice of lodgings, yet the foreigner who intends to frequent the bath would do well some time beforehand to announce his arrival to the inspector of the bath, or to one of the physicians; to state how large a lodging he requires, and to bespeak a bathing hour, which last must not

*) The finely situated country-house Stuberud, near the Laagen, has for many years belonged to Englishmen, who reside there every summer, principally for the sake of the salmon fishery.

be forgotten; for, in the same succession as such orders come in, the best vacant bathing hour is appropriated to the coming visitor.

The bathing season begins on the first of June, and ends usually on the last day of August.

With respect to food, dinner may be had at the "restaurants," either at the "table d'hôte" or sent out; the prices vary between Sp. 4½ and Sp. 8 (£ 1 and £ 1. 16s) per month. Breakfast and supper may always be had at the lodgings for Sp. 5 or Sp. 6 (£ 1. 2. 6 or £ 1. 7s) per month.

The prices of the different sorts of bath are as follows:

	sk. Norw.*)
Sea Bath	8
Simple Shower Bath	12
Warm Sea Water Bath	22
Do. with Shower Bath	26
Do. with Do. and "douche"	34
Sulphur Bath	42

Of the last four two baths are given gratis when twenty are taken.

Mud Bath	60
Steam Bath	48
Steam Shower Bath	20
Mud Poultice	12

Every bather pays Sp. 2 (9s) for drinking the water, newspapers, music &c. For families an abatement is made.

The expenses for six weeks residence at the bath for a gentleman may usually be reckoned at from Sp. 70 to Sp. 80 (£ 15. 11. 1 to £ 17. 15. 6).

*) A Norwegian Specie Dollar is 120 skillings, = 1 Swedish or 1 Danish Speciedollar, = 2 Danish Rixdollars, = 1½ Prussian Dollars, = 3 marks Hamburg Banco. £ 1 Sterling is about 4½ Speciedollars.

Water drinking and bathing.

The bathers must begin their day early. At 6 in the morning they assemble (fasting) at the spring. Weak and sensitive persons may indeed be permitted to come a little later, or also to take a glass of milk or a little weak coffee beforehand; but as this may easily diminish the effect of the water, it is best avoided. The sulphureous water is then taken in cups — 4 to 6 oz. — slowly and with intervals of from 10 to 15 minutes, the patients walking about constantly; usually the water is taken cold, but sometimes warm, which, as well as the quantity and number of cups &c., depends on the disease, constitution, age &c. Children must be attended to, so that they do not drink too much, as many are inclined to do. Some patients are advised to drink in bed, others to take very small and frequent doses; most of them take 3 cups of 6 oz. After the last they take a brisk walk for an hour, and then breakfast at 7½ or 8 o'clock.

The sulphureous water is not exactly pleasant to the taste, particularly when warm, and therefore sometimes produces qualms in sensitive persons; but the taste is soon got rid of by rinsing the mouth with fresh water. An easier and more copious evacuation is the immediate effect of drinking the water. Two or three abundant and agreeable motions follow in the course of a few hours, and often even earlier. The next effect is improved appetite, and therefore the breakfast is enjoyed. The breakfast is to consist only of coffee, milk, bread and butter.

After breakfast the patients rest a little until bathing time. The most favourable bathing time is between 10 and 12, so that the bath can be taken a few hours after breakfast, and as many hours before dinner. But this can only be the case with a few patients. Each must therefore endeavour to arrange his meals so that there shall be at least 1½ hour between the

meal times and the bath. One hour is allowed for a bath, which is quite enough, but the time should also be fully occupied.

Besides the proper or principal bath many patients are ordered to take others, particularly local baths, as for instance, the steam shower bath, mud poultice, sea bath &c., which are to be taken at some other time of the day.

It is an old and well known rule for patients at bathing places, that, during their residence and treatment, they should lay aside every serious occupation, and carefully seek to avoid bodily and especially mental and sexual exertion. They are only to occupy themselves with their prescribed treatment, and otherwise lead an idle life. Rest must be taken immediately before a bath, particularly if the patient is of a weak temperament, for the bath causes fatigue. In the bath it is well, as far as possible, to help oneself in the brushing and rubbing. In the beginning the physician is often to be consulted, in order as far as possible to have the temperature of the bath regulated according to individuality and condition. In case of shivering under the pouring or shower bath the cistern must not be entirely emptied, but the patient must remain standing in the warm water. The shower bath is always taken spreaded on the breast and abdomen, and is never allowed to fall long on any one point. All such rules the patient must listen to so often that he remembers them exactly, so as to be able to control the bathing servants, who moreover have their special instructions. Ladies with thick hair difficult to dry may use a cap of oiled silk in the bath, but it is better to avoid this. The wiping dry is performed with coarse towels, powerfully employed, so that the skin may become both dry and warm.

After the bath a brisk walk for about an hour should be taken.*) If it be early in the day and one have a good appe-

*) Patients, who cannot walk, are drawn in small carriages to the bath, and to take the air.

tite or be tired, food or rest may be enjoyed with moderation. As a rule sleeping after dinner is only allowed to weak persons. During the period of menstruation the treatment is intermitted. Pregnancy is no absolute impediment to the treatment, unless connected with other circumstances, as disposition to miscarriage, or organic disease, which makes it desirable to avoid bathing. It is natural however that the treatment should often be modified.

Diet plays certainly an important part at a bathing place, as well as in all other medical treatments. There is therefore a regulation as regards food, which all housekeepers must attend to. The dietary regulation is not severe, but spirits, salt, fat, and highly seasoned dishes are forbidden. Only for certain patients a particular and stricter diet is prescribed.

As before said, the bathing season at Sandefjord comprises the three months of June, July and August, and only seldom extends over the first week in September. The duration of the treatment may be estimated at about six weeks. If one choose the last half of the season, it is necessary to arrive at the bath in the middle of July. The first half of the season is usually more agreeable, and for some persons it is also necessary to undergo a subsequent treatment at an iron bath, for instance, at St. Olaf's Bath, or at Eidsvold; and for all persons it is useful to have a part of the summer for recreation. But, with respect to the result of the treatment, the second half of the season stands in no wise behind the first, and has even the advantage that the Medusæ are always to be had, while they seldom appear before the middle of June. This circumstance is for those, who suffer from rheumatic, arthritic, or paralytic affections, a matter of importance in the choice of the time for their arrival at the bath.

Patients who suffer from considerable and complicated affections should always bring with them from their own physician a complete description of their previous medical treatment.

Method of Treatment.

The means, which are at the disposition of the medical attendants at the baths of Sandefjord, are principally the following: 1. Sea water, 2. sulphur water, 3. mud (Gytje) and 4. Medusæ. The bath was originally established only for sea-bathing, and it is partly owing to an accident that we have come into possession of the other excellent means of treatment.

1. Sulphureous-water. During the building of the bathing house and digging in the earth, water was discovered of a peculiar smell and taste, which Dr. Thaulow, then physician at the bath, on analysis, discovered to be a salt, ferruginous, sulphur water. This water occurs in great abundance in the soil all round the bathing house, which is built on the strand formerly covered by the sea. Here are now established numerous deep, paved wells, wherein the sulphur water is collected, and by subterranean tubes conveyed into the bathing house. The water has been several times analyzed, for instance, by the Swedish Professor Berlin, by Professor Strecker, and by his brother Mr. Strecker, a chemist in Christiania. The last two in 1853 analyzed the sulphur water, the sea water, and the mud, which the next year they made the subject of a program at the university, whence the following description is derived.

Analysis of Sulphur Water. The water is clear, yellowish, with a strong smell of sulphurated hydrogen, neutral reaction, and salt bitter taste. Exposed to the air it becomes milky and precipitates sulphur. In corked bottles there appear after some time black flakes of sulphuret of iron. The specific gravity of the water at + 20° C. is 1,0155. A pound of water = 16 oz. = 7680 grs. and contains:

a. Solid components:

Chloride of Sodium	129,697	Grains.
— magnesium	17,010	„
Bromide of —	0,491	„
Sulphate of Potash	4,056	„
— of Lime	4,471	„
Carbonate of Magnesia	5,223	„
— Lime	4,182	„
— Iron	0,358	„
— Mangan	0,062	„
Oxyde of Aluminium	0,052	„
Silicic acid	0,210	„
Organic matter	1,744	„
	167,556	Grains.

b. Volatile components:

Carbonic acid	4,867	„
Sulphurated hydrogen	0,135	„

c. Besides traces of ammonia, nitric acid, iodetted hydrogen, and boracic acid.

The composition of the sulphur water approaches thus very much to the water in Dobberan, but among other things it has a greater quantity of salts. It has more sulphurated hydrogen, than that of Aix-la-Chapelle, but less than that of Nendorph. The quantity of carbonic acid is more than sufficient to make double carbonates of the single. With a temperature of + 10° 3, C. in the spring, and with a normal state of the barometer, 1000 volumes of water contain 332,1 volumes of free carbonic acid.

Analysis of the sea water. At a temperature of + 17° C. and a specific gravity of 1,0114 the sea water of the fjord contains in 1 lb. of water = 16 oz. = 7680 grs.:

Chloride of Jodium	83,800	Grains.
— Magnesium	11,469	„
Bromide of —	0,260	„
Sulphate of Potash	3,001	„
— Magnesia	3,529	„
— Lime	4,952	„
Carbonate of iron	0,149	„
Oxyde of aluminium	0,025	„
Silicic acid	0,103	„
	107,288	Grains.

Probably the sulphur water is formed from the sea water, and we find by comparison, that the sulphur water contains:

1. More solid components, and more chlorine.
2. A quantity of carbonates, wanting in the sea water.
3. A quantity of organic substances, nearly wanting in the sea water.
4. Much sulphurated hydrogen, wanting in the sea water, but on the other hand less sulphuric acid.

If the sulphur water is produced from the sea water, the latter must either undergo a concentration in the earth, or take up chloride of Jodium, or at various times contain various quantities of salts. Perhaps all three causes operate simultaneously, but it is very probable, that water more or less impregnated with salt runs into the fjord according to the prevailing wind.

Use of the Sulphur Water. It is applied internally and externally. The internal use is for many patients a very important part of their treatment. It has been already mentioned under the head of "water-drinking." Externally it is applied in the form of baths, steam baths, steam shower baths, local poultices, and ablution, and also for inhalation.

Operation. It is not possible completely to explain the working of the mineral waters, although the chemical combina-

tion may guide us in this respect. We shall therefore confine ourselves to saying, that while using the waters the following is to be observed. Taken in doses of from 4 to 6 oz. three times, it usually produces two or three thin, relieving stools in the course of one or two hours; rarely subsequent looseness. Sometimes the dose named operates too strongly, so that it must be reduced; or incompletely, so that it must be increased, but not generally to more than four cups. One should rather give the water lukewarm, in which manner it is best supported by many persons, and works most powerfully. Sometimes it works best in very small and frequent doses, for instance, two oz., six or eight times. In the beginning of the treatment it cannot always be supported, but is vomited up, causes flatulence, congestion to the head, and dizziness on account of the abundant quantity of gas. In this case it is better to let the filled cups stand for a time in order to let the gas escape. If the flatulence and costiveness continue for a long time, one must seek the help of rhubarb or water injection; moreover the diet must be regulated, which in this case is often in fault. With scrofulous, thick bellied children the sulphur water works excellently, by expelling a quantity of slime and intestinal worms. — The next effect of drinking the waters, when the relieving stools are regular, is an increased appetite and a universal feeling of comfort.

2. The mud, Gytje, is slime mixed with organic matter, of black colour when under water, but of a lighter colour when exposed and oxidized by the action of the air. It is of the consistency of soft soap, fine and greasy to the feel, and smells strongly of sulphurated hydrogen. Its application in the bath has been learned from the bathing place Strömstad in Sweden, but its existence in the fjord at Sandefjord has been long known to the fishermen. It is found in abundant strata in many places in the fjord, and even near the bathing-house. It is dug from the bottom of the sea at a

depth of some feet. It is formed especially in narrow bays, where no out-running rivers or brooks produce currents in the water, and in places, which are not very deep, but always under water. It is found best and purest, where the bottom of the sea suddenly inclines out towards the deep. It has been examined by Professor Erdmann of Leipzic, and lately by Professor Strecker. According to the analysis of the latter its composition is as follows:

Analysis of the Mud. For 100 parts by weight of the mud:

Silicic acid	1,39	16,29 perCt. in water and muriatic acid soluble matters.
Lime	1,31	
Oxyde of iron	4,15	
„ aluminium . . .	1,25	
Magnesia	1,18	
Chloride of sodium	4,18	
Potash	0,78	
Sulphuric acid	2,05	
Organic substance and water	9,91	
Quartz and indissoluble parts	73,80	
	100,00.	

With respect to its composition the mud differs in many points from other deposits of the sea water. The "tangues," used in Normandy as an important manure, is a different article. According to the analysis of Pierre the sea slime collected on the coast of Normandy contains 24 to 25 p.Ct. of carbonate of lime, but it contains much less organic matter than the Sandefjord mud.

Use and effect of the Mud. It is used partly with and partly without sulphur water and sea water for bathing, rubbing, and local poultices. The effect is to mollify, disperse, and solve.

3. The Jelly Fish, a marine animal well known by fishermen and bathers along the coast, and often very annoying on account of the burning it produces on the skin, forms an

important means of cure at the bath of Sandefjord. It has not been properly ascertained, whether any physician out of Norway has at any time employed this means, the application of which in any case is little known. It has been said, that Dr. Danzemann in Travemunde has had the idea, but more is not known. It is however certain, that Dr. Thaulow, one of the founders of the bath at Sandefjord, is the first, who in this country used the jelly fish, and to whom the credit belongs of having enriched our materia medica with a powerful and effective remedy, which certainly is specially adapted for bath treatment, but can also be otherwise applied with advantage. Dr. Thaulow left Sandefjord a short time after the establishment of the bath, and thus had little opportunity of further testing the new remedy. It was reserved to the future, by means of many years practice and abundant experience, to learn the right method and great advantage of using the Medusa in the treatment of many diseases.

The jelly fish belong to the Acalephans, a class of marine animals, the natural history of which has not yet been minutely studied. The order Medusa is best known, principally owing to the zealous investigations of our celebrated naturalist Professor Sars. This study has likewise occupied the attention of Messrs Forbes, Ehrenberg, Steenstrup, Wagner, and others.

It is the species Medusa capillata (Lin.), which is used at our bath. It has a jelly-like, nearly transparent disk-formed body, convex on the upper part, concave below, and furnished with a number of long tentacles, which form a swab. The colour is brown; the disk may be up to one foot in diameter, and the swab many feet long. Another species, Medusa aurita, is much smaller, of a beautiful blue colour, but possesses little of the acrid matter, which specially is found in the swab of the former, and which is applied as a remedy. The Norwegian name of the Medusa, "Mandæter," is derived from its well known quality of burning the skin. R. Wagner has discovered

in the outer skin of the Medusa peculiar microscopic organs, which he calls nettle-organs, consisting of oval cells, in which there is found a long fine thread, rolled together and easily protruded. The sharp burning is probably occasioned by these threads, or by some humour adhering to them. The Medusas are often found in July and August in such quantities in our fjords, that in rowing one touches them at every stroke; but occasionally they disappear suddenly for several days. This, in connexion with the circumstance, that they seldom appear before the latter part of the month of June, has occasioned many attempts to preserve this important requisite for bathing; but these attempts have hitherto always failed. It is of no use to attempt to preserve the jelly fish in fish boxes or similar apparatus, for they soon die, and are then without virtue. Dried in the sun or in any other manner, they likewise lose every trace of their burning quality, as we have ascertained by numerous experiments.

Effect. When the jelly fish is brought into contact with the skin, there immediately arises an irritating, pricking, burning sensation, like that produced by stinging-nettles. If this burning be very intense, it soon extends far beyond the touched spot, even to all parts of the body, and is often accompanied by a very remarkable phenomenon, viz. contraction of the muscles, quite like the effect of an electro-galvanic apparatus. Strong contraction of this sort may be accompanied with fever, and may last several hours. The pain can be alleviated by cold ablutions and internal sedatives, for instance, morphia; even by very slight contact the skin becomes red, and is frequently covered with pearly perspiration, and by repeated application on the same place there is produced a red, papulous exanthem, which may remain for several days.

According to this description it is clear, that the jelly fish must be an excellent irritant for the peripheristic nerves; therefore it was first used in cases of paralysis, in which it still

finds its chief application; but subsequent experience has taught us, that it can also operate to regulate other affections of the nervous system, and that, as a powerful counter-irritant, it calms and removes pains. It is therefore especially used in cases of paralysis, neuralgia, rheumatism, arthrocaces, cerebro-spinal irritations, and nervous debility.

On the peculiar method of bathing, and various sorts of baths.

After having thus given an account of the materials of our bath, we shall explain, how they are applied, and we shall first describe the most important bath, viz.

1. The Sulphur Bath. Mud and sulphur water are mixed together in large reservoirs to the consistency of gruel, with which the bath is half filled. Boiling salt water is added, until the proper temperature of the bath is obtained, usually between 88 and 97 degrees of Fahrenheit. The patient lies in the bath immersed to his neck, and the bathing servant now begins a series of operations, which tend to soften the skin, and thus promote absorption. First he applies the birch; this consists of fine leafy twigs, bound together in a bunch of 12 or 18 inches long. It is dipped in warm water and applied with frequent and vigorous strokes on the different parts of the body, which the patient gradually lifts out of the water. The breast, the abdomen, and some other sensitive parts of the body are not struck, but only rubbed with the leaves. The practised bathing servant never flips with the twigs, but often applies to an adult six or seven hundred strokes in one bath. After the birch large brushes are applied over the whole skin, and in the same order as the birch. All this occupies about twenty minutes. The bath is emptied through a wastepipe; the bather raises himself, and sits on a bench in the bath, and is well rubbed

with warm mud from top to toe, which acts very agreeably on the skin, rendered tender by the birch and brushes. Now comes the spout bath (Douche), a stream of salt water, 8 to 10 degrees colder than the bath. The cistern contains 100 gallons, and stands in the loft, so that the pressure is tolerably strong. The water is conducted through a leather hose, which the bathing servant guides with his hand, and directs on all parts of the body, but especially along the back, and on a few suffering parts. Finally another shower bath is taken, which is usually cold; it is of short duration, and then the patient is well dried with coarse linen and woollen towels.

This is the usual mode of bathing, which can be varied according to circumstances. The birch and the brush are sometimes omitted; for instance, where the skin is diseased. The spout and the shower bath are doubled, as in nervous debility, or are applied both at once. The rubbing with mud is repeated partially or on certain parts, where it is necessary to operate more strongly, as with swellings, arthrocaces &c. The temperature of the bath is subject to many modifications, according to age, sickness, and individuality. Much can certainly be effected by the proper application of the relative temperatures of the bath and the spout. Moreover one begins the treatment most frequently with higher temperatures and terminates with lower ones in order to harden the patient.

If jelly fish are to be applied, it is done immediately before or after the drying. The bathing servant takes the living medusa up from the pail of water, in which it is kept, holds it by the disk, and brings a part of the swab in contact with the suffering part, either by a simple touch or by a stroke. It must often be regularly rubbed in, before the burning sensation is felt, viz. when the skin is thick, or in paralytic affections, where its sensibility is blunted. It is seldom used more frequently than every second day, which depends on the case and intensity of the operation.

After the bath the patient takes a good walk for an hour.

2. The Shower Bath consists of a bathing vessel and a cistern with cullender.

3. The Spout Bath. Here the bathing vessel contains only pure sea water; otherwise this bath does not differ in any respect from the sulphur bath.

4. The simple warm Bath is only used as a preparation for the others, or in connexion with a course of diet.

5. The small Spout Bath is cold water, which from a proper height falls in jets of various degrees of force.

6. The Steam Bath is taken either in a room, where warm steam is conducted by tubes, or in certain air-tight cases, in which the patient sits with his head out of the influence of the steam.

7. The Mud Bath. The bathing vessel is filled only with mud, warmed by steam to a temperature of from 90° to 110°, and of the consistency of thick porridge, in which the patient remains for from 25 to 30 minutes under friction. Then he is washed in another vessel with cooler water, and he finally takes a shower bath.

8. The Steam Spout consists of a jet of warm water steam, conducted through a tube on to the suffering part, which, during this process, is continually rubbed with mud. In order to make it more stimulating the steam is sometimes conducted through a case filled with green fir twigs, the resinous parts of which are extracted and conveyed by the steam.

9. The Vaginal Spout is simply an ascending jet of water of various temperatures. The apparatus is found in several of the ladies bathing rooms, and is usually employed immediately after a bath.

10. The Mud Poultice. Warm mud is spread on linen, and is applied locally like a poultice. Large poultices, for instance for whole limbs or for the abdomen, are taken in

special rooms in the bathing house, but smaller poultices, as, for instance, on a knee, foot &c. are most conveniently taken at home, and many patients are ordered to keep them on at night.

11. Inhalation. In the last few years sulphur water has been applied for inhalation in a particular manner. This is done by help of a special apparatus (pulverisateur des fluids), by which the water with compressed air is driven out in very minute particles, almost like smoke or steam, which is inhaled. It is applied in chronic affections of the respiratory organs. One of the writers has used it in chronic bronchitis with great success, but otherwise the remedy is still so new, that one dare not positively pronounce an opinion as to its value.

The Diseases, which require the use of the bath.

The diseases, for which the Sandefjord baths are particularly adapted, are:

Scrophulosis, chronic Rheumatism, Neuralgiæ, Nervous Debility, chronic Exanthems, Arthrocace, Diseases of the Abdomen, Liver and Milt, and Paralysis. But Arthritis, Calculi renales, chronic Periostitis, Irritatio spinalis, Chorea, Epilepsy, and other spasmodic diseases, Cardialgia and chronic Gastritis, as well as anomalous menstruation are also treated successfully. The annual report for the last 15 years shows, that of all the cases, treated during that time, 12 per cent. were cured, 54 per cent. considerably improved, 20 per cent. somewhat improved, and 14 per cent remained incurable — a result, which must be called good, considering that in most instances the diseases, which are treated at a bathing place, are chronic maladies, that for a long time have defied all other treatment. It may be well to state the result of the treatment of the following diseases during the said time:

	Either cured or much improved.	Somewhat improved.	Incurable.
Scrophulosis	86 p.Ct.	10 p.Ct.	4 p.Ct.
Rheumatismus chron. .	76	17	7
Obstructio alvi . . .	80	13	7
Affectio hæmorrh. . .	75	14	11
Plethora abdominal . .	77	23	0
Morbi hepatis	69	17	14
Debilitas nervosa . . .	68	22	10
Exanthemata chron. . .	67	19	14
Neuralgia	59	26	15
Arthrocaces	49	30	21
Arthritis	55	25	20
Paralysis	37	29	34

The attendance at the bath during the last five years may be seen from the following list.

In	1856	the number of patients was	520
-	1857	„ „	536
-	1858	„ „	500
-	1859	„ „	664
-	1860	„ „	637

Cases.

We will now refer to some few interesting cases.

Arthrocaces.

No. 1. Gonarthrocace. Bathing two summers. Cure.

1858, 5th June. A public functionary, aged 41 years, somewhat scrofulous from his childhood, and in later years always pale, and sallow in complexion; had exerted himself much in walking, having a long way to go to his office. About a

year ago the disease began to develop itself in his right knee, and some months afterwards hydarthrus supervened. At present there is a considerable swelling in cond. ext. femoris, some stiffness, some pain, which symptoms are immediately increased by attempting to walk, wherefore he always lies with his lower limbs stretched out on the sofa. The muscular system in the diseased extremity is much relaxed. He looks very weak and exhausted, for he last winter suffered from pleurisy, with considerable effusion in the left pleura. The breast is somewhat fallen in, the cellular respiration obstructed. He has not left his room for 11 months; otherwise he feels pretty well. His digestion is in order. He has used Kali hydroiod, Ferrum, Oleum jecoris aselli &c. Of late Arthrocace has also developed itself in the right great toe, and Metatarsus with swelling and stiffness, without pain.

Prescribed: Sulphur bath 92°, Spout bath 80°, Shower bath 72°; the knee, the foot, and the breast rubbed in the bath twice with mud. Application of jelly fish on the knee and foot every third day; afterwards steam spout bath on the same place. Mud poultice on the diseased joints at home. To drink 3 four oz. cups of sulphur water; to be wheeled to and from the bath.

30th June. To leave off drinking the water, stop bathing for a week, as the patient's strength is much exhausted. He can now walk a little on level ground with crutches without resting on his right foot, which is supported by a sling over his shoulder.

7th July. Begins again to bathe. After the steam spout bath the knee is very red for a few days. The jelly fish operates feebly.

8th August. Again stopped the bath for a week; good improvement.

29th August. The treatment ceases. He has had 63 sulphur baths, 13 steam spout baths; walks with tolerable ease

on crutches, without supporting himself much on the knee. The knee has now nearly its normal appearance, is sufficiently flexible, the muscular system of the extremity nearly in a normal state.

The next year he came again to the bath. — Looks well; has become plump; walks briskly in the street with the help of only a stick; bends his knee and foot easily; there is still some swelling and stiffness in the great toe.

Prescribed: In every respect as last year. Had 50 baths, and was completely cured without relapse to this day.

No. 2. Gonarthrocace, plethora abdominalis. Bathing two summers. Cure.

1861 June 1st. A woman 56 years old — very corpulent — suffered about 20 years ago from the venereal disease — used Cura Dzondi — and was cured without subsequent appearance of relapse. She was afterwards always well with the exception of some rheumatism; but about one year ago both her knees began to fail and to swell, and she has now lain in bed for eight months. She can just stand on her legs, and with the help of crutches move her feet a little on the floor. Both the knees considerably swollen. — Cond. ext. tibiæ on both legs especially hypertrophic; patella turned much outwards. Pains in moving, particularly in the lower ligament of the patella. Doubtless all the articulating extremities of the bones in both knees are hypertrophized, but on account of her considerable fatness it could not be easily ascertained. Digestion in order.

Prescribed: Sulphur bath 90°; spout bath 80°; shower bath 72° (gradually reduced to 90°—76—65). Both knees rubbed twice with mud in the bath. Steam spout bath every third day. Mud poultice all the night, and occasionally jelly fish on the painful parts. To drink 3 full cups (about 6 oz.). Wheeled to and from the bath. In the course of 71 days she had 60 sulphur baths, 20 steam spout baths; also several times 5 leeches on each knee on account of the pain. On her

departure her great corpulence was considerably reduced. The bloated appearance of the face improved. The circumference of the knees much smaller. She walked with tolerable ease to the bath with crutches, and felt on the whole well.

The next year she came again to the bath. She has occasionally during the winter used compression applied to the knees by the help of plaster capsules. She walks briskly in the street only with a stick.

Prescribed: The same treatment as last year. This time she took 30 baths, and departed almost completely cured. Her knees had their normal shape the patella had resumed its place, and no pain was felt. This lady lives now in the third floor, and walks up and down stairs with tolerable ease.

No. 3. Tumor albus genu, periostitis tibiæ, abscesus plantæ pedis. — Three years treatment. Cure.

1846. An unmarried lady — 31 years old — had been ill for two years; the cause probably refrigerium. Her right knee is occupied by a considerable, smooth, hard, white swelling, extending all down along the shin bone, with constant boring pains across the knee, which are increased by motion. The flexibility of the joint restricted. The left lower extremity suffers from a similar affection, but in less degree, yet the shin bone and the foot are more swollen. On moving the left knee a considerable crepitation is remarked, when the hand is placed thereon. The patient can walk a little in the room with crutches. The menstruation scanty, but regular. Evacuation sluggish.

Prescribed: Sulphur bath 95°, 86°, 70°; double rubbing in on both the lower extremities with mud; mud poultice on the knees in the night; jelly fish; three cups. The sulphur water did not operate very well. Leeches were applied once on account of increased pains in the knee. She bathed for two months and half, but was not much improved.

In the next year there was an evident improvement in all

the phenomena. In the inner edge of both feet there had formed an abscess of congestion, which afterwards broke and discharged a thin secretion. She used the bath in the same manner as last summer; continued improvement. — The third summer on her arrival at the bath the abscesses appeared still to be open; the pains had concentrated themselves round these abscesses, and had abated on all other points. The same treatment as before. Evident improvement. — The next winter she was considered to be completely cured, and is since married.

Arthritis.

No. 4. Arthritis and calculi renales. Bathing one season. Considerable improvement.

A beer brewer — 45 years old — full blooded, and corpulent from good living; has suffered four or five years from these diseases. Every year in the month of January he gets a violent attack of arthritis in the knees and feet, which confines him for a long time to his bed. At intervals of some months violent pains occur in the region of the kidneys. He observes how a stone from the kidneys passes through the urethra, and finally slips into the bladder, when all pain ceases. The stone is loose and is easily decomposed. The largest stone he has voided was oval, and half the size of a grain of coffee. Digestion in order.

Prescribed: Sulphur bath 92°, 80°, 72° (gradually reduced to 88—77—66). Double rubbing on the back, knees, and feet with mud. Mud poultice on the knees and feet at home. Application of Medusa every second day. Three full cups. — After three weeks the sulphur water was discontinued, and he subsequently drank Carlsbad water.

12th July. The treatment terminates with the 40th bath. The jelly fish has operated powerfully, and the sulphur water has purged him copiously.

In the following summer I spoke with him. During the

past winter he had not had the usual attack of arthritis in the month of January, and since the treatment at the bath he had not remarked the least pain in the back, nor any symptom of stone in the kidneys; yet he sometimes voids gravel with his urine, though in much smaller quantities, than before.

Debilitas nervosa.

No. 5. 1860. July 4th. An unmarried lady — 18 years old — of weak appearance, and much debilitated by grief and night-watching at a sick bed. She also suffered from periodical nervous headache, obstinate constipation, and on the whole from deranged digestion, also from weak eyesight, owing to reading by candle-light. Menstruation normal.

Prescribed: Spout bath 90°, 80°, 72° (88°, 77°, 66°); mud poultice on the abdomen for one hour; jelly fish on the temples every third day; three cups of sulphur water; afterwards a stream-bath for some weeks.

1st August. Has for ten days suffered from a large carbuncle on the back, which was opened by a cross cut.

19th August. Has had 25 spout baths, and 12 stream baths; departed in a vigorous state. — Half a year afterwards I saw her again. Appearance, humour, and strength much improved, and less headache. Has not required aperients since the treatment at the bath.

Exanthemata.

No. 6. Eczema chronicum for 15 years. Bathing three summers. Cure.

1858. A young peasant, 18 years old, had suffered from his third year from a very extensive and very inconvenient eczema. Various remedies were at first tried for him, but without avail. When the boy had grown up, he was determined

to try a serious treatment. The eruption occupied the whole of the extremities excepting the hands and feet, and was found also on the neck, the forehead, and over the whole head. The skin on the affected parts was intensely red, covered with dry, white crusts, falling off in quantities. Here and there new eruptions of eczema, as also deep cracks in the skin, which were nearly every where ensanguined. The smarting and itching were dreadful, particularly in the warmth, and left the patient no peace night or day. Digestion tolerably normal.

Prescribed: Sulphur bath 88°, 82°, 72° (86°, 77°, 68°); three full cups. At first neither flogging nor brushing in the bath. — He had in the first summer 40 baths. The water operated well. The skin became cleaner, the itching ceased; but the smarting was sometimes so violent, that it was necessary to bathe him in fresh water, and smear him with oil.

The next year the eruption was much less intense, but equally extended. His state did not now prevent him from working, as before had been the case.

Prescribed: The same treatment as last year. No striking nor brushing. Afterwards a stream bath in addition. He this time took 56 sulphur baths, 20 stream baths, and departed in a very satisfactory state.

Third year. Has since last year found himself so well, that he cannot remember to have been so well before. The eruption has nearly disappeared from the extremities. Only here and there a single papula. The skin has nearly the appearance of having been tanned, it is so full of scars. Only on the forehead, and on the head are there new and old eruptions together.

Prescribed: The same treatment as last year. Sulphur bath in the forenoon; stream bath in the afternoon. He bathed this time about 50 days, and departed in the best health. — Ten months afterwards I saw him and was convinced, that he

might now be considered cured. His skin, which formerly, even on those parts, that were not attacked, had been dry and loose, had regained its normal elasticity. His whole person had become plumper.

It is very usual, that chronic eruptions of the skin become worse after the first eight or ten baths, the smarting, especially, increasing. This was remarked also with this patient every summer he used the bath.

No. 7. — 1858 — 7 June. A middle aged tradesman had for 10 or 12 years suffered from a chronic eczema on both the lower extremities from the ancle to the groin. The case resembled very much the last one described. The itching and pain were so violent, that the man actually cried, as he tore and scratched himself with both hands until the blood came, and his bed was in the morning covered with white scales in great quantity. The skin in the poplitæa and groin was thick and stiff from infiltration, the patient very much emaciated; constant obstruction.

Prescribed: Sulphur bath 88°, 80°, 72° (88°, 77°, 66°), without strjking or brushing; three full cups.

12 June. No sufficient effect from the sulphur water. Takes 4 cups. — He took 40 baths, and departed very glad and pleased at the result. The smarting and itching had nearly ceased, the skin was much cleaner. The following spring I heard him say, that he was much pleased with the first year's bathing, but intended to bathe again, as he of course was not cured. He did not however come again to the bath.

Affectio hæmorrhoidalis.

No. 8. 1857 — 1 June. Government officer — 50 years old — slight and thin. Had for many years suffered from hæmorrhoidal affection with the usually symptoms: pains across the back periodically increasing — confined bowels — heavi-

ness and tightness in the abdomen — congestion to the head; of late he had become very nervous and melancholy — appetite and sleep indifferent.

Prescribed: Sulphur bath 92°, 83°, 72 (90°, 77°, 66°), double friction on the loins and back, poultice along the back one hour daily, three full cups, jelly fish along the back and loins.

The water operated badly at first, and for a fortnight he had to drink it warm, but afterwards he returned to the cold water, which subsequently worked well. The Medusa was applied every third day with considerable alleviation of the pains in the back. He bathed regularly for six weeks, and was obliged to cease from exhaustion. During the treatment he noticed evident improvement in all his symptoms, and when I spoke with him, several months afterwards, he considered himself nearly cured. He ought doubtless to have repeated the treatment.

No. 9. 1860 — 2 June. An unmarried man, 47 years old, tolerably strongly built, but lean, and with yellowish brown complexion — had for many years suffered from an extremely irregular digestion, and occasionally from violent colic. In the autumn of 1858 he was attacked by peritonitis, which reduced him so much, that he did not regain his strength before Christmas time. In August 1859 he again had a violent attack of vomiting and diarrhœa, which at last became bloody, combined with pains in the abdomen. After these repeated illnesses he became very nervous, could scarcely bear to speak, and moreover suffered from constant obstruction. Subsequently pains across the back supervened, with feeling of heaviness in the abdomen, oppressio cardiæ, congestion to the head, and melancholy. In this state he came to the bath.

Prescribed: Sulphur bath 90°, 80°, 70° (88°, 77°, 68°) — double friction on the stomach and back — poultice for one hour on the same places — jelly fish twice a week — three

full cups. He took 40 baths that summer and as many in the next year, and he may now be considered as very nearly cured. After the treatment in the first year he did not require to take any aperients until the month of February.

Morbi Hepatis.

10. Hypertrophia hepatis, plethora abdominalis, obstructio alvi. Bathing two summers. Cure.

A countryman 51 years old, tolerably corpulent, contracted several years ago a rheumatism with affection of the heart, which required a very long treatment. Two years ago he began to suffer from an affection of the abdomen, feeling a heaviness and pressure, especially in the region of the liver, which swelled considerably, icteric colour, yellowish brown, cloudy urine, obstruction, congestion to the head and breast, vestiges of the old heart disease, molimina hæmorrhoidalia and at last a hypocondriac state of mind. In this state he came to the bath. The abdomen was very voluminous, the region of the heart and the liver tender, the liver considerably enlarged, the complexion icteric, sleep and appetite indifferent. — A few inches under the inferior margin of the liver there was to be felt a little, hard, knotty, moveable, painless swelling of the size of a walnut.

Prescribed: Sulphur bath 90°, 80°, 70° (88°, 77°, 66°) — double friction on the abdomen — jelly fish on the region of the liver — mud poultice on the same place at night — four full cups.

After 40 baths he departed much improved: the complexion more natural, his humour better, the fullness of the abdomen and particularly that of the liver diminished.

The next year, when he again appeared at the bath, his exterior was remarkably improved, as likewise his general state of health. He had during the winter had a number of large

and small boils round his body, which discharged a great quantity of matter*), to the great relief of the patient. He had then the same treatment as last year, but only required three cups. He took between 20 and 30 baths. In the third year he visited the bath again, in passing that way on a journey, and although he was to be considered as cured, yet he took 10 baths at my request.

11. Hypertrophia hepatis with Symptoms of affection of the brain. One summer's bathing. Cure.

1851. June. A public functionary — 60 years old — of middle stature — had during many years led a sedentary life, and suffered from very considerable obstruction. In the year 1846 he had an apoplectic stroke with much giddiness, distortion of the face, paresis of the left side, and difficulty in voiding his urine, so that it was often necessary to use a catheter. In 1849 and 1850 he could only walk a short distance, and often staggered, particularly on the left side — the urine sluggish, and with a full bladder even involuntary. In the autumn of 1850 after a strong excitement again an attack of dizziness recurring every third day, every other day, and afterwards every day, lasting from some seconds to some minutes particularly in the forenoon, when he was fasting. He always staggered towards the left side; his face was pale, his pulse and pupils without change. After the application of leeches on the temples the dizziness increased. After a few months he improved, and has since been free from dizziness.

On examination of his abdomen the liver was found to extend upwards to between the fifth and the sixth rib. Evacuation sluggish. Complexion pale grey. He trails his left leg a little.

Prescribed: Sulphur bath 90°, 79°, 70°. The region of

*) A similar critic process of purification is not seldom observed in persons, who have been treated at the bath, on their return home.

the liver rubbed several times; three cups, mud poultice. — He took about 40 baths, and evidently improved under the treatment. On his departure his liver was reduced to its normal size. The colour of his countenance fresher, and the patient declared himself to be well in all respects.

12. Hepatitis chronica, one summer's treatment. Cure.

1847 Juli 7. A married lady — 42 years old — had in the autumn of 1845 inflammation of the liver with violent bilious diarrhœa and vomiting, pressing pains in the right hypochondrium and cardia, fever, furred tongue, and thirst. She recovered indeed from this acute attack, but her state afterwards become worse.

On examination the liver was found to have risen above the sixth rib, tenderness to the touch in the cardia and region of the liver, qualms, pale yellow complexion, depressed spirits, disturbed sleep, sluggish evacuations.

Prescribed: Sulphur bath 90°, 77°, 70°; three oz. of sulphur water three times. During the treatment nothing remarkable occurred. It was necessary to double the dose of sulphur water. After seven week's treatment the liver was reduced to its normal size. Evacuations and sleep regular. Spirits good. Complexion healthy and fresh. She only felt still some pressure in the right side.

Morbi lienis.

13. Inflammatio chronica lienis cum hypertrophia. Cure after one season's treatment.

1843. June. The patient, a middle aged man, suffered in January from ague with affection of the spleen, which was the seat of a dull, pressing pain, increased by pressure and inconvenient position. The affected side was evidently rather prominent, and even on arrival at the bath in the month of

June the unpleasant sensation in the left side was experienced, and he could not sit leaning forward without immediate pain. Evacuations sluggish. Occasional dizziness and bleeding from the left nostril. His appearance sickly, complexion grey and earthy. — This sickness in the spleen had lasted according to his account five or six years, but had become much worse after the ague.

Prescribed: Sulphur bath 90°, 82° — no shower bath, but simple pouring of cold water. Double rubbing in on the left side. Three full cups.

He took 40 baths, and found that he had gained considerably with respect to fresh complexion and lively appearance. In the course of the first months after the treatment this improvement increased considerably; he lost the pressing sensation in the left side, and subsequently has always enjoyed good health.

14. Hypertrophia lienis; protracted sickness. Three years treatment. Cure.

1850. June. An unmarried lady — 33 years old — suffered 15 years ago from ague for a year and half, and has never since felt well. Complains particularly of pains, often violent, in the whole of the left side, from the ribs to the hip, outwards towards the back to the os coccygis. Moreover a feeling of weakness and lassitude in the left leg. Sometimes she is obliged to keep her bed. In 1847 these pains occurred by paroxysms with tolerable regularity. — She used many remedies without much effect.

On examination there is observed dull percution and increased resistance from crista ossis ilei to three inches above the lowest rib, and to a breadth of four or five inches.

Prescribed: Sulphur bath 90°, 79°, 72°. Three half cups Mud poultice in the region of the spleen all the night.

During the bathing constant indisposition, with pains in the side, lassitude and trembling. Evacuations somewhat too

abundant, so that only two half cups were given. Took this year about 40 baths. After the patient's return home some improvement took place.

In the following year she came again to the bath. The same treatment as in the former year. The same number of baths, but this time she found herself very well during the treatment, and was so much improved afterwards, that her health was considered very good for the space of a year, but then the old sickness began to appear again, and in 1854 she again came to the bath. The result of the treatment this time was very good, and subsequently the patient has always been quite well.

Irritatio spinalis.

Of the class of disorders bearing this name many of the ladies, who visit our bath, are sufferers.

15. A married lady — 27 years old — tall and thin — had been sickly from her childhood, and suffered from spinal irritation from her 11th year, when menstruation began. She had for many years had an eczema on her hands, neck, and face, and convulsions of the nature of St. Vitus's dance, particularly on the right half of the body. Only one childbirth. Menstruation most frequently painful and irregular. Constant leuchorrhæa. The uterus tumefied. Nearly always pain on voiding the urine, and in the back when she moves her arms. Strong palpitations, some cough, occasionally with bloody expectorations. Digestion tolerable.

Prescribed: Sulphur bath 90°, 82°, 70° (88°, 77°, 66°) — cold vaginal douche — jelly fish along the back — mud poultice on the same place at night — three cups.

This sensitive patient could not well bear the sulphur bath, which usually diminishes the strength. She had therefore only 20 sulphur bath, and afterwards 20 spout baths of the same

temperature. Once all her skin swelled, and a new eruption of the skin disease was apprehended, but did not take place. Her health improved much. All morbid phenomena decreased, and her medical attendant announced in the next year, that she had obtained e good result from the treatment at the bath.

In the treatment of irritatio spinalis mud poultice on the back at night is usually prescribed. Long, narrow bags of thin stuff are filled with warm mud, and thus applied with great advantage. The patient soon becomes accustomed to sleep well on this cushion.

Paralysis.

16. Hemiplegia — Bathing one season — Cure.

1860 — 19 July. A young sailor, of powerful frame, had an apoplectic stroke on board, and became speechless, while the right arm fell powerless. After 12 hours sleep he felt himself restored for a short time, but the symptoms soon appeared again to the same extent as before. He was speechless for three weeks, and was a fortnight at sea before he came under medical treatment. On his arrival at the bath, seven weeks after his first attack, he could only speak slowly, and with effort. His arm was weak, the hand entirely without strength, but the sensibility was unimpaired. He asserted, that he had never suffered from siphilis, nor had used mercury.

Prescribed: Sulphur bath 92°, 82°, 70° (88°, 77°, 66); double rubbing in on the back of the neck and arm; jelly fish every other day; mud poultice one hour daily; no water drinking. 22 July. He states that he has formerly suffered from rheumatism in a high degree. 30 July. To-day during the bathing his arm suddenly become quite powerless, so that he could not lift it; but this dangerous phenomenon disappeared again before the evening, For patients, whose brain is affected, drinking the water may be very injurious, as it may produce congestion to the brain and dizziness. Therefore this patient was not to drink the sulphur water. He had however drunk it for a few days when this case occurred.

2 August. He is to take also a spout bath every other day.

26 August. The treatment ceases. He has taken 38 sulphur baths, 12 spout baths, and several times jelly fish. He speaks with perfect ease. The arm and the hand have regained their full strength. He has danced, and participated in all social pleasures. — Half a year afterwards I heard from him indirectly. He did not think he required to repeat the treatment.

17. Paralysis cum atrophia in the left arm and leg after a blow in the back. One summer's bathing. Cure.

1851 — 12 June. A public functionary, 37 years old. In 1848 received a violent blow on the left side of his spine, just above the lumbar region, from which resulted debility in the left arm and leg. A year afterwards there supervened rather suddenly after a cold paralysis in the said extremities and violent nervous pains. On arrival at the bath the said parts were much atrophized, and were the seat of violent pains, which prevented him from sleeping. He dragged his leg after him. The arm was quite powerless. The digestion normal.

Prescribed: Sulphur bath 90°, 77°, 65°. Double rubbing in on the back, arm, and leg. Medusa every day.

After 12 days bathing he once on his own responsibility took the medusa in a much greater quantity, than prescribed; the consequence was violent pains in the back, particularly on the place where the blow had fallen. In the night the pains increased in a high degree, and he did not fall asleep until the morning. But in the forenoon on the arrival of the medical attendant the pains had ceased, and he exclaimed, "I have suffered much, but not too much, for I am cured," and immediately he proved, that his former strength in the arm and leg was restoren. The parts which had been rubbed with

the jelly fish were as if bathed in perspiration. He continued the bathing. The former symptoms occurred subsequently again, but in a much slighter degree. He took 40 baths, and in the following year he reported, that since Christmas his improvement had continually progressed, so that he was now completely cured.

38. Paralysis in the right lower extremity, of rheumatic origin. One summer's bathing. Cure.

1848—15 July. A young student about three years ago, after having taken a violent cold, was attacked by periodical rheumatic pains in all his limbs, to which was added lameness in the right lower extremity, so that be could only drag himself along with the help of a stick. Sensibility was unimpaired. On pressing the sixth to eighth spinal vertebra pain was produced, which extended forwards, and occasioned dyspnæa. Sleep middling. Evacuation sluggish.

Prescribed: Sulphur bath 90°, 72°, 68°, medusa, two cups.

After the first application of the medusa violent pains occurred along the whole of the lower extremity. The skin was affected with itching, papulous eruption, and was bathed in perspiration. This local perspiration, which was confined to the part touched by the medusa, lasted a long time, and the pain continued nearly all the night. But the day afterwards nearly every trace of lameness had disappeared. This improvement continued. He bathed for six weeks, and used the jelly fish with caution. Even during the treatment he could take good long walks, and afterwards became completely cured.

Neuralgia.

19. 1859 — 22 June. A woman 53 years old, tall and thin, much debilitated by numerous childbirths and many illnesses. Has for many years suffered from paroxysms of nervous headache, with dizziness and vomiting, which alternating

with cramps in the stomach keep her in bed for many days. The sickness has become worse since the menstruation ceased Evacuation sluggish, sleep disturbed, feet frequently cold.

Prescribed: Sulphur bath 88°, 82°, 77° (88°, 77°, 66°); double spout; mud is rubbed in on the head with brushes; jelly fish on temple and on the back of the neck; three cups.

She took 40 baths, and improved considerably. The paroxysms became more rare and less violent. The sulphur water operated very regularly, the jelly fish once too strongly. — The next year she again took 40 baths. The attacks of vertigo were now so mild, that the vomiting did not occur, and she felt her nerves much strengthened. She bathed again for a short time in the third year, and we had occasion to see, that she was to be considered as essentially cured.

20. A married lady, 40 years old, who had never been pregnant, but menstruated regularly; had for many years suffered from a violent neuralgia capitis, which proceeded from a point just over the left eyebrow, which point however was not tender to the touch. The neuralgia usually occurred twice in the course of a month, lasted for a few days, and was accompanied with qualms and vomiting. When the attack ceased, the appetite was voracious. She suffered moreover also from rheumatic headache. When the neuralgia occurred at the same time as the menstruation, the pain was always most violent.

Prescribed: Sulphur bath 90°, 80°, 70° (86°, 75°, 64°); brushing with mud on the head; jelly fish; three cups. She took 40 baths in the course of six weeks. During a similar period she usually had two or three attacks, but now the attack did not occur, until the sixth weeck. Sometime before she had remarked the symptoms of an attack, which disappeared again after a bath. At last the neuralgia came, but milder and shorter than usual, and without vomiting. It was then eight weeks since the last attack. She had never before en-

joyed so long an interval of rest. This patient will certainly come again to the bath, as the cure must be considered far from complete; but the history of her treatment is already a good proof of the virtues our bath possesses.

21. Neuralgia facialis. Bathing three seasons. Considerable improvement.

1850 — 20 July. A middle aged public functionary had for many years been sickly, hypochondriacal, and unfitted for continued work; evacuation irregular. Two years ago he began to suffer from violent neuralgia in the right temple, eye and cheek, and down the throat. The pain did not follow any particular nerve. In the first year the pains were milder, but afterwards became more intense and constant, and seemed to proceed from a cheek-tooth. But when this tooth was drawn, the pains began in the next. — On his arrival at the bath he was very unhappy on account of his sufferings, and of the total inactivity, to which his sickness condemned him. Evacuation sluggish.

Prescribed: Sulphur bath 90°, 81°, 68°, double friction on the temples and cheek; jelly fish; three half cups. — He took about 40 baths. The dose of sulphur water was increased to four cups. The medusa worked powerfully, and with local perspiration. During the treatment he found himself tolerably well, after his return home again worse; and this varied thus for some time, but after the new year a constant improvement began, so that he could begin to work.

In the following year he came again. The pains were less intense. Sleep and digestion much improved. He bathed in the same manner as before. In the following winter he was able to go through his rather fatiguing business without becoming worse in health. — When he came to the bath in the third year the pains, which had been before so tormenting, were changed to a simple rumbling in the face and cheekbone. This did not disappear entirely after the third year's bathing,

but did not inconvenience him much. He attended to his business, participated again in the duties and pleasures of social life, eat and slept well, and in short was considerably improved.

This case is worthy of remark. The so called Fothergills Nevralgia facialis, of which this man suffered, is so violent and obstinate a disease and recovery is so rare, that the successful operation of the bath treatment is worthy of note. One has likewise here an express proof, that the physician is justified in speaking of the after-effects of the treatment, which frequently do not appear until several months after the treatment is over.

22. Neuralgia ischiatica, affectio organica uteri. Three seasons bathing. Cure.

1846 — June. A woman, 38 years old, had for 10 years suffered from neuralgia in the left hip and leg. It was sometimes very violent, when she was sitting; was increased by pressure on the trochanter major, and sometimes accompanied by small convulsions in the limb and by want of feeling. No lameness; menstruation normal. She has two children. In the spring she began to suffer from a pressing sensation in the pelvis. The uterus was much swollen, oblique and descended. On the labium post. uteri there was a knot of the size of a hazel-nut, but neither hard nor ulcerated. This state was nearly unchanged on her arrival at the bath.

Prescribed: Sulphur bath 95°, 86°, 77° (90°, 77°, 66°); medusa; three cups.

The medusa operated so strongly, that it could only be applied a few times. No remarkable improvement in the first summer. — In the next year the knot on the uterus was away; the labia uteri even and without pain, and the uterus moveable. This year she supported the jelly fish better. Some improvement. — In the third year she supported the jelly fish very well, and applied them diligently. The next winter her

medical attendant reported, that the uterus was in its normal state, and that the neuralgia had entirely disappeared.

Chronic Rheumatism.

23. — 1859 — 3 July. A young lady, well formed and of strong constitution, had always been in good health until 4 or 5 years ago, when she contracted a rheumatism, which subsequently has always reappeard on the slightest occasion.

In the course of the last three years she has twice suffered from acute articular rheumatism, the last time accompanied by endo-and pericarditis, as well as pleuritis with considerable effusion in both lungs. Her functions are in order.

Prescribed: Sulphur bath 92°, 83°, 74° (90°, 79°, 70°); breast and hips rubbed in twice; jelly fish; three cups. As she was very chilly and shivered under the spout it was ordered, that the spout and the shower bath should be taken at once, in which manner the former is better supported. — She took 40 baths, and the next winter found herself so well, that her medical attendant was nearly obliged to threaten her to induce her to repeat the treatment the following year. Subsequently she has been entirely cured of rheumatism, and of her former disposition to be attacked by it.

24. An elderly peasant, of powerful frame, had for many years suffered from rheumatism, and twice from rheumatic fever. Of late years this disease had concentrated itself in both feet, where all the joints were knotty, swollen, and stiff, while the soles of his feet were as thick as cushions, the seat of constant pains, and so tender that he could neither wear shoes nor walk. On his hands the knuckles were likewise swollen from chalky deposita.

Prescribed: Sulphur bath 92°, 82°, 72° (90°, 79°, 68°); mud poultice in the night; jelly fish and steam spout alternately every third day; three half cups.

After the first year's bathing (40 baths) he was already evidently better, and could walk pretty well. This improvement increased afterwards, and in the next year, when he had repeated the treatment, all the joints, which had been attacked, were fine, flexible, and free from pain; in short, the man was cured.

25. Rheumatismus chronicus, vitia organica cordis, menstruatio difficilis. Bathing three seasons; considerable improvement.

A married lady, 28 years old, slightly formed, and not strong, never pregnant, had eight years ago suffered from rheumatic fever, and since that time never been free from rheumatic pains. For three years she had lived in the north of Norway, in which raw climate the disease had become worse. At present she suffered particularly from headache, weakness of sight, constant pains in the region of the heart, strong buzzing at the first sounds of the heart, bad appetite, sluggish evacuation. After meals she always had pains in the left side of her stomach. The catamenia had always been scanty and painful; the vagina unnaturally narrow, collum uteri atrophic, the internal orifice narrow, but the cavity of the uterus free.

Prescriced: Sulphur bath 90°, 81°, 72° (90°, 77°, 68°); double friction on the back and abdomen; poultice on the abdomen one hour; warm vaginal spout (86°, 95°); three half cups.

After three weeks bathing there occurred an abundant miliaria accompanied by fever, which ended after six days with abundant bran-like desquamation. She began again to bathe, but after some time there occurred a new eruption, which did not last long.*) This summer she took 37 baths.

*) The so called bathing rash, a miliaria rubra, appears occasionally among the bathers but seldom twice on the same person. It is considered to be a consequence of the effect of the bathing on a fine and sensitive skin.

The next year she again came to the bath. With the exception of one rheumatic attack she had in the mean time found herself very well, and was in many respects considerably better. The catamenia were regular, although still painful; the digestion and sleep better. — Same treatment. 40 baths. — The third year she was very well. The pains in the stomach after ingestion had been one of the most obstinate phenomena, but these also were much diminished. The abnormal sounds of the heart were, as might be expected, unchanged. She took more than 40 baths, and departed considerably improved; complete cure could not be expected in this case. She has since become pregnant for the first time after being married six years.

Scorbutus.

This disease seldom appears at the bath, but in 1858 one case was treated with success.

26. It was a very corpulent man, 42 years old, an incorrigible drunkard. There were swollen gums easily bleeding, frequent bleeding of the nose, bad teeth, large ecchymoses on the legs and in the mouth, universal lassitude, moreover erythema nodosum on the legs with pains, stimulating prickings and sensation like the creeping of ants and chillnes. Digestion tolerably normal.

Prescribed: Sulphur bath 93°, 81°, 72° (90°, 77°, 66°); no brushing nor striking on the places where the eruption appears; four cups; gargling of sulphur water.

On account of debility, and partly from laziness he took only 24 baths, about half the proper number, but nevertheless the result was very good. After two months he got rid of the chilly sensation, the creeping of ants, the ecchymoses, the debility, and of the whole cachectic appearance. The drinking of the water operated as a strong aperient, and certainly contributed in a great degree to the cure.

Tumor retroperitonæalis.

27. A young lady, married two years, without children, had formerly been always well. A year ago had a rheumatic fever, and subsequently had suffered constantly from rheumatic pains; has had two miscarriages with great loss of blood; has afterwards had fluor albus and descensus uteri.

The catamenia very irregular. Six weeks ago fever, violent pains in the abdomen, tenderness on pressure, qualms and vomiting. The pains were concentrated in the regio iliaca sinistra, and there had formed a round, hard, immovable tumour, which was tender on pressure, and painful during evacuation. On her arrival at the bath it was as large as a duck's egg; evacuation sluggish, appetite little, humour, strength, and appearance bad.

Prescribed: Sulphur bath 90°, 81°, 72° (90°, 77°, 66°); double rubbing in on the abdomen; mud poultice on the same place at night; three cups. — After one month's bathing the swellingwas not perceptible. Her health has subsequently in all respects been good. Immediately after her return home she became pregnant, and has since given birth to a healthy child.

Contents.

REMARKS

ON

WOMAN'S WORK

IN

SANITARY REFORM.

ADDRESSED SPECIALLY TO MOTHERS, EDUCATORS, TRACT-DISTRIBUTORS, AND VISITORS OF SCHOOLS, COTTAGES, AND WORKHOUSES.

LADIES' NATIONAL ASSOCIATION FOR THE DIFFUSION OF SANITARY KNOWLEDGE.

Reprinted from the English Woman's Journal.

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REMARKS ON WOMAN'S WORK IN SANITARY REFORM.

"I conclude that all our endowments for social good, whatever their special purpose or denomination—educational, *sanitary*, charitable, penal—will prosper and fulfil their objects in so far as we carry out the principle of combining in due proportion the masculine and the feminine element, and will fail or become perverted into some form of evil in so far as we neglect or ignore it."

Mrs. Jameson.

SANITARY REFORM is an object claiming the most serious attention of every conscientious woman. We, the inhabitants of this wonderful little England, have attained to a height of civilization beyond that of any other people; but it is a lamentable fact that the improvement in our physical condition is far from being commensurate with our general progress. Among us are seen examples of mental and moral dignity, equalled by few of the most advanced nations, but among us also exist physical degradation and suffering unknown to many of the most savage; to all the blessings of Christian civilization our children are heirs, but a third of them die before they can enjoy their heritage;* our productions win for us world-wide renown, but it is too often at the sacrifice of the producer's health or life. What can woman do, in her domestic and social capacities, to remedy these evils?

To answer this question fully, is not possible within the limits of a short tract; it is here intended merely to offer a few general hints, with the hope of leading to a further study of the subjects touched upon.

The great field of sanitary labor may be divided into two parts:—the amelioration of injurious external circumstances, and the reform of injurious habits and customs. Of these parts the former belongs principally to man, the latter, principally to woman. It is for man's comprehensive mind to devise schemes for draining and cleansing

* Earl Shaftesbury stated in an address delivered last year, that *sixty thousand* still-born infants are annually produced in this country, and from the Registrar General's last annual report, we learn that nearly one third of those born alive die before they attain to their fifth year.

our towns, for improving dwellings, and for placing the necessaries of life within the reach of all; and it is for his strong hand to execute these schemes. It is for him to discover the laws of health, and to teach and apply them where he can. It is for woman, in her functions of mother, housewife, and teacher, to effect those urgently needed changes in infant management, domestic economy, education, and the general habits of her own sex, without which humanity could never attain to its destined state of bodily perfection, though all injurious external circumstances were changed. It is for her to teach and apply the laws of health in her own provinces, where man cannot act.

Most of us are at present unable to perform our part in the work of sanitary reform, because of our ignorance of the great truths upon which that work is based. Sanitary science rarely forms a part of female education, though a knowledge of it is of the greatest utility and importance to every one. But in this matter, it is easy to supply educational defects. There are many excellent books from which any woman of ordinary culture and intelligence, may gain sufficient knowledge of sanitary science to bring it to bear very usefully upon her own practice and on that of others.*

Woman's work in sanitary reform should, like all other charities, "begin at home," and there begin with herself. As the teacher of Christianity should be a living illustration of the truths he inculcates, so should the woman who attempts to lead others to obey the laws of health, be herself an example of constant obedience to them. This seems so very obvious a truth as hardly to need mention; but, strange to say, it is one which not a few who are working for the improvement of the health of others do not seem to understand. Obedience to the laws of health sometimes involves great self-denial and disloyalty to Queen Fashion, and, therefore, requires an amount of determination and moral courage which too many of us do not possess; so we disobey. Whenever we act thus, we not only injure others by example, but also greatly wrong ourselves. The noble efforts now being made for our elevation, will never be more than partially successful while, by disobedience to the laws of health, we wantonly waste our life-powers. There is much just complaint about our political and legal disabilities, but they are trifling compared with the physical disabilities which we inflict upon ourselves. We are justly striving to obtain the same industrial advantages as man, yet we continue enervating habits which render us physically incapable of successful competition with him. "While striving to improve the external conditions of life, we waste life itself, forgetful that abstract 'rights' have but a nominal value when not practically available."

To detail all the violations of the laws of health which are committed in English households, merely through the ignorance and

* A list of very excellent sanitary books, specially designed for non-medical readers is given on page 20.

mismanagement of their female heads, would fill a volume. Let those who doubt, carefully read over any good treatise on the preservation of health, and compare its teachings with the general domestic practice. A few only of the most common domestic violations of the laws of health can here be considered.

Foremost, perhaps, may be placed the use of unsuitable and badly cooked food. In choosing our food and mode of cookery, we regard palate and length of purse; but through our ignorance, the choice is generally more or less in violation of the laws of health, and we pay the penalty in a host of digestive disorders. Whatever grand schemes of public sanitary reform may be carried out, England will never be a healthy nation till English housewives study the science of health, and bring it to bear upon the choice and preparation of food.* Though there is not always need for the mistress of a household herself to prepare the meals, she should certainly have knowledge which would enable her always to order such food and methods of cookery as are suited to the season, and to the particular constitution, occupation, and state of health of each member of her family. This subject is really a most important one, for not only physical, but mental and moral health, are, to a great extent, dependent on so material a thing as dinner.

In the nursery, our ignorant violations of the laws of health are still more numerous and mischievous. The rate of infant mortality among us and other civilized communities, is something unparalleled in all creation. From every hundred of our little ones, thirty are cut down,

"An unripe harvest for the scythe of Death,"

before five summers' suns have shone upon them, and a great part of the remainder grow up weak and sickly. No other creature perishes and suffers thus. We do not find the eaglet dead in its aerie, or the young wolf moaning with pain in its lair; among all the inferior animals health and long life are the rule; while with the offspring of civilized humanity, the capital of creation's pillar, they are the exception. Over some great causes of infant mortality and disease, most women have little control; in large towns thousands of infants fade away, like blighted flowers, for want of pure air, light, and sunshine, others come into the world with the seal of death already on their brow through hereditary influences, and others suffer or die for want of the necessary food and care which poor mothers working at a distance from home cannot give, but in very many instances the principal causes are maternal ignorance and mismanagement: on all sides "Rachel sits weeping for the

* A "School of Cookery" is established under the direction of a committee of ladies, at 90, Albany Street, Regent's Park. "The object of this school is, to teach correct principles of cookery and household economy. Girls are received as boarders, and instruction is given to daily pupils."—*See Prospectus.*

children" whom she has herself unwittingly slain.* With regard to maternal duties, we are generally far too wise in our own conceit; it is a very rare thing to find a mother who, however ignorant, does not believe that she knows all about the management of her children. Womanly instincts, it is sometimes argued, teach all a mother needs to know. When it can be proved that there are superfluities in God's creation, and that woman's reasoning faculties are among the number, we may talk of the sufficiency of instinct—not before. Either Drs. Combe, Conquest, Bull, Besser, and other eminent physicians, who have written volumes to instruct women in infantile management, wasted time and stationery in making "much ado about nothing," or there is a great deal of important sanitary knowledge which every mother ought to acquire. Surely no one can be at a loss to decide between these alternatives; surely no one should rest a day without bringing her decision to bear upon her practice. Every mother ought then carefully to study the laws of infantile health, so that she may intelligently apply them in her own nursery.

The first thing which needs to be done in connection with a reform in the management of infants and children is, to obtain intelligent, well trained monthly nurses and nursery maids.†

A monthly nurse, whose work it is to tend a mother and child during the most trying and critical period of physical life, ought certainly to be an educated, sensible woman, able intelligently to co-operate with the medical attendant, instead of mistaking one third of his directions and wilfully disobeying another, as the ignorance and prejudice of the present class of nurses so often lead them to do. "Serious and important," writes Dr. Bull,‡ "are the duties which devolve upon the monthly nurse; and well would it be for English women, if all who undertake this office came from a better educated class of society than they too often do. Ignorance and coarseness of manners are unbearable in a nurse; it is dangerous for the medical man to have such a person to carry out his measures, while she is certainly anything but a fit companion for the patient, who nevertheless has almost no other for two or three weeks." We must help ourselves and each other in this matter. Thousands of intelligent women of the middle classes who have their bread to

* It is worthy of special remark, that, although the rate of infant mortality is very much higher than that of adults, infants are entirely exempt from many of the fatal influences to which adults are subject. Intemperance, over-work, anxiety, "accidents by flood and field," and other things which destroy thousands of adult lives, do not affect the little denizens of the cradle. Surely they would live and thrive if well managed.

† The substance of most of the following remarks on monthly nurses and nursery-maids, is derived from a pamphlet on "Woman's Work," by Mrs. W. Baines, (London: Tweedie, 1859,) and another entitled, "A few Friendly Words to Young Mothers," by the same lady, (London: Wertheim, Macintosh, and Hunt.)

‡ "Hints to Mothers," 11th Edition, p. 169.

earn, and know not where to earn it, might greatly benefit both society and themselves by going through a course of training which would qualify them for the office of nurse. They need not think such a position beneath them, for no employment is really degrading which affords scope for the exercise of the highest faculties of the employed; and it is quite certain that the efficient discharge of the duties of a nurse would do this far more than many of the so-called "genteel" occupations now followed by thousands of middle-class English women. The heroines of the Crimean war have already ennobled the office of nurse to sick men; we wait now for others to do the same for that of nurse to our own sex in the most critical period of physical life.

In all lying-in hospitals, arrangements should be made for the training of intelligent women as nurses; this has already been done to a limited extent. The women chosen for this training should be single women of from twenty-five to thirty-five, who would thus procure suitable and profitable employment, which too many of them now seek in vain.

It has been objected that a nurse who is not a mother cannot sufficiently sympathise with the class of sufferings which she is called to alleviate. Upon this point the writer has received very conflicting opinions from several highly intelligent mothers. When a jury of matrons "disagrees" on such a point, "who shall decide?" But even if it were proved that single women are not in some respects quite so well qualified for monthly nurses as mothers are, still, while the present urgently pressing want of remunerative and suitable occupation for single women exists, and while the battle of life is so hard a one for them, they ought to be chosen.

Women of the richer classes, who subscribe to lying-in hospitals, might very advantageously use their influence with the committees, to urge them to make arrangements for the training of monthly nurses; and mothers generally, would do well to offer every inducement to truly worthy and intelligent women of the middle classes to serve in this capacity. Now, the woman of the middle classes who comes out into the world to earn her own bread, loses caste and position which she would have maintained had she remained at home in burdensome idleness. While this state of things continues, it will not be easy to raise up a better class of monthly nurses. Comparatively very few women in the middle classes could be found willing to write their own writ of social outlawry, by taking the place so long filled by "Mrs. Gamp." We need, every one of us, to be more deeply impressed with the dignity of *all* useful labor; we must learn to honor each other, not in proportion to what society does for us, but to what we do for it.

The next thing to be done by us for the nursery is, to raise up a better class of nursery-maids. It is strange that mothers so often confide their little ones—their most precious treasures—to raw,

ignorant, untrained girls, who injure them hourly, in body, mind, and heart. Mothers know and deplore that their children suffer thus; but they have yet devised no efficient remedy. We have seldom any right to complain of servants, for they are generally far less to be blamed for being thriftless, awkward, and ignorant of the duties of their station, than to be pitied as victims of the wrong system of education which has made them so. What is wanted in all our schools for girls of the working classes is, a systematic training for their future duties, as suggested by Mrs. Austin, in her very admirable "Letters on Girls' Schools and the Training of Working Women."

The adoption of Mrs. Austin's plan, extended so as to embrace practical instruction in the management of infants, would effect that wherein our present educational system fails so lamentably:—the production of good house-servants and nursery-maids.* To impart such instruction is at present a difficult matter, for the teachers in schools for girls of the working classes are generally single women who know little of the physical management of infants and children. Moreover, the pupils would need to practise the operations of washing, dressing, feeding, etc., upon infants. Various plans of meeting these difficulties have been proposed. The one most easily practicable, appears to the writer to be that suggested by the "Ladies National Association for the Diffusion of Sanitary Knowledge."† This association proposes to establish training institutions wherein a few orphan infants might be reared, and practical instruction in their management, and other branches of sanitary knowledge, be given by a competent female teacher. At these institutions, the senior girls of schools in the neighbourhood might attend to receive instruction as often as necessary: thus they would become qualified not only to tend the children of others, but their own, in after life. If this plan be a good and efficient one, to carry it out is an important part of woman's work in sanitary reform: she and her loved ones have long suffered from ignorant, untrained attendants; it is now for her to make an intelligent effort to raise up a better class.

After the home-work, should come efforts for the improvement of health among our poor neighbours. The prevention of the present fearfully high rate of mortality among their children, is an object specially demanding attention. "It has been shown in the sanitary report," says Mr. Chadwick, "that in the same districts where one fourth of the children of the gentry have died, more than one half of the children of the poor have died; and this excess of death among the poorer classes was traceable to preventable causes." Of these, maternal ignorance and mismanagement are, as has been before stated, among the most fatal. Few but those who have been much among the poor, know how fearfully mismanaged their

* See "English Woman's Journal" for March 1859, article "Training Schools for Female Servants."

† See Prospectus on cover.

little ones are—how the infant shares his mother's dram and all her food, from red herring to cucumber—how he takes medicine sufficient homœopathically to treat the whole community—and how, finally, an incautiously large dose of laudanum wraps him in the sleep that knows no waking.*

Ignorance of the laws of health is not only one of the greatest causes of the low physical condition of the children in poor families, but also of that of the adult members. Sanitary knowledge is one of the greatest wants of our poor population, and it is one which educated women may do very much to supply.

Those of us who are district visitors and tract distributors, have excellent opportunities for imparting this knowledge. We should be all the more successful even in the directly spiritual part of our work, if we showed our poor friends how to remove those sore physical evils which cramp and fetter mind and soul, and so often prevent all thought or care for moral and spiritual elevation. We have the highest possible precedent for constantly combining ministrations to the body with those to the soul. If Christians were faithful imitators of their Great Exemplar, there would be no need to form combinations for the special purpose of sanitary reform; every Christian society would be a "Sanitary Association," every Christian an earnest sanitary reformer. The morbid sublimation which leads some of us to devote exclusive attention to the souls of the people, to the neglect of their physical well-being, is no part of Christianity; it is but a remnant of medieval mysticism, and the sooner it is destroyed the better. Those who possess an ordinary amount of tact will not find it difficult to impart sanitary knowledge during their cottage visitation, without being obtrusive, or violating

* Many painful instances of the results of maternal ignorance might be cited. The following suggestive cases are taken from a report of the causes of infant mortality in fifty cases personally investigated by Mrs. W. Baines.

"Case 3. Boy, aged eight months. Died in a convulsive fit. Coroner's inquest. *Alleged cause* of death, *teething*."

"Case 48. Child, aged five months. Coroner's inquest: verdict, 'Over-feeding.'"

"Case 49. Child, aged seven months. Coroner's inquest: verdict, "Died through over-feeding."

"Fed upon tea and *muffin* heartily the night before it died. Always ate heartily, and had also breast milk."

"These two cases happened together in the same house. The child of a wet nurse, and her nursling, were fed on a hearty supper of bread food, and were found dead at 4 a.m."

The report is thus summed up:—

"Total of cases traceable to over-feeding and injudicious feeding . 34.
Or per cent . . . . . 68."

"The Mortality of Infants," by Dr. C. H. F. Routh, pp. 42-5-6.

With regard to the use of laudanum and other opiates, Dr. Playfair remarks, "We have three druggists in one district of Manchester, selling respectively five and a half, three and a half, and one, in all ten gallons weekly; two of them testifying that almost all the families of the poor in that district habitually drug their children with opiates." In Rochdale, Clitheroe, and other towns, similar evidence was given.

any of those laws of courtesy which should be held sacred alike in intercourse with peasant and peeress. In those cottages where there is a young family, the visitor will find it a good plan to commence operations by noticing the children, the wonderful baby, "the finest baby the doctor ever saw," especially, and then it will be easy to say a hundred useful things about their physical management, fresh air, wholesome food and cookery, cleanliness, etc., all of which will, if expressed kindly, judiciously, and without unnecessary personal allusions, be generally well received. All appearance of fault-finding and dictation should be most carefully avoided, or little good will be done; better words of advice to all who visit their poor sisters can hardly be found than those of the Rev. Charles Kingsley:—

"Visit whom, when, and where you will; but let your visits be those of woman to woman. Consider to whom you go—to poor souls whose life, compared with yours, is one long *mal-aise* of body, and soul, and spirit—and do as you would be done by; instead of reproaching and fault-finding, encourage. In God's name, encourage. They scramble through life's rocks, bogs, and thornbrakes, clumsily enough, and have many a fall, poor things! But why, in the name of a God of love and justice, is the lady, rolling along the smooth turnpike-road in her comfortable carriage, to be calling out all day long to the poor soul who drags on beside her, over hedge and ditch, moss and moor, bare-footed and weary-hearted, with half-a-dozen children at her back, 'You ought not to have fallen here; and it was very cowardly to lie down there; and it was your duty, as a mother, to have helped that child through the puddle; while, as for sleeping under that bush, it is most imprudent and inadmissible?' Why not encourage her, praise her, cheer her on her weary way by loving words, and keep your reproofs for yourself? * * * * * Bear in mind, (for without this all visiting of the poor will be utterly void and useless,) that you must regulate your conduct to them and in their houses, even to the most minute particulars, by the very same rules which apply to persons of your own class. Never let any woman say of you, (thought fatal to all confidence, all influence,) 'Yes, it is all very kind; but she does not behave to me as she would to one of her own quality.' Piety, earnestness, affectionateness, eloquence,—all may be nullified and stultified by simply keeping a poor woman standing in her own cottage while you sit, or entering her house, even at her own request, while she is at meals. She may decline to sit; she may beg you to come in: all the more reason for refusing utterly to obey her, because it shows that that very inward gulph between you and her still exists in her mind, which it is the object of your visit to bridge over. If you know her to be in trouble, touch on that trouble as you would with a lady; *woman's heart is alike in all ranks.* * * * * * We should not like any one—no, not an angel from heaven—to come into our houses, without knocking at the door, and say, 'I hear you are very ill off; I will lend you a hundred pounds. I think you are very careless of money, I will take your accounts into my own hands;' and still less again, 'Your son is a very bad, profligate, disgraceful fellow, not fit to be mentioned; I intend to take him into my hands, and reform him myself.' Neither do the poor like such unceremonious mercy, such untender tenderness, benevolence at horse play, mistaking kicks for caresses."*

Much good may be done by the distribution of simple, interesting tracts containing expositions of the laws of health. There are two series of tracts of this kind, one entitled "Household Tracts,"† and another, specially addressed to women, issued by the "Ladies' National Association for the Diffusion of Sanitary Knowledge."‡

Those who have not maternal or domestic experience, will find that the best way in which they can impart to their poor neighbours that important part of sanitary knowledge which relates to maternal and domestic management is, to give away, or, still better, read such tracts to them. For though a young, unmarried woman may from study be able to impart most valuable information upon the management of infants and children, and upon household matters, she will not find that her words—true and wise though they be—have much weight with her poor neighbours who are mothers and heads of households. "What *can* she know?" will be a question always presenting itself to their minds. But if she reads from a tract which she assures her hearers was prepared by mothers of families, she may hope to be listened to with attention and docility. On her own authority she must venture to teach only about clothing, fresh air, ablution, and other matters involving no maternal or housewifely arcana.

Those who hold maternal meetings, have in them excellent opportunities for imparting sanitary knowledge. The following remarks on this point, are from the pen of a lady who has worked long and successfully for the elevation of her poor neighbours, and has introduced sanitary teaching at the maternal meetings conducted by her:—

"Maternal meetings are just the opportunities for imparting sanitary knowledge to poor mothers. I find it necessary to vary the mode of instruction. Sometimes I have read one of the sanitary tracts, and conversed a little upon its subject, concluding the strictly religious part of the exercises a little sooner for the purpose. Again, it may happen that the [religious] subject on which I may be speaking leads to sanitary topics. For instance, when speaking of be-

* "Practical Lectures to Ladies," pp. 61-2-3-4.

† 1.—The Worth of Fresh Air. 2.—The Use of Pure Water. 3.—The Value of Wholesome Food. 4.—The Influence of Wholesome Drink. London: Jarrold & Sons.

‡ 1.—The Health of Mothers. 2.—How to Manage a Baby. 3.—How to Feed a Baby with the Bottle. 4.—The Cheap Doctor. A word about Fresh Air. London: Groombridge, 1859.

reavement, and the consolation which mothers may derive from religion in the death of their little ones, the remarks in the tract on infant management come in very naturally, and then at some length the causes of infant mortality may with great propriety be stated, parts of the tract read, and at the conclusion copies of it given to those who have been led to take an interest in the subject.

"As to the manner in which my teachings on the laws of health have been received, I must remark that it is most difficult to get the poor to attend to this subject, and it is necessary to be very guarded in bringing it before them. Remarks which will be well received by one, will be cavilled at by another. For instance, it seems almost a mockery to read to a poor woman with six small children and a husband earning nine shillings a week, that part of the tract wherein mothers are told to "take good, plain, wholesome food, and plenty of it." If, therefore, I have prepared a subject to speak upon at a meeting, and find some present who I know cannot possibly carry out my proposed instructions, I postpone them for that month. Adaptation in such instructions is very essential, and this is impossible unless we have a personal knowledge of the circumstances of our poor neighbours, and that loving sympathy which they always appreciate. I do not find the poor ungrateful; but certainly they are very sensitive, and will not endure anything like dictation from one, who, surrounded herself by every comfort, has no experience of their many privations."

Another way in which women can impart sanitary knowledge to their poorer sisters is, by delivering lectures to them. It would require no great genius, or very laborious course of study, to enable a woman thus to teach well and interestingly—in some respects far better than a male lecturer, for there are many important subjects upon which she could speak more fully and freely than conventional rules permit him to do. She, moreover, could explain the laws of health with relation to domestic economy, infantile management, female dress, etc., far better than the most accomplished male physiologist, though his general scientific knowledge might be very much greater.

Those women whose privilege it is to belong to the great army of professional or amateur writers, may do much towards the diffusion of a knowledge of the laws of health, not only among the poor, but among all classes of the reading public. The numerous works of fiction, magazine articles, and tracts which come from woman's pen, could easily be made a medium for the diffusion of this kind of information: the Rev. Charles Kingsley and a few others have already shown, to some extent, how much may be thus done even in the former class of writings. Many of them would be decidedly the better for the infusion of a new element. The stereotyped tales, in which the author, after dragging Walter and Evelina through a series of extravagant improbabilities, sends them off the stage into the haven of matrimony, and lets the curtain fall, have become exceedingly "stale, flat, and unprofitable." Now, let more of our female writers make imaginative literature a vehicle of popular sanitary instruction—tell us why preventable disease and death for ever sit scattering our hopes and joys, and holding a grim carnival among our loved ones—why youth is ground prematurely old in Mammon's mill—why the churchyard is so full of little graves—why the young mother's chair stands empty in the ingle nook. We wish to know these things.*

Woman's present part in sanitary literature is distinct; it is merely to translate into popular language, and illustrate, the truths she has learned from the writings of medical men, most of whom, through their education and frequent study of scientific books, are unable to communicate their knowledge in other than Latinised, technical language which is unintelligible and repulsive to a very large class of readers. Leaving the writings of female physicians out of the question, women without regular medical or scientific education have already made contributions to sanitary literature, which are a very encouraging earnest of what the female pen may and will accomplish in this department. Miss Catherine E. Beecher's "Letters on Health and Happiness," Mrs. Barwell's "Infant Treatment," Mrs. Esther Copley's "Nurse-maid" and "Young Mother," may be cited by way of illustration. This matter concerns not only women of the higher grades of literary talent, but also of the lower—those who never achieve anything more than an occasional letter or article in some second-rate newspaper or magazine—all may do something to dispel the gross ignorance of sanitary law which prevails.

Those women who are engaged in the work of education, can do much to elevate the physical condition of society by instructing their pupils in the elements of human anatomy, physiology, and hygiene. No other branch of secular knowledge is of such universal, every-day utility and importance as these. The mental, moral, and physical welfare of every human being are dependent upon obedience to the sanitary laws; certainly then all should have that knowledge without which obedience is impossible. To girls this knowledge is especially necessary, for upon them will devolve in after life the management of households, the training of infants and children, and the care of the sick, none of which duties can be properly performed by one ignorant of the laws of life and health. Several of the most intelligent members of the medical profession have for years been attempting to introduce the study of physiology and

* Lest our readers should think this suggestion of a combination between fiction and philosophy an impracticable one, we would remind them of the profound impression made many years ago by Mrs. Trollope's "Michael Armstrong," the life of a factory child. Many of Miss Sedgwick's tales exhibit a singular felicity in the introduction of sanitary advice. Rightly considered, the doom of ill health is a doom as terrible as any that ever scourged the hero of a Greek play, and "Plague, Pestilence, and Famine," are but the culminating points of an unsanitary condition.—Editor of the "English Woman's Journal."

hygiene into our schools. From a very admirable pamphlet on this subject by the late Mr. George Combe,* we learn that "the following document has been drawn up and subscribed to by sixty-five of the leading physicians and surgeons of London, including the principal teachers of anatomy and physiology and the practice of medicine and surgery, and also all the medical officers of the royal household:—

"'Our opinion having been requested as to the advantage of making the elements of human physiology, or a general knowledge of the laws of health, a part of the education of youth, we, the undersigned, have no hesitation in giving it strongly in the affirmative. We are satisfied that much of the sickness from which the working classes at present suffer might be avoided; and we know that the best directed efforts to benefit them by medical treatment are often greatly impeded, and sometimes entirely frustrated, by their ignorance and neglect of the conditions upon which health necessarily depends. We are, therefore, of opinion, that it would greatly tend to prevent sickness, and to promote soundness of body and mind, were the elements of physiology, in its application to the preservation of health, made a part of general education,' etc.†

"The government gave effect to this opinion by ordering the preparation of an elementary work on physiology applied to health, and suitable diagrams to illustrate it, and by instituting examinations in physiology, and making a certificate of ability to teach it a title to an increased allowance of pay." The Committee of Council for Education in England and the Commissioners of Education in Ireland then co-operated with the Board of Trade in the introduction of physiology into schools. A series of nine beautifully executed large diagrams, showing the structure of the human frame, have been since published for the use of schools by the Board of Trade. It now remains only for teachers and the friends of education to take advantage of these means; but this, from some causes not easily explained without questioning the wisdom and knowledge of all concerned, few seem willing to do. Not only is the study of the structure and laws of the "fearfully and wonderfully made" human frame very useful and interesting, but it is also eminently calculated to elevate and purify the mind, to create lofty conceptions of the love, power, and wisdom of the Creator, and to fill the heart with adoring gratitude to Him.

A very absurd opinion is sometimes expressed that this study injures the delicacy and purity of the mind. This idea is so utterly false and revolting, that it would not be worthy of mention here, did it not unfortunately exist in the minds of many conscientious educators, and prevent them from imparting knowledge of the highest

* "On Teaching Physiology, and its applications in common schools." London: Simpkin & Marshall, 1857.

† "The greater part of the (physical) evils from which the country people are now suffering are the result of ignorance."—"Return of the Registrar General," for the quarter ending October, 1858.

importance. To say that any can be injured by studying those divine laws through which we "live, and move, and have our being," is nothing less than to reproach the Great Lawgiver. For we must study them, or suffer the heavy penalties resulting from ignorance and consequent violation of them. Here, our ignorance leads to bitter physical suffering; if our knowledge were to cause moral injury, we should indeed be most unfortunately constituted, and should have good reason reproachfully to ask, "Why hast Thou made me thus?"

Women have it also in their power to put an end to the undue exercise of the mental faculties, and the neglect of physical training which are so general in girls' schools, and which so seriously undermine the health of the pupils.* Probably, in most schools far more attention is now paid to the fulfilment of the conditions of physical health than was usual ten or fifteen years ago; but a still greater reform is urgently needed. The latest writer on bodily exercise † "expresses his firm conviction—a conviction arrived at after making numerous inquiries into the matter, and with considerable painstaking to reach the truth—that there exist in England, at the present day, thousands of schools for girls where [through muscular inaction and other violations of the laws of health] at least one-third of the pupils are more or less deformed; and that there are a still greater number of schools where, among thirty or forty girls, it would be difficult, in many cases impossible, to find a single one, who, after having lived under the regime only a few months, would be pronounced by the well practised medical man as not evidencing symptoms of functional derangement." A whole legion of medical writers have for many years been complaining thus; but the evils complained of must continue till educators feel their deep responsibility in the matter, and resolve to allow no conventional prejudices, no parental whims, to prevent them from adopting every means necessary to the healthy, harmonious physical development of their pupils. To secure this end, some more systematic and thorough method of exercise is needed than walks or dancing lessons, which, though beneficial so far as their influence extends, only bring into action some of the muscles. The system of bodily training distinguished as Ling's Rational Gymnastics, is the most perfect of any yet introduced. These gymnastics are practised with most beneficial results in some of the best conducted schools in London, and also very generally in those in Sweden, Russia, Prussia, Saxony, and Austria. An explanation of the peculiar excellencies of this admirable system would be misplaced in these merely suggestive pages, especially as it has been already given elsewhere.‡ Swim-

* See "English Woman's Journal" for May, 1858, article on "Physical Training."

† Mr. Thomas Hopley: see "Lecture on Bodily Exercise," Part 2. London, 1858.

‡ See "Gymnastic Free Exercises of Ling," translated by Dr. Roth; and "Letter on the Importance of Rational Gymnastics," by Dr. Roth. London: Groombridge, 1854.

ming is another most beneficial exercise, the importance of which cannot be too strongly urged upon the attention of every educator; its claims as a means of self-preservation, independently of its value as a means of health and enjoyment, are sufficient to prove that it ought to form part of the education of all.* Dancing should not be confined, as it now generally is in girls' schools, to the formal lessons given once or twice during the week, but the pupils should be encouraged to dance as a recreation in the playground when the weather permits. In winter evenings, too, when the day's work is done, a merry school-room dance—about as orderly as Mr. Fezziwig's—is a very healthful and exhilirating affair, at once destructive to chilblains and "the blues." Every encouragement should also be given to the practice of those out-door and in-door games which bring the muscles into vigorous exercise.

In many schools it is found very difficult to induce the elder pupils to take any interest in the means of physical development. Usually when a school-girl attains to the magnificent age of thirteen or fourteen she leaves active games to "the children." If she is a pretty, vain girl, she straightway turns her attention to the mysteries of bonnets, mantles, and crinoline; if she is an ambitious, clever one, she begins "cramming" for examinations, and waxes great in crayon heads; if she is thoughtful and conscientious, she devotes herself to an unmerciful course of study, under the idea of "improving her advantages;" whatever she is, she votes exercise a bore and a hinderance, and takes as little as she can. This state of things is a necessary result of the plan of education usually adopted; girls are rarely taught the value of physical development and strength; they are stimulated by prizes and every possible inducement to cultivate the mind, while the claims of the body are tacitly understood to be of far less importance. But let every girl be constantly and thoroughly impressed with the fact, that the highest perfection and happiness of which her nature is susceptible can be attained only through the simultaneous, harmonious development of all her faculties; let the belle of the school know that health heightens beauty; let the ambitious, studious girl be told of the dependence of mental upon bodily vigor; let the conscientious one be convinced, that to develope her whole being, is a duty she owes to her Creator, to society, and to herself. Let prizes be offered not only to those who excel in languages, music, and drawing, but also to those who dance best, and execute gymnastics and other exercises with most grace, ease, and precision. Then we should soon see girls taking delight in all the means of physical development. In some schools for boys, prizes are offered for proficiency in various active out-door games. This plan should be adopted with girls also: the physical

* See "English Woman's Journal" for August, 1858, article on the "Opening of the Swimming Bath for Ladies;" and "Why do not Women Swim?" a tract issued by the "Ladies' National Association for the Diffusion of Sanitary Knowledge." London: Groombridge, 1858.

frame of both sexes is governed by the same general laws, both alike require vigorous muscular exercise, both should alike be encouraged to take it. A prize for the boys who throw the hammer the furthest, and fence the most skilfully; a prize for the girls who run the fastest, and skip the best. The idea of any similarity in the training of the two sexes gives instant alarm to some persons, who, having no faith in the permanence of the eternal distinctions nature has established, fear that if girls are allowed to develope their physical, or other faculties, as fully as boys, they will become boy-like. But, on the contrary, the more fully and freely a girl is allowed to develope her whole being, the more distinctly marked will her feminine characteristics become. They are deeply rooted in her very nature; there is no need to cripple her for fear of destroying them. It is most painful to know, however, that to thousands of the inmates of our ladies' schools, vigorous out-door exercise is impossible through want of playgrounds. In London there are many hundreds of schools to which no space whatever for out-door exercise is attached*— in other words, *hundreds of schools where the pupils are compelled to violate one of the primary conditions of health.*

In many schools for girls of the poorer classes also, the health of the pupils is much injured through bodily inaction and other preventable causes. The lady-visitors and supporters of such schools may do very much to remedy these evils. A visitor fulfils her task of inspection but very imperfectly if she confines her attention to the mental and moral condition of the children: she should look upon the school not only as a nursery for minds and souls, but also for bodies, and should see that it is favorable to the harmonious, healthy development of all. "Educate! educate!" is the watchword of the day; but, after all, education is a very questionable boon to poor girls, when it undermines the bodily health upon which they will be dependent for their bread.

It is next to impossible to effect a sanitary reform in schools for the poor while the governesses are so ignorant of the laws of health as they now generally are. The first step must be to convince them of the need of such a reform, and to induce them earnestly to co-operate in effecting it. They should be kindly encouraged to qualify themselves to teach physiology and hygiene, and every facility should be afforded them for the study of those sciences. In many cases, some benevolent medical gentleman—the name of such is Legion—will be found willing to give a course of lessons in the elements of physiology and hygiene to a class of governesses and pupil teachers. Where such aid is not available, the necessary knowledge can be well obtained from books; Lord's "Popular Physiology," and Miss C. E. Beecher's "Letters to the People on Health and Happiness," are among those especially suitable.

* Mr. Thomas Hopley's "Lecture on Bodily Exercise." Part 2, page 31.

In many schools a visitor will find ventilation much neglected.* This is not the place to detail all the evils resulting from this one cause;† suffice it to say, that a constant supply of pure air is one of the primary conditions of health, and where it is not fulfilled in the schools we provide for the children of the poor, we do them a grievous wrong. A lady who visits an ill-ventilated school cannot, it is true, put ventilators in the walls with her own hands, but she can lay the matter before the school managers, and in most cases will succeed in getting it attended to.

The visitor should observe whether the children are comfortably seated. It is common to find little children perched on a high form, with their feet hanging in mid air several inches from the floor; others will be found tightly packed together, herring fashion, in various uncomfortable postures. These and other physical discomforts are often the great cause of the children's irritability and so-called "naughtiness," which are generally attributed to something far different. Of course, little physical discomforts never, never make us adult philosophers at all irritable or unamiable, but poor little school children have not attained to our exalted equanimity; if, therefore, we wish to make them "good," we must first make them comfortable. The school forms should all be suited to the height of the children, so that their feet can rest comfortably on the floor, and all over-crowding must be prevented. All the forms should be provided with backs, as to sit without a support for the spine is to most children very injurious.

The visitor will do well to observe the posture of the children when standing to read, sitting to sew, write, etc. They are often required to stand to recite, etc., with their feet closed and their hands crossed on the chest; a very small base is thus afforded to the body, and the posture is therefore difficult and injurious to maintain; moreover, crossing the hands on the chest prevents free breathing. The best method of standing is with the feet several inches apart, so as to afford a firm base for the body; the arms should hang freely by the sides. It is not judicious to keep the children standing, even in a good posture, more than a quarter of an hour. When seated to write, they will generally be found in a variety of bad postures; the only correct one is with both fore-arms leaning on the desk, and supporting the trunk, which should never lean on the edge of the desk. A bad posture in writing prevents free breathing, and causes contraction of the chest and stooping.

The visitor will do well also to notice by what patterns the articles of clothing made in the school are cut. Very bad patterns are generally used; and schools should, therefore, be provided with

* The substance of most of the following remarks on day-schools is derived from a paper on the "Sanitary State of Schools," by Dr. Roth, in the "Literarium" of May 27, 1857.

† See Mr. Thomas Hopley's "Lecture on Respiration." London: Churchill, 1855.

model sets made in accordance with the laws of health.* The visitor should ascertain how much time is allotted to out-door exercise in the playground. Half an hour, both in the morning and the afternoon, should be thus spent when the weather is suitable; and when it is not, the children should march, or perform other gymnastic exercises in the school-room, for the same length of time. Ling's Rational Gymnastics, before mentioned, are very suitable for such children.

Many other things to be observed and inquired into will present themselves to the mind of a visitor who is thoroughly and intelligently interested in the physical well-being of the children, and a vast amount of good will result from her quiet visits.

Those of us who teach in Sunday schools may do much by earnestly and frequently inculcating the duty of using all means to preserve and improve health, as a command of God. We should oftener explain the breadth of the command, "Thou shalt not kill," show that it relates not only to instantaneous suicide and murder, by knife, halter, or poison, but also to suicide by inches, through unhealthy habits, and to slow murder, by forcing those dependent upon us to violate the divinely instituted laws of health. If we taught all this, we should save many from the common sin of self-destruction—many from walking the earth with the brand of Cain upon them.

In workhouses, many gross violations of the laws of health are committed which the lady visitors might doubtless do much to prevent, if their attention was not so exclusively directed to the spiritual state of the inmates.

"Workhouses," says a medical author, "are the hot-beds of ricketty and scrofulous disease." In an account of the sanitary condition of one of the metropolitan workhouses, it is stated that out of 1,089 inmates, 474, or 43·5 per cent are afflicted with chronic disease; of these, 9·3 per cent were infants under two years old, and 30·7 per cent children under fifteen.† Many proofs of the want of sanitary supervision in workhouses might be cited. One lady complains of the tight lacing which is practised in them through the ignorance and false economy of their managers. "In these establishments," writes this lady, "the girls' stays are provided by contract; they are not made to fit each individual, but each individual has to be fitted to them. New-comers are laced up in the boned straight-waistcoats of their predecessors, however different their figures may be. The weaker must give way to the stronger; the stays being generally the latter. The consequences

* Such patterns of clothing for women, children, and infants, may be obtained from the Ladies' National Association for the Diffusion of Sanitary Knowledge, 14a, Princes Street, Cavendish Square, London, and 17, Egremont Place, Brighton.

† "Aphoristic Notes on Sanitary Statistics of Workhouses," by Dr. Roth; page 3. London: Groombridge.

are often serious, for, vanity being indigenous even to workhouses, the young, growing girls not content with the unavoidable pressure of the boned stays, increase it by tight lacing." Many a good Board of Guardians sit in solemn conclave fruitlessly pondering that problem which seems to beat everything in Euclid hollow: "How to diminish the Poor Rate?" Would that some sensible women were there to tell them not to waste the parish money on the certain means of deformity and disease! Another lady states that after a visit to a poor bedridden inmate of one of the London workhouses, she was so completely colonized by tribes of insects unmentionable, that she was compelled to go to her medical attendant for some means of destroying them.

Such gross violations of the laws of health would doubtless be to a great extent prevented, if every lady who visits a workhouse were to pay intelligent attention to the sanitary condition of its inmates. "The Workhouse Visiting Society," an admirable association, from the working of which a vast amount of good may be confidently expected to result, appears, judging from its printed rules,* to intend only to devote systematic attention "to the moral and spiritual improvement" of those visited. If such is the case, this excellent society must inevitably be far less useful than it would be, if the promotion of sanitary improvement were also included in its plan.

However excellent our philanthropic schemes may be, if they do not practically recognise the importance of physical elevation, they fail to fulfil one of the primary conditions of complete success. Body, mind, soul, acting and reacting each one on the others—so God has made us. "What He has thus joined let none put asunder," even in thought. Never shall we evoke all the harmonies of the divinely-strung harp of humanity till we leave off continually playing on one chord.

Much, very much, more might be written on woman's work in sanitary reform, and yet half of it would be left unexplained; the thoughtful mind which contemplates it, will find its ramifications extending far into every sphere of womanly action.

Beside their own direct sanitary work, women may do much indirectly through their influence over fathers, brothers, sons, and the "nearer and dearer ones." The best and most useful men in sanitary and all labors are, other things being equal, invariably those with wives, mothers, daughters, and sisters, who encourage them in their good work. Men whose benevolent impulses lead them to enter upon public sanitary or other philanthropic labors, have almost invariably to encounter most depressing opposition and difficulty in the prosecution of them, and, to the shame of womanhood be it written, have often also to meet with discouragement

* Inserted in the "English Woman's Journal" of August, 1858. Article "Workhouse Visiting Society."

and want of sympathy by their own firesides. This results chiefly from woman's selfishness, ignorance, and timidity: selfishness which wishes to merge the man and the citizen into the mere bread-winner for his own household; ignorance that cannot read the signs of the times, or understand what God is calling men to do; timidity which fears that "He who feeds the raven, and providently caters for the sparrow," will not provide for those who sacrifice personal advancement to carry on His own work. From the member of parliament, endeavoring to introduce sanitary legislative measures, and the rich land-owner, anxious to improve the cottages on his estate, to the poor author or medical man spending his leisure in diffusing sanitary knowledge, all need woman's encouragement and sympathy, and it is part of her divine mission to bestow them largely.

Women's influence is sometimes needed to awake men to a sense of their duty with regard to the physical elevation of their dependents. Nobler words on this point can hardly be found than those of the writer whom we have before quoted—the Rev. Charles Kingsley: "A large proportion of your parish work will be to influence the men of your family to do their duty by their dependents. You wish to cure the evils under which they labor. The greater part of these are in the hands of your men relatives. It is a mockery for you to visit the fever-stricken cottage while your husband leaves it in a state which breeds that fever. Your business is to go to him and say, '*Here is a wrong, right it!*' This, as many a beautiful middle-age legend tell us, has been woman's function in all uncivilised times; not merely to melt man's heart to pity, but to awaken it to duty. But the man must see that the woman is in earnest: that if he will not repair the wrong by justice, she will, if possible, (as in those old legends,) by self-sacrifice. Be sure this method will conquer. Do but say, 'If you will not new-roof that cottage, if you will not make that drain, I will. I will not buy a new dress till it is done; I will sell the horse you gave me, pawn the bracelet you gave me, but the thing shall be done.' Let him see, I say, that you are in earnest, and he will feel that your message is a divine one which he must obey for very shame and weariness, if for nothing else."*

The sum of the whole matter is then, that we, as wives, mothers, heads of households, educators, and supporters of benevolent enterprise, are to a great extent responsible for the sore physical evils around us. Till we work for their removal with all our power, removed they never can be. Noble, disinterested men are devoting time, talent, and money to the promotion of Sanitary Reform, but their efforts alone will not suffice. Men drain and cleanse our towns, and build improved dwellings, but in them we practise a thousand violations of health's laws—men labor and legislate to

* "Practical Lectures to Ladies," page 56.

supply the necessaries of life to all, but we misuse them—men discover the truths of sanitary science, but we are too ignorant to apply them—so, after all, the work of physical elevation goes on but slowly. May we soon learn to do our part in it!

S. R. P.

LIST OF BOOKS RECOMMENDED AT PAGE 2.

1.—The Principles of Physiology applied to the Preservation of Health, and to the Improvement of Physical and Mental Education. By Dr. Andrew Combe. Price 3s. 6d. Simpkin and Marshall.

2.—Popular Physiology. By Dr. P. B. Lord. Price 5s. John Parker.

3.—A Treatise on the Physiological and Moral Management of Infancy. By Dr. Andrew Combe. Price 2s. 6d. Simpkin and Marshall.

4.—Letters to a Mother. By Dr. J. T. Conquest. Price 5s. Longman.

5.—Hints to Mothers on the Management of Health. By Dr. Ball. Price 5s. Longman.

6.—The Maternal Management of Children. By Dr. Bull. Price 3s. Longman.

7.—The Hygienic Management of Infants and Children. By Dr. T. Herbert Barker. Price 5s. Churchill.

8.—Elements of Health and Principles of Female Hygiene. By Dr. E. J. Tilt. Price 6s. Henry G. Bohn.

9.—Infant Treatment. By Mrs. Barwell; edited by W. & R. Chambers. Price 1s. 3d. W. & R. Chambers.

10.—A Few Friendly Words to Young Mothers, with Remarks on Monthly Nurses and Nurses in general. By one of the Maternity. Price 6d. Wertheim, Macintosh, and Hunt.

11.—Letters to the People on Health and Happiness. By Catherine E. Beecher. Price 3s. 6d. Sampson Low.

12.—Laws of Life, with Special Reference to the Education of Girls. By Dr. Elizabeth Blackwell. Price 2s. English Woman's Journal Company, 14A, Princes-street, Cavendish-square.

13.—The Gymnastic Free Exercises of Ling. Arranged by Rothstein, translated by Dr. Roth. Price 2s. 6d. Groombridge.

14.—Movements or Exercises, according to Ling's System. By Dr. Roth. Price 1s. Groombridge.

15.—Lectures on Bodily Exercise. By Thomas Hopley, Esq. No. 1, price 1s. No. 2, price 1s. 6d. Churchill.

16.—Lecture on Education. By Thomas Hopley, Esq. Price 1s. Churchill.

17.—Lecture on Respiration. By Thomas Hopley, Esq. Price 1s. Churchill.

ON SOME

XANTHOXYLOUS PEPPERS

FROM

NORTH CHINA AND MANTCHURIA

BY

W. F. DANIELL, M.D.,

STAFF-SURGEON.

[*From the* Annals and Magazine of Natural History *for September* 1862.]

Professor Simmonds F.R.C.S.
with the best wishes of his
friend the Author

NOTES ON SOME CHINESE CONDIMENTS OBTAINED FROM THE XANTHOXYLACEÆ.

[Plate V.]

I. *Chinese or Japanese Pepper* (Xanthoxylum piperitum, *DC.*).

Among other articles of food vended in the grocers' shops of the various provinces of the Chinese empire, may be enumerated collections of small dried fruits, consisting of dehiscent capsules or carpels of a plant belonging to the natural order Xanthoxylaceæ. These fruits are employed as a condiment not only by the inhabitants of the Japan islands, but also by those of China. In consequence of their exportation from the sea-ports of the former, they have received the designation of Japan pepper; but, so far as their predominant use extends, they may with equal propriety merit the corresponding term of Chinese pepper. The name by which it is known throughout the latter country is that of *Hwa-Tseaou*. With reference to the source of this product, we have hitherto possessed but scanty information. Mr. D. Hanbury has recently stated that the supply of the Chinese shops was exclusively derived from the *Xanthoxylum alatum*, Roxb.* This statement, however, does not appear to be correct; on the contrary, so far as my researches reach, it is the produce of quite a different species, viz. *X. piperitum*, DC. (*Fagara piperita*, Linn.). During the recent war in Northern

* Pharmaceutical Journal, ser. 2. vol. ii. p. 553.

China, this plant was frequently observed under cultivation along the line of march from the mouth of the Peiho to Hang-chow. Isolated trees might be noticed growing on the native farms or clearances on the banks of the river, from Taku to Tien-tsin. It was also found under culture in several of the gardens in the villages of Sinho, Taku, &c., in the vicinity and in the court-yards of a few of the yamuns in Tien-tsin, and in one or two of those in the town of Peitang. The general habit of this species is that of a bushy tree of moderate growth, about 15–20 feet in height, with compact, flexuose, prickly branches, flowering in June and July, and densely covered, when the fruit ripens in October, with numerous corymbose expansions of deep-red berries. In this latter condition it presents a very ornate aspect, and can readily be distinguished in this respect from the circumjacent shrubs, bearing in the distance a close resemblance to the *Crataegus oxyacantha*, or Hawthorn-tree of Europe. In October and November, the people in the suburbs of Tien-tsin were engaged in gathering the ripe capsules for winter use; and with the view, therefore, of ascertaining whether they were identical with the dried article exhibited for sale in the local markets, I was induced to take the fruit-bearing branches to different shopkeepers of the towns, who without hesitation pronounced them to be the same. Upon comparison, no difference could be detected either in quality or flavour. That this species is known in other parts of China may be inferred from the circumstance of several of the Coolie corps from the southern provinces, attached to the expeditionary force, collecting the fruit for their daily meals, whenever an opportunity offered. From its wide distribution, it is probable that several varieties of this product may exist, one of which (marked by broader leaflets, a panicled inflorescence, and few, if any, spines) was sometimes brought for sale to the markets of the southern Taku Fort. I was informed that the inhabitants in the maritime and other districts of Petchili often plucked the immature fruit both for use and commerce.

Although the Xanthoxylaceæ are to be met with more or less abundant throughout the tract of country that embraced the seat of war, I nevertheless failed to discover the *X. alatum*, which, if it had constituted the ordinary source of the condiment of the population of Northern China, would have been placed under cultivation: such, apparently, is not the fact. This pepper, independently of its consumption as a spice, has been supposed to possess certain medicinal properties, and to act as an antidote against poisons. It is, however, never retailed in the drug-shops as a medicine, but only in those depôts where various kinds of food are submitted for purchase. Taking into consideration the

preceding data, I can only arrive at the conclusion that the mercantile article denominated Chinese pepper, exported from various provincial sea-ports, is in a great proportion procured from the *X. piperitum*, DC.

II. *Anise Pepper* (Xanthoxylum Mantchuricum, *Benn.*).

Scattered among the oak (*Quercus Mongolica*, Fisch.; *Q. obovata*, Bge.), mulberry (*Broussonetia papyrifera*), and other trees that fringed the outskirts of the Tuns, or native hamlets, in the neighbourhood of Taku-shan (a small village on the eastern side of Talie-whan, in Mantchuria) were a number of arborescent shrubs or young trees, whose corymbose inflorescence, imparipinnate foliage, and widely-spreading branches rendered them somewhat conspicuous objects in the botanical features of the locality. They afforded the usual characteristics of the Xanthoxylaceæ, and, from dried specimens of the plants submitted to the consideration of Mr. Bennett, have been determined by him to be a new species, which will be subsequently described in this paper under the name of *X. Mantchuricum*. This production may be distinguished from the preceding species by the more erect and tapering trunk (10–20 feet in height), divergent branches, expanded leaves, narrow and smaller pinnæ with fewer spines, the peculiar deep-pink hue of the pedicels and entire peduncle, but more especially by the remarkable anise-like flavour of the capsules. The plant flowers in May and June; and the fruits, which crown the summit in terminal corymbs, are at first green, but gradually change into a deep-red colour towards the end of September, when they attain maturity. The carpels, as they ripen, dehisce and display a solitary, black, shining and slightly compressed seed, the singular appearance of a large number of which, when exposed at the same period, soon attracts the attention of the botanist. When dried, the carpels are one-third less in size, round or oval, wrinkled, pellucido-punctulate, and not roughly tuberculated as are those of the *X. piperitum*. The pericarp, however, in its unripe state, is studded with minute tubercular prominences, filled with an oleaginous secretion, that exudes on the slightest pressure, and to such a degree as to saturate the folds of paper in which the specimens were kept for preservation. The fruit, when eaten in its mature condition, is endowed with a pleasant sweetish taste and anise-like aromatic flavour, which, however, is dissipated to a great extent either by the process of exsiccation or by transmission to a colder climate. In aroma and other analogous qualities, it is much inferior to the seed-follicles of the *Pa-kioh*, or Star Anise tree (*Illicium anisatum*). By the inhabitants of the districts to which it is indigenous the

fruit is apparently valued for its carminative and stomachic virtues; and although it enters into the composition of several of their dishes, it is also frequently administered as a remedial agent, under the form of a tea or infusion, for the relief of various visceral diseases.

III. *Star or Bitter Pepper* (Xanthoxylum (Oxyactis) Danielli, *Benn.*).

This species was discovered on a small promontory to the northward of the village of Taku-shan, adjoining a small joss-house or temple near its extremity. It in general assumed the character of a moderate-sized bushy tree, from 10–20 feet in height, except on the verge of the cliffs, where it became of more stunted growth, dwindling into low brush-like shrubs. The majority of the larger plants flourished on the borders of a field of Sesamum (*S. orientale*), where they had evidently been reared for some specific purpose. An essential difference in the peculiar disposition of the fruit, and the more luxuriant development of the foliage, was observed when placed in comparison with the preceding species. The imparipinnate leaves were also of larger growth, being from 1–1½ inch in breadth, and 2–3 inches in length, ovate, obtusely acuminate, and almost smooth. The branches were destitute of spines and less tortuous. The flowering occurred in June and July, in numerous corymbose panicles. The fruit consisted of a variable number of oblong or elongated capsules, arranged in stellate groups on a series of terminal panicles, which were at first of a deep green, but imperceptibly altering into a dusky-red colour as they advanced towards maturity, in September and October. The carpels are 8–10 lines long, and about 1–2 broad, dehiscing longitudinally into separate portions, and exposing to view two small, black, shining seeds. The epicarp was completely dotted over with tubercular receptacles or vesicles, containing a straw-coloured oil, or oleo-resin, which copiously oozed forth on any abrasion of its surface. The capsules have a peculiar aromatic odour, with a pungent bitter flavour and warm burning taste, that subsequently imparts to the palate a sensation of coolness when the air has been drawn into the mouth.

Although informed by the natives that these carpels were employed as a condiment, and also for certain medicinal and other economic uses, I was unable to obtain any precise statement illustrating their mode of appliance. That this and the anise-pepper are of some utility, may be inferred from the care taken in the preservation of the trees; for, owing to the great dearth of fuel, no brushwood of any kind is permitted to grow throughout the country, the inhabitants being reduced to the necessity

of burning dried grass and the stalks of *Zea*, *Panicum*, and other Cerealia, to cook their food.

I am indebted for the specific distinctions and following botanical details to Mr. Bennett of the British Museum, who, with unvarying kindness, has embodied the whole in a concise descriptive account contained in the appended letter. He remarks, with reference to the application of the term *Xanthoxylum* to these Chinese species, that he so spells "the name in conformity with its etymology and with the practice of Smith, Sprengel, Martius, and Bentham, and in spite of the authority of Linnæus, Kunth, and DeCandolle, in favour of *Zanthoxylon*.

"Your specimen from Tien-tsin agrees perfectly with *Fagara piperita* of Linnæus, which is entirely founded upon the 'Teo and Tansjo' of Kæmpfer, to whose figure your specimen bears the most striking resemblance. This figure and the description which accompanies it, together with the very accurate character and description given by Siebold and Zuccarini in the 'Abhandlungen der Mathem.-Physikalischer Classe der K. Bayerischen Akademie,' iv. p. 137, leave no room for any addition. We have in the herbarium of the British Museum a miserable specimen from Kæmpfer himself, and a tolerable one from Thunberg, which entirely confirm the identification. I have some doubt with respect to your specimen from the Taku Fort, on account of the total want of prickles, the larger size of the leaflets, and the more ample and almost panicled inflorescence; but as it agrees in all other points, I am disposed to consider it only as a variety.

"You ask me whether this plant is the true source of the Japanese pepper; and of this I imagine there can be no doubt, the authority of Kæmpfer, Thunberg, and Siebold being decisive on this point. But you mention *Xanthoxylum alatum* as having been so regarded. I know of no Asiatic species so called, with the exception of Roxburgh's (Flor. Ind. iii. p. 768), which appears in DeCandolle's 'Prodromus' under the name of *X. acanthopodium*, and differs very widely indeed from the Chinese and Japanese species by its strongly winged and strongly armed petioles, and by its very short and sessile axillary cymes. Its seeds (or, more probably, its capsules), as we learn from Roxburgh, are used medicinally; but this is doubtless the case with many of the species, on account of their peculiar taste and odour. The true Japanese pepper, however, must be that which is found in Japan, and which was originally described by Kæmpfer, and adopted from him by Linnæus*.

* "Since I wrote to you on this subject, I have looked over Mr. Hanbury's paper in the 'Pharmaceutical Journal' for the present year (1861), and find that he speaks of the fruits of two species of *Xanthoxylum* as sold in the

"Your Mantchurian specimen from Talie-whan is certainly distinct, and differs, I think, from all the species hitherto known. I characterize it as follows:—

"*Xanthoxylum Mantchuricum.*

"*X.* aculeis sparsis v. infrapetiolaribus rectis conicis armatum, foliis sparsis imparipinnatis 5–9-foliolatis, foliolo terminali sessili, omnibus oblongo-lanceolatis utrinque attenuatis subsessilibus crenato-dentatis superne punctulis elevatis piliferis scaberulis cæterum glaberrimis, in crenarum axillis nec alibi in lamina pellucido-punctatis, corymbis terminalibus, coccis 1–3 punctulato-rugosis.

"The differences between this species and *X. piperitum* are obvious from the character: they mainly consist in the narrower form of the leaflets, the slight scabrities of their upper surface, which I have not noticed in any other species, the entire absence of pellucid glands, except in the axils of the marginal crenatures, and the surface of the cocci, which, instead of being rudely glanduloso-tubercular, as in *X. piperitum*, are merely pellucido-punctulate and wrinkled. The common petioles, which are angular, are from 2 to 4 inches in length, and the leaflets from 8 to 10 lines long by 3 or 4 wide. This species I had at first, as you are aware, considered as identical with *Fagara Avicennæ*, Lam.; and, as far as the description of that plant goes, I see little to distinguish them, except the generally smaller number of leaflets and the little asperities of their surface; but as Mr. Bentham has, in his 'Flora of Hongkong,' identified Lamarck's plant with a totally different species, to which Lamarck's description is at least equally applicable, I adopt his determination without hesitation, and describe your plant as new. I may add to the synonyms of *X. Avicennæ*, DC. and Benth., the *X. clava Herculis*, Lour. nec Linn., as proved by Loureiro's specimen in the herbarium of the British Museum.

"Your other *Xanthoxylum* from Talie-whan is one of the finest and most remarkable species of the genus. Many botanists, I doubt not, would regard it as constituting a new and very distinct genus; but, taking into account the numerous transitional modifications of structure and the consequent phalanx of merely

Chinese markets, the one the produce of *X. piperitum*, L., the other *X. alatum*, Roxb. The fruits of both species are remarkably similar in character; but I have not seen any specimens of the plant from China which can be positively identified as *X. alatum*. I have little or rather no doubt, however, of the identity of *X. alatum*, Roxb., and *X. acanthopodium*, DC. The specimens distributed by Dr. Wallich under the name of *X. alatum*, Roxb., agree in every particular with DeCandolle's character of *X. acanthopodium*; and the fragment preserved in the Indian herbarium of the Linnean Society, from Dr. Roxburgh's own collection, cannot be distinguished from them."

conventional genera that have already been formed at the expense of this extensive and polymorphous group, I cannot but agree with those who prefer to unite them all, or nearly all, under one generic name. I regard your plant, however, as offering sufficient characters to constitute a well-marked subgenus, and I am disposed to consider in the same light *Euodia* and *Boymia* (whether kept separate or combined), inasmuch as approximations to a valvate æstivation of the petals and superposed ovules are to be found in species having alternate as well as opposite leaves. If opposite leaves and superposed ovules were alone to be regarded, your plant would belong to the same division with *Euodia* (*Boymia* included); but as far as I am acquainted with the fruit of the other species, it differs from them remarkably in the form and arrangement of the cocci. I proceed, therefore, to give its characters as a subgenus, premising that I have seen only specimens with ripe fruit:—

"Gen. Xanthoxylum.

"Subgen. *Oxyactis*, Benn.

"*Cocci* 5 (rarius 4), stellatim dispositi, in valvulas 2 apice acuminatas dehiscentes, ideoque æqualiter 10- (8-) radiati. *Semina* 2, perfecta, superposita.

"*X.* (*Oxyactis*) *Danielli*. Pl. V. fig. 1.

"*X.* inerme, foliis oppositis imparipinnatis 5–9-foliolatis, foliolo terminali longius- reliquis brevipetiolulatis, omnibus basi rotundatis ovatis obtuse acuminatis superne glabris inferne in nervis margineque puberulis obscure crenulatis nisi in crenularum axillis impunctatis, corymbis (fructiferis) folio brevioribus terminalibus divaricatim ramosis.

"The common petioles are from 3 to 6 inches long, rounded, and perfectly smooth; the leaflets from 2 to 3 inches long, and an inch or more in breadth, rounded or slightly cordate at the base, the lower ones in pairs supported on petiolules of 2 to 3 lines long, while the terminal one has a petiolule of an inch in length; and the terminal corymb expands almost into a panicle. The combined fruit, after dehiscence, measures fully half an inch across. In some respects the plant appears to approach *Euodia meliæfolia*, Benth. = *Megabotrya meliæfolia*, Hance = *Boymia glabrifolia*, Champ., but differs widely in the character of the fruit, in the crenulate margin of the leaflets, and in the pubescence of their nerves, none of which characters are indicated in the several descriptions of the plant of Southern China. A northern plant, *Phellodendron Amurense*, Rupr. in 'Bull. Acad. St. Petersb.' and in 'Maxim. Prim. Flor. Amur.' p. 73, t. 4, also bears considerable resemblance in its habit, in the size and composition of the

leaves, and in the form of the leaflets, but, if the fruit be correctly figured, is very different indeed."

EXPLANATION OF PLATE V.

Fig. 1. *Xanthoxylum* (*Oxyactis*) *Daniellii*; leaf and inflorescence, two-thirds of the natural size.

Fig. 2. Separate carpella, of the natural size.

Fig. 3. Seeds, of the natural size.

INFANTICIDES—SUICIDES.

INFANTICIDES—SUICIDES.

May not such crimes be checked; their frequency prevented? According to report many remain undetected.

The ingenuous remarks of learned foreigners on our institutions, should not pass unnoticed, become especially valuable and worthy of grateful consideration, when submitted to us for the prevention of misery and crime.

Corvisart, Dessault, Scarpa, Roux, and Girard, were all admirers of our charities and medical establishments; many others, recent visitors of our Crystal Palaces, etc., have been loud in their encomiums of England and of her various attractions. Some deficiencies have not escaped observation and criticism.

In one respect they consider themselves greatly in advance of England. They had, and probably still have, a *real, magnificent Charity*, free, open to all, without jobbery or patronage; not requiring even a letter of recommendation or any questioning. Like our Floating Hospital, the *Dreadnought*, free and open to

sailors of *all* countries; a real, magnificent charity, doing great honour, not only to our own country, but to humanity generally.

So their "*Enfants Trouvès.*" If that large establishment with its branches, still is, what it originally was, with its former endowments and contributions, it certainly deserves all the praise bestowed upon it.

Infanticide and crime were checked by it in France, no doubt the same results would be expected from similar establishments in England.

The plan and original regulations were excellent, and should be known.

A similar establishment existed for many years at Milan, and was greatly patronised by the Emperor, Joseph the Second, and by his royal mother; both were beloved; their mild and careful administration had won for them the attachment of all northern Italy.

The Orfanotrofio of Milan was upon the plan of that of Paris, and prospered up to the period of revolutionary wars in 1796. Moscati, the eminent physician, was then the Resident Director. Both these were real, fine charities; were fully what their names announced, for "Foundlings," and for Foundlings *only*, for nothing else. Their funds were not to be perverted to any other purpose than to the care and training of Foundlings.

Had such asylums existed under the same rules as abroad, with moveable closets, open in front, having shelves, for receiving deposited children, the closets turning round upon pivots, above and below, many of

the horrible tragedies, frequent of late, would not have occurred. After months of hard labour and destitution, industrious, worthy women, in *despair*, having released their children from hopeless misery, and in "extreme maternal affection," not to be separated from their offspring, have destroyed themselves. In the foreign asylums, the children deposited might have been identified, and reclaimed after the lapse of two or three years, or more; a paper, stating name, age, health, with any bodily mark, a bracelet or necklace, was expected with each child, and a registration was strictly kept for those likely to be reclaimed.

Such was the credit and support of the "Enfants Trouvès" under the *ancien regime*, that ladies of the highest classes, in want of nurses, would send there and be well supplied, at a fixed rate, by the week or month. It was a part of the system to have properly trained nurses, from the country branches, in readiness for such demands.

The question has been mooted whether England may not be especially benefited, by the collecting and training of Foundlings. Good subjects will long be in request for the Army, Navy, and public services, for our splendid colonies, Australia, Western Canada, rising rapidly in prosperity, and elsewhere. According to reports recently sent to the Geographical Society, large tracts of fine land, scarcely peopled, under luxuriant natural vegetation, have been explored in northern and western Australia.

According to a late census of population, in some of

our possessions there were more than *four* men to every woman. The soil and climate are generally favourable to organic life. Long ago, Scott, Archdeacon of Australia, during seven years presided over the schools and churches, reported the children of the residents, and of the expiated convicts, as a remarkably fine generation, rising especially around Sydney and in the south. Subsequent experience has confirmed Scott's report. Sick officers in the East India Company's service with sickly children, have been since habitually sent to Sydney, for the recovery of health, on six months' leave, and with good results.

Female Foundlings, not likely to be reclaimed, might be sent out at an early age, with great advantage to themselves and to the colony, under proper matrons.

Some years ago, a naval medical officer established a *stud* for breeding horses, on Swan River. He has succeeded in his undertaking. Many fine horses have been reared there, and sent to India for the native cavalry of the East India Company.

Since the early establishment of the Mac-Arthur Colony, in the reign of George the Third, such improvements have ensued as were expected from the associate of Sir John Sinclair, Coke, of Norfolk, and of Arthur Young; especially in the breed of cattle, of sheep. The Mac-Arthurs have been great benefactors, both to Australia and to the mother country. Vast crops of the *finest* wool, have been regularly sent to our clothiers in England. Large quantities of good oils have been obtained from the fisheries and other sources: in short,

under their auspices, and the genial influence of climate, the air, the land, the seas, all alive, all teeming with animation, that country has risen rapidly, is still rising to unprecedented prosperity. Moreover, the quiet Pacific, not subject to the awful agitations of the Atlantic, and its icebergs, is the sea most favourable for Steam Navigation.

With respect to Canada, though we have had it longer than Australia, though much nearer home, with the beautiful and voluptuous cities of Quebec and Montreal, now to be reached in a voyage of a few days only from Galway, we still are little acquainted with western Canada, it is still a sort of *terra incognita* to us.

Extensive tracts, with strong luxuriant natural vegetation, are unpeopled; with healthy climate, though not so mild as the Australian.

By a concurrence of extraordinary events we shall soon be made fully acquainted with this valuable country and its advantages. It is now thrown open to us, 1st, by the Grand Trunk Railway, running above 1200 miles directly through it from the Atlantic, towards the Pacific, westward. 2nd, by the Victoria Monster Bridge across the St. Lawrance, in conjunction with the said Railway; both stupendous works connecting all the cities of Canada with each other, and opening direct communication between the Canadian cities, north, with the United States, south of the Monster Bridge. 3rd, by the well-judged, well-timed opening of the Bridge, and the visits and ovations to His Royal Highness Prince of Wales in the Canadian

cities on one side, in the United States on the other side of the Bridge.

While disturbances, tribulations, collisions, and destructions are prevailing in the *Old* World, in the *New* World we see His Royal Highness, the young hereditary Prince of England, gloriously occupied, in the midst of rejoicings, inaugurating wonderful constructions—laying foundations for the future prosperity and mutual attachment of interesting countries—cementing unions, which never should be otherwise than cemented—everywhere receiving the warmest welcome, greetings, and congratulations in honour of Her Most Gracious Majesty, whom he represents, of himself, and of the missions he is engaged in; with the importance of which, glad and grateful populations seem duly and deeply impressed.

From the remarks of

AN OCTOGENARIAN

MILITARY MEDICAL OFFICER, IN RETIREMENT.

September 15*th*, 1860.

OXYGEN — AND OXYGEN +

CONDENSED FROM

G. MEISSNER'S

UNTERSUCHUNGEN

UBER DEN

SAUERSTOFF.

BY

SURGEON MAJOR R. S. TRIBE,

H. M. MADRAS ARMY.

MADRAS:
GANTZ BROTHERS,
ADELPHI PRESS, 175, MOUNT ROAD.

1865.

PREFACE.

A QUARTER of a Century has elapsed since Schönbein first discovered ozone, and, judging by the vague and contradictory accounts given in late treatises on Chemistry and Hygiene, very little appears to be known about it: the fact being that ozone and antozone, not merely two different but two antagonistic substances, have been confounded the one with the other.

Meissner's researches, now translated, reconcile many apparent contradictions, and unite many disjointed fragments and opposing statements into a comprehensible and consistent whole. They not only irresistibly lead us to the conclusion that chemical combination is nothing but union of substances differently electrified, but they explain how this combination may take place. What was little more than a mere phrase is become a fact.

No one can peruse these researches of Meissner's without perceiving that a great advance has been made in explaining the causes of many appearances which, without a knowledge that oxygen could be polarized, were, to say the least, very puzzling. To talk of nascent oxygen was to state a fact by using a meaningless term that expressed no definite idea, but negatively electrified oxygen is comprehensible to all who do not deny its two-fold nature.

Should we ever be able to explain the how and the why of malarious intoxication, it will be by a thorough comprehension of all the phenomena attending the polarization of oxygen. In the same manner any prophylactic measures that may be devised to avoid, neutralize, or destroy malarious emanations must, unless empirical and fortuitous, originate in a knowledge of these same phenomena.

In translating these researches, I have endeavoured to give Meissner's meaning without his verbosity and continual repetitions, and have omitted much that appeared of trifling importance. A few observations not in the original have been placed between [ ], and the attempt to explain the phenomena of the simoom is not in the original. Meissner is a most diligent and pains-taking observer of facts, and whether we agree with his deductions and explanations or not, the fullest reliance may be placed on his statements of facts.

SECUNDERABAD,
12th February, 1865.

PART I.

THE RELATIONS OF ELECTRICITY TO OXYGEN.

1. ELECTRIFIED OXYGEN.

1. It being well known that ozone is produced by electrifying oxygen, we proceed to find out if any other change besides this takes place when oxygen is electrified.

2. The best way of finding this out appeared to be to electrify dry air, absorb the ozone thereby produced, and see if the remaining air possess any property which ordinary air has not. Various means may be used to deprive the air of its ozone; some, as a high temperature, destroy the ozone before it enters into any combination, while others combine with the ozone. Of these two, the latter appeared to be the most suitable, as many easily oxydisable substances absorb ozone at ordinary temperatures: a solution of iodide of potassium at once absorbs every particle of ozone, when the latter is passed through without the necessity of any prolonged contact.

3. If perfectly dry air, after being strongly electrified by the apparatus described in the appendix (No. I), be passed first through a saturated solution of iodide of potassium and then through water, the following appearances present themselves: before the entrance of the air into the solution of iodide of potassium, there is nothing particular to be seen; everything being perfectly clear and transparent. Beyond the iodide solution for depriving the air of its ozone to its entrance into the water of the second receptacle, there is nothing remarkable; but the stream of air comes out of the water as a dense white mist, which may be thick enough to make the vessel above the water, when filled with mist, quite opaque. If all the air tubing be dry, the iodide solution quite saturated, and no moisture between the washer for the iodide and that for the water, so that the dried air first comes into contact with water in the second washer, this dense mist is visible only over this water. Where the solution of iodide of potassium is not saturated, a much fainter mist may be seen over this likewise.

4. This mist exactly resembles the steam arising from the condensation of vapour over boiling water; but there is no elevation of temperature, the ordinary temperature prevailing throughout the current of air, the iodide solution, and the water. Moreover, the temperature within certain limits has no effect on the production of this mist: it matters not whether the deozonised air be passed through water at 32° or at 100°.

5. To produce this mist, it is not necessary to pass the deozonised air through water: it is enough to pass it over water or into a vessel of air saturated with moisture, or even into the open air, provided the latter be sufficiently moist.

6. *Ceteris paribus* the more saturated with moisture the place is into which the deozonised air is conducted, the denser the mist. If the air be passed from the solution of iodide through tubes or washers quite free from moisture derived from the solution, it forms no mist: it may thus be carried a considerable distance as transparent as ordinary air, without anything particular in its appearance: but the moment it comes into contact with moisture, mist is formed. If the air be dried after passing through the iodide, it is perfectly transparent so long as it remains dry. If a large dry receiver be filled with this deozonised air free from mist and shut up close, it remains transparent until some water is shaken up in it, when mist is immediately formed.

7. It is, therefore, evident, that moisture is absolutely necessary for the production of mist.

8. The mist appears under the conditions mentioned, only so long as the electricity is passing through the tube. So soon as the electricity is interrupted, the mist ceases, and begins again so soon as the circuit is again completed; of course, allowing sufficient time for the removal of the mist, and for the re-arrival of the deozonised air.

9. There can, therefore, be no doubt whatever that this formation of mist, which takes place at ordinary temperatures, is dependent on the electrifying of the air, and that the formation of mist depends upon the same cause as the production of ozone. If the electricity be weakened, less ozone appears, and the density of the mist decreases in a corresponding ratio.

10. Of the conditions necessary for the formation of mist, one is known for certainty, viz., the presence of moisture. It is next to be proved that the remaining conditions are contained in the electrified and deozonised air: that, except

the water, nothing else *ab externo* is required. If deozonised air be collected over water that has been boiled, the vessel is filled with dense mist.

11. If the cause of this mist were not in the air before its passage through the iodide, it would not be seen where other substances are used to deozonise the air. If an alcative solution of pyrogallic acid, a solution of albumen, or other easily oxydisable substance be used to absorb the ozone, the mist is formed just the same. These substances differ so much in their nature, that not even a suspicion can be entertained that they have anything whatever to do with it.

12. It is also possible to obtain direct proof that such is the fact, for if dry electrified air be passed through water or through a moistened tube without being deozonised, the mist is formed just the same.

13. The latter experiment, however, is much more difficult than the former, and the absence of mist where ozone was present, was very unaccountable, until it was found that the desiderata were, that absolutely dry and strongly electrified air should come suddenly into contact either with water or with air perfectly saturated with moisture. A degree of dryness on the one hand, or of moisture on the other, amply sufficient to form mist with deozonised air, fails entirely to do so in the presence of ozone. Should the dry air first come into contact with but a minute quantity of moisture, it entirely loses its power of forming mist, unless previously deozonised.

14. Of course, no mist is formed if the electrified air flows out into the open air, unless the latter be saturated with moisture; but if a drop of water be brought to the edge of the ozone tube, mist is immediately formed, while, should a drop of water by accident fall into the ozone tube, the whole experiment is spoiled. Should this experiment not succeed, we may be sure either that the air is not perfectly dry, or that the electricity is not strong enough.

15. From the above experiments, it may be concluded that the formation of mist is due to something in the electrified air, and as nothing but a dry mixture of oxygen and nitrogen is exposed to the action of electricity, and as this mixture may be freed from all known impurities without influencing the result, the cause of it must be sought for either in the oxygen or in the nitrogen, or in a mixture of both. The simplest way of deciding this is, to submit them separately to the action of electricity.

16. This was done first with pure oxygen, every possible precaution being taken to prevent the smallest admixture of nitrogen: as a gasometer could not be used, the experiment was an exceedingly difficult one, much time being taken in completely emptying the space of air. When the dryness was perfect, the electrified oxygen produced mist both with and without previous deozonisation. The experiment was performed with complete success with oxygen produced by electrolysis from water, as well as with oxygen obtained from chlorate of potash.

17. When the experiment was performed either with perfectly pure nitrogen or hydrogen, no mist whatever was formed, but a small admixture of oxygen caused a proportionate amount of mist to be formed.

18. Meissner's experiments have thus completely confirmed the results formerly arrived at by De la Rive Marchand, Fremy and Becquerel, and Schönbein. There can be no doubt but that the cause both of ozone and of the mist, when it comes into contact with water, is contained in electrified oxygen.

19. Two assumptions may be made as to this power of electrified oxygen to form mist: either that ozone in contact with water or its vapour undergoes a change and becomes modified in such a manner, that while it is not ordinary oxygen it loses the characteristic oxydising property of ozone and acquires that of forming mist with moisture. In this case, of course, only a portion of the ozone is absorbed by the iodide, while another portion loses its oxydising property, and acquires that of forming mist: moreover, a portion of the ozone, merely by contact with moisture, must undergo this transformation. Further, if we assume that the formation of ozone is the only action of electricity upon oxygen, we must regard this property of its forming mist as but secondary.

20. The other view is, that mist forming or fuming oxygen is produced directly by electricity, as well as and together with ozone.

21. The improbability of the first assumption is self-evident, and future researches will show its impossibility. But, it may be asked, cannot some substance be used to cause the disappearance of this fuming oxygen, as iodide of potassium removes ozone? Cannot it be managed to remove the fuming oxygen, and leave the ozone unchanged? so that the latter, while retaining its peculiar properties, can no longer

form mist when brought into contact with moisture. This can, in fact, be done, though in a manner different from that employed for the removal of ozone, as there is no substance which attracts this fuming oxygen as iodide of potassium does ozone. But this fuming oxygen possesses another property by which it can be removed from ozone, leaving the latter unchanged, and which will hereafter be mentioned. We must, therefore, here anticipate the result of this experiment, and regard the second assumption as proved.

22. Schönbein, having come to the conclusion that there existed a second excited state of oxygen distinct from ozone, designated it antozone, but the Göttingen Professor at first gave to this substance the name of atmizone (from ατμιξω, I smoke), as it was not found to agree in all its properties with Schönbein's antozone, and Meissner performed very many experiments before he arrived at the conviction that they were one and the same substance. It was often only where Meissner failed in his experiment, mostly from the air not having been perfectly dried before it was electrified, that he succeeded in obtaining the results indicated by Schönbein.

23. We now proceed to enquire more particularly into the behaviour of this mist. If electrified air deozonised by iodide of potassium be passed through water, each bubble as it rises to the surface is filled with a dense white mist, which at first lies on the surface of the water, and only rises and ultimately flows over, through being forced upwards by the following bubbles as they rise to the surface. When the air in the room is quite still, this mist flows over and slowly sinks like little clouds. If the mist be passed into a bowl or cylinder, the vessel is gradually filled from below upwards with layers of mist which gravitate towards the bottom, and are sharply defined from the transparent air above it. In this way, a vessel may be filled with white mist which only begins to flow over when the vessel is full. This mist remains a long time in the open vessel unchanged, separating itself into little formed masses with a rounded surface,—in fact, into little clouds.

24. If a dry bowl containing a quart or so be filled with mist and allowed to remain closed, the bowl, through which at first day-light could not penetrate, becomes gradually transparent, and the air, in from half to three quarters of an hour becomes quite clear. In this disappearance the mist not merely decreases, it becomes more diffused and less

sharply defined. During this gradual disappearance of the mist, the inner surface of the bowl becomes bedewed with moisture, which at first, like condensed breath, may be removed by the finger; but gradually, as the mist disappears, small drops of water are seen, which, if there be mist enough, flow together in large drops at the bottom of the vessel. This bedewing increases from above downwards as the mist first disappears at the top, and slowly sinks.

25. In the course of some half an hour or more, this mist forming oxygen, this antozone, gives up the water with which it formed mist, and lets it fall in the form of fine rain without any external change of temperature outside or any perceptible cooling inside the bowl. Now, by shaking the air left with water no more mist is to be obtained, the power of forming mist is no longer there, there is nothing in the air in the bowl to distinguish it from ordinary oxygen or air. The antozone meaning by this term a quality which may be communicated to oxygen by electricity, has disappeared. The water deposited may be pure water or contain various extraneous substances in solution.

26. By continuing the passage of electrified air through water for some time, a considerable quantity of water may be collected: but when non-electrified air is treated in the same manner, *i.e.*, saturated with moisture and conducted into a vessel, no water is precipitated unless considerable cooling take place, however long the process may be continued.

27. The mist of which we are speaking consists of antozone and condensed vapour, the former having the property of condensing moisture and forming mist with it. In forming mist it gradually loses this property, *i.e.*, the antozone as such disappears, and the mist-water which cannot exist in the gaseous form in a place already saturated with water, falls down as rain, which expression is much more appropriate than dew, to which it has a much greater resemblance in appearance, but which signifies that it was precipitated on the bedewed body because its temperature was lower than that of the air, which is not the case with this precipitate from the disappearing antozone mist.

28. Many substances, as concentrated sulphuric acid and chloride of calcium, have a stronger attraction for water than antozone, so that they can withdraw the water from the mist. If antozone mist be passed over a sufficient surface of sulphuric acid or chloride of calcium, the mist disappears,

and the air appears clear and transparent without any disappearance of the antozone: and if this antozone be again passed through or over water, the mist re-appears. If the air be passed from the sulphuric acid or chloride of calcium tube through a dry tube and then into moist air, we may see that only the mist and not the antozone was destroyed by the drying.

29. Many concentrated solutions, as those of the chlorides of barium, sodium, and potassium, iodide of potassium, sulphate of magnesia, caustic, potash, &c., possess the power of removing water from mist and rendering it clear, while their more dilute solutions again yield water to the same antozone to re-form mist. So, of course, when a saturated solution of iodide of potassium is used, there is no mist over it, but should the solution be dilute, there will be mist over it. By shaking even a saturated solution, enough moisture may be evaporated to enable the antozone to form mist; but all these experiments depend much on the amount of antozone in the air and on the degree to which it has been electrified.

30. If a stream of air containing antozone be led from a narrow-mouthed tube through an inclined tube filled with water in which the gas-bubbles ascend slowly, these bubbles, at first transparent, may be seen gradually to become opaque as they go through the water. As mist consists of condensed water and not of vapour, its amount is not to be taken into consideration in estimating the point of saturation as dependent on temperature, when compared with ordinary air under similar circumstances. As antozone arrives in air standing over and saturated with water, it continually condenses more and more vapour until the amount of moisture in the air is very great. If the increase of weight which a tube filled with chloride of calcium obtains from a certain amount of electrified air saturated with moisture, be compared with the increase derived from the same amount of common air under similar circumstances, it will be found to be about double.

31. A dry stream of electrified air has a much stronger drying quality than a stream of common dry air at the same temperature. A wet tube in which antozone forms mist is much sooner dried by the antozone passing through it than by ordinary dry air. Since antozone, on arriving in moist air, condenses the moisture, it follows to reason that it must have a very drying effect.

32. As electrified air can contain much more moisture than common air, it requires a much more effective apparatus to dry it, and even where there is not sufficient moisture for the antozone to form cloud, the antozone may, by its attraction for vapour, prevent the air from being dried. As antozone has a drying effect where it forms cloud, it has the very opposite effect where it deposits its moisture, without any lowering of the temperature: the mist left to itself in contact with moist air and the glass wall of the receiver gradually disappears, while the antozone loses its attraction for water, *i. e.*, it disappears, ceases to be antozone: and this happens quicker when hygroscopic substances attract the moisture or by the admixture of dry air, or by warming the air and thus raising the point of saturation.

33. As ozone designates a certain property communicated to oxygen by electricity, antozone designates another property communicated to oxygen by the same agent. This property disappears in the presence of moisture in a comparatively short time—in from 30 to 45 minutes, without any change of external circumstances. This antozone does not disappear by entering into any chemical combination, and when this property is lost, there being nothing to distinguish it from ordinary oxygen it may be regarded as such. To this dying or fading away the Germans have applied the term "*abklinging*,"—meaning not merely the gradual disappearance of the antozone, but also the diffusion of its peculiar properties among surrounding atoms: the term is used to indicate the gradual cessation of motion or sound, as when a bell ceases to ring: it may be as well to retain this term for convenience.

34. This gradual diminution of the attraction for water as the antozone abklings is curiously exemplified in the following experiment, in which a substance containing water is made first to yield its water to antozone and then to withdraw it. If strongly-electrified deozonised air be first passed through alcohol of 80 per cent., then through water, then through alcohol of the same strength, and, lastly again through water, slight mist is formed over the first alcohol, and dense mist over the first water, while over the second alcohol it is perfectly transparent though over the second water mist again makes its appearance. The same experiment may be performed, with similiar results, if other hygroscopic substances be used.

35. If deozonised air be passed through a number of

receptacles with water, this gradual abklinging is to be noticed as the mist becomes weaker in each successive washer. As antozone begins to abkling from the moment of its coming into contact with moisture, the washer's tubing, &c., should have the smallest possible dimensions: with 4 or 5 quarts of air to be electrified in the hour, the washers in which the air is deozonised saturated with moisture, &c., should not exceed 3 or 4 cubic inches.

36. The stronger the air is electrified, the less quickly does it abkling: if two bowls of equal size be filled, the one with air strongly electrified, deozonised and saturated with moisture, and the other with air similarly treated, but not so strongly electrified, the first has a denser mist than the second, and takes longer to abkling. It does not, however, follow that a small quantity of strongly electrified antozone is equal to a larger quantity somewhat advanced in abklinging.

37. If several glass receivers are filled with electrified deozonised air that has been thoroughly dried, they can be examined at leisure: the antozone will be found to abkling, though much slower than when in contact with moisture, for after as much as an hour and a half it will be found to form mist when brought in contact with moisture.

38. Ozone is very permanent compared with antozone.

39. If a large flask be filled with air not deozonised and be well closed, so that the air is in contact with nothing but pure water and glass, the antozone disappears in a very short time, while the ozone is scarcely diminished, and months afterwards possesses all of its original properties unchanged.

40. On this great and characteristic difference in the behaviour of these two conditions of electrified oxygen depends the possibility of removing not the ozone from the antozone, but the latter from the ozone, by causing the antozone to disappear, which proves that the latter does not arise from ozone, but is produced by electricity together with it. If a large flask be filled with strongly electrified air and shaken with water, mist is produced, which gradually disappears, and after the air has become transparent, cannot be again produced even by deozonising the remaining air; while the ozone, or at least the greater part of it, remains unchanged, proving that antozone is originally different and distinct from ozone, and all facts are in agreement with this assumption.

41. Both antozone and ozone are immediately destroyed, *i. e.*, converted into ordinary oxygen by a heat of from 230 to 240 Fahrenheit.

42. Antozone disappears quicker in the dry than in the moist state when passed over spongy platinum, or over the peroxydes of lead or manganese. An extended and intimate contact is, however, necessary, and the more so the stronger and the greater in quantity the antozone.

43. The temperature, so long as it is not below 32 nor above 100, seems to have but little effect either on the production or behaviour of ozone and antozone, but, on the whole, a low temperature appears to be more favourable than a high one. But when water approaches the boiling point, antozone is quickly destroyed, though the mere boiling heat does not destroy it, but only hastens its abklinging.

44. We have hitherto examined the behaviour of antozone only when deprived of ozone; it now behoves us to examine its behaviour in the presence of ozone.

45. When ozone is present every other condition must be favourable, *i. e.*, the air must be absolutely dry, it must be strongly electrified, and it must come suddenly into contact with abundant moisture; and should any one of these conditions fail, either no mist or but very little will be formed. A diminution in the strength of the electricity, or an amount of moisture either before or after the electrifying has taken place, that exercises but little influence on the deozonised air, may entirely prevent the formation of mist with air that has not been deozonised. This would appear to depend upon a certain property possessed by ozone in reference to antozone, of preventing the latter from exercising its influence, of keeping its powers in abeyance, and not from any diminution in the quantity of antozone.

46. The following experiment is very striking. If well dried and strongly electrified air be passed through or over water, very little mist makes its appearance; but if it be then passed through a solution of iodide of potassium, and again through water, dense mist is formed, even when there is none over the first water, notwithstanding the abklinging which must have taken place. Or, let electrified air be passed through water into a vessel, and the ozone absorbed by iodide of potassium: if the deozonised air be then shaken up with a little water, mist will appear, though very little or none was to be seen before. But if the electrified air be deozonised before it comes into contact with water, the mist

is very much denser,—of course taking time into consideration. For the preventive action of ozone is not the only thing to be taken into account; as it would appear that ozone in the presence of moisture causes antozone to disappear, *i. e.*, to part with its electricity with great rapidity.

47. It was before mentioned that antozone mist in the absence of ozone disappeared in the course of from 30 to 45 minutes: but when ozone is present it disappears in the course of a few minutes, nor can it be re-produced even after the ozone has been absorbed. So not only does ozone prevent the action of antozone, but it also causes it to disappear, to abkling; for it can hardly enter into any chemical combination any more than when no ozone is present. The proportionate amount of ozone and antozone has also to be taken into consideration, for if but a proportionally small amount of ozone be present, the disappearance of the antozone is much less hastened. This will be of more importance when we come to the consideration of ozone and antozone when produced by an easily oxydisable substance.

48. Even where no ozone is present it depends much on the quantity of moisture whether dense or slight mist is formed, and this is of much more importance where ozone is present. This needs no explanation, as the attraction between antozone and moisture depends on the amount of the latter as well as on that of the former. It appears, then, that the presence of ozone hastens the abklinging of antozone more when the electrified air comes into contact only with a little moisture, than when it comes into contact with enough moisture to form mist; in other words, ozone acts stronger on moist antozone than on mist. It is very probable that the enveloping of the particles of antozone by water preserves them from the action of ozone. On this account the smallest quantity of moisture may lead to the most complete failure where ozone and antozone are in the presence of one another, as it may cause the latter entirely to disappear before it has arrived where it is expected to form mist.

49. It is very probable that, since ozone causes antozone so quickly to disappear where moisture is present, free ozone likewise disappears. Although we have not yet come to take into consideration the nature of these two states of oxygen, ozone and antozone, it is evident that there is a certain antagonistic relation between the two from the influence which one exerts on the other. It is therefore pro-

bable that ozone likewise disappears, though not to the same extent as antozone, since ozone is only one of the causes of the disappearance of antozone, which abklings in contact with moisture and with the glass-wall of the receiver. We know nothing of the relative amount of ozone and antozone produced by electricity, but we may presume them to be equal, and therefore we might expect the ozone which disappears to be equal not to the total amount of antozone which disappears, but to this total amount minus that which disappears from other causes.

50. If dry electrified air or oxygen be passed through a two-legged tube, through one leg of which the air is passed to be immediately deozonised, while in the other leg the air is first brought into contact with water and then deozonised, and if the pressure be so regulated that equal quantities pass through either tube in a given time, it will be found that much less iodine is separated in the latter than where the air is at once deozonised. Now, we already know that when electrified air comes in contact with moisture before the ozone is absorbed, much or all of the antozone disappears, while a certain known amount of ozone may be preserved for months almost without diminution. The reason of the notable difference in the quantity of ozone separated can only be, that the ozone where it was moist before its entrance into the iodide solution was in contact with antozone. Where ozone and antozone are together in contact with moisture, a mutual neutralization appears to take place; a part of the ozone disappears, while the antozone is hastened in abklinging.

51. As a considerable proportion of the ozone remains after all the antozone has disappeared, and as the latter disappears without any process of neutralization, it is hardly too much to assume that ozone and antozone are produced by electricity in proportional quantities, although there are no means for estimating the quantity of antozone as of ozone. In Von Babo's apparatus, even where moisture is present we almost always obtain ozone, though no antozone may be perceptible for the reasons above-mentioned.

52. The following, at first sight, striking appearances are simply explained by what has just been mentioned. When electrified air is passed through a moderately sized receptacle half filled with water, the following successive appearances take place. The first bubbles (after electrifying has commenced) ascend and burst with mist, which continues

for some time, and the space above the water becomes filled with mist (not dense, however, on account of the ozone), but gradually the bubbles have less and less mist, until at last there is no more mist and the space above the water becomes transparent, none of the conditions of the experiment having been changed. If now the electricity (only the electricity, not the stream of air) be interrupted for a time and then renewed, the same succession of appearances takes place, provided that the conditions of the experiment are the same. The explanation is simple enough; every bubble possesses the same amount of antozone, but so long as the proportion of ozone is not great enough to prevent the antozone from forming mist, mist is formed, but as the experiment proceeds the relative amount of ozone increases by the rapid disappearance of the antozone in contact with ozone and moisture, until at last the amount of ozone is so great that it prevents the antozone from condensing moisture to form mist. Of course, when the electricity ceases, the current of non-electrified air soon expels not only the antozone but the ozone, and a fresh start can be made.

53. If a number of perfectly dry glass vessels be filled with absolutely dry and strongly electrified air and hermetically sealed, they can be examined at leisure. There is nothing to be seen, so long as these vessels remain closed. If one of them be opened and the contents deozonised with iodide solution, strong mist appears on the addition of a little water: mist appears too, though weaker, even without the previous deozonisation. During the first two hours or so, the amount of antozone appears to suffer hardly any perceptible diminution, and after even so long as twelve hours the presence of antozone has been demonstrated by its power of forming mist. But at last the antozone disappears entirely, though ozone still remains; but it is very remarkable that what remains of the ozone is much less than where antozone has disappeared in the presence of ozone together with moisture.

54. While, therefore, ozone remarkably hastens the disappearance of antozone in the moist, it retards it in the dry state: moreover, much more ozone disappears in neutralizing dry antozone than moist. Ozone appears to have the very opposite effect on dry and on moist antozone. It may, however, be asked, if ozone would have the same effect upon antozone which had been first wetted and then dried, and whether as dry antozone was first passed through iodide

solution to be deozonised, some abklinging tendency were not in this manner given to it. To decide this question, dry electrified air was first passed through water, and then thoroughly dried and bottled up: it was found that the ozone still retarded the disappearance of the antozone, though to a much less extent than where it had never been in contact with moisture, as it was already far gone in abklinging.

55. It may, therefore, be concluded, not only that ozone in the dry state does not hasten the abklinging of antozone, but that it has, so to speak, a binding action on the antozone condition of oxygen. There is a certain connection between ozone and antozone; they have a mutual action and reaction upon one another. This connexion in the presence of moisture causes a quick neutralization of both, in which, however, much more antozone than ozone disappears, because of the contact with water, air, oxygen, and glass, all of which tend to destroy antozone. Where there is no moisture, this connexion between ozone and antozone retards the disappearance of the latter: antozone disappears gradually in contact with dry air or oxygen and with glass, but not so quickly as in contact with water: there must, therefore, be something contained in these things which contribute to the disappearance of antozone by this mutual reaction. As now ozone has a preservative action on antozone, under these circumstances it must, in the dry state, oppose the ordinary action of these unavoidable causes upon antozone, and maintain it as it were bound, which again must be regarded but as a reciprocal binding. Experience teaches us that when the antozone has quite disappeared, more ozone has disappeared than when its abklinging in the moist state has been hastened by ozone.

56. This sympathy between ozone and antozone, which when they are dry protects the latter from the destructive action of other causes, in time leads to their neutralizing one another, in which action, however, more ozone is expended than when they are moist, as their antozone is exposed not only to the reciprocal action of oxygen, but to other still more destructive influences.

2. OZONE AND ANTOZONE.

57. It is known that Schönbein succeeded in producing

antozone in a free state from peroxyde of barium: the experiment was first made by Houzeau, who, however, mistook the oxygen evolved for ozone. Schönbein observed that the oxygen evolved by the introduction of powdered peroxyde of barium into sulphuric acid possessed a peculiar smell, and strong oxydising properties like ozone, but that a very essential difference existed between them, viz., that the oxygen from peroxyde of barium had a great tendency to form binoxyde of hydrogen with water.

58. The production of antozone from peroxyde of barium may be made in the following manner. Some water and a narrow short tube with some sulphuric acid in it are put into a widish test tube with a ground glass stopper, so that the surfaces of the two fluids are near each other. When peroxyde of barium is introduced in small quantities, strong effervescence with disengagement of heat takes place, which gradually becomes a quiet evolution of oxygen as the peroxyde sinks to the bottom. The smell of the gas evolved resembles that of ozone, but may be distinguished from it by comparing the two together, or by a person well acquainted with the smell of ozone, and produces a very unpleasant choking and spasm of the throat, which ozone does not. It is advisable occasionally to raise the stopper, and to change the acid to prevent too much heat being evolved when it is wished to obtain binoxyde of hydrogen.

59. This process may be made to afford a pure though weak solution of binoxyde of hydrogen, provided care be taken that no sulphuric acid is spilt by the effervescence. Schönbein produced a concentrated solution by Pelouze's method with hydro-fluor-silicic acid. Meissner adopted neither of these plans, as he found the decomposition of peroxyde of barium with carbonic acid not only developed oxygen with the formation of carbonate of barytes, but that a large portion of the oxygen united with the water, and that he obtained a concentrated solution of binoxyde of hydrogen in a short time. It can be produced so strong that it is decomposed by light.

60. [Binoxyde, deutoxyde, or peroxyde, of hydrogen, when as free from water as possible, is a syrupy liquid, colourless, and possessed of a slightly disagreeable odour, like that of bleaching liquor, and of a peculiar, nauseous, bitter, and astringent taste. Its Sp. G. is 1·453 water, being = 1. It does not become solid, even in a very intense cold.]

61. [This compound is very easily decomposed, yielding water and oxygen. The contact of carbon, of many metals, and even of metallic oxydes, also of many salts, causes the separation of oxygen, often with explosion, and sometimes with a flash of light. It is very remarkable that peroxyde of manganese, for example, should cause this rapid decomposition, without combining with any portion of the disengaged oxygen: and still more astonishing, that oxyde of silver, so far from combining with more oxygen, loses all that it previously contained, and is reduced to the metallic state. We cannot at present explain these phenomena. The application of heat to the deutoxyde of hydrogen, causes oxygen to escape with effervescence. It is less easily decomposed when diluted, and especially if acidulated; the presence of a hose, on the contrary, hastens its decomposition.]

62. Mist also may be produced with the antozone evolved from peroxyde of barium; the gas set free forms a thick white mist when it comes into contact with moisture: if it take place in an open tube to which the air has free access, a white exhalation immediately arises over the sulphuric acid, which is diffused in the air as small clouds. Should the tube, however, become hot, the mist is weak, or may fail altogether. (Vide Appendix No. 2.)

63. Schönbein discovered that antozone may be produced by the rubbing of Welsendorf flupspath, and that if the rubbing take place under water binoxyde of hydrogen is formed. The smell produced by rubbing Welsendorf flupspath resembles that of ozone, but has still more resemblance to that produced when peroxide of barium is added to sulphuric acid. If a tolerably sized piece of flusspath, which smells strongly when rubbed, be triturated under enough water to cover it, the clear colourless filtered fluid, usually neutral, behaves like a dilute solution of binoxyde of hydrogen.

64. When this water is mixed with a solution of iodide of potassium, it behaves differently if triturated a short or a long time. In the first case, as soon as it is mixed with the iodide, some iodide is precipitated, while if it be rubbed longer it remains quite colourless, at least, a minute before any iodine is precipitated. This is owing to free antozone which is dissolved in the water, but not chemically united with it, and may be removed by boiling it up or merely by letting

it stand for some time: by this boiling a smell of antozone is given off, and when this smell ceases it loses its peculiarity.

65. This behaviour of spathwater in which there is no antozone is very striking at first, for a pure solution of binoxyde of hydrogen has no such action even after many hours. If we make a solution of binoxyde of hydrogen of such a strength, that, on the addition of a drop of a solution of sulphate of iron it separates as much iodine from a solution of iodide of potassium of known strength, as a similar quantity of spathwater under similar circumstances, and if we then compare two such mixtures to which no iron has been added, we shall find that in a few minutes decomposition begins and slowly continues in the spathwater test, while in the other there is no trace of any separation of iodine. Further, if we compare two similar mixtures of spathwater and iodide of potassium, one of which is left to itself, while to the other a drop of a solution of sulphate of iron is added, we shall find that the same quantity of iodine is precipitated in both, but in the one case slowly and in the other suddenly. This slow action of spathwater, which takes several minutes, is quite different from that mentioned in the former paragraph; the latter ceases at once and is only a part of the total action of which this spathwater is capable, and is removable by boiling up, while this slow continuous action takes place so long as any binoxyde of hydrogen remain.

66. As a pure solution of binoxyde of hydrogen, even when concentrated, does not by itself decompose iodide of potassium, but needs some pre-disposing substance, which acts like acid on the iodide, or like iron on the binoxyde of hydrogen, it was evident that there must be some such substance in the spathwater. If now freshly prepared spathwater be evaporated to dryness and what remains re-dissolved (which process is not necessary as all the binoxyde of hydrogen is destroyed long before it is dry), this solution mixed with a pure solution of peroxyde of hydrogen and iodide of potassium, acts precisely in the same manner, similar to the action of sulphate of iron, but more gradual. As however, this substance, after being evaporated, does not possess its original strength, it is perhaps partly destroyed, probably by some reciprocal action with binoxyde of hydrogen, and should this be the case, it rather resembles sulphate of iron, which acts on the binoxyde of hydrogen than acid which acts on the iodide of potassium. This supposition is

supported by the fact that the binoxyde of hydrogen in the spathwater disappears quicker than a pure solution of binoxyde of hydrogen, and because the solution of this remainder has, like a solution of sulphate of iron, no action on iodide of potassium. By shaking spathwater with an excess of sulphate of iron, the binoxyde of hydrogen is destroyed in a short time.

67. As this substance behaves so very like sulphate of iron towards binoxyde of hydrogen, it was not unlikely that it was a protosalt of iron, but not a trace of iron could be found: but there may be other substances besides protosalts of iron which become slowly oxydised at the expense of the binoxyde of hydrogen. Different pieces of the Welsendorf flusspath contain various amounts of antozone and of this substance. The behaviour of spathwater mixed with iodide of potassium, on the addition of a very little acid, is very like that of solutions of binoxyde of hydrogen and iodide of potassium with a very minute quantity of iron; when a little dilute acid is added, it scarcely hastens the decomposition of the iodide. This quickening probably depends upon the acid causing oxydation of the proto to a peroxyde soluble in free acid, and so an admixture of acid and sulphate of iron may partly shield the iodide from decomposition.

68. How antozone should exist in Welsendorf flusspath, it is impossible even to conjecture. It is very extraordinary, and is contained in no other known spath or mineral,—not even in the compact flusspath of Ivikaet in Greenland, which smells when rubbed.

69. Oxygenated turpentine, among other substances, belongs to the group of bodies termed antozonides, of which binoxyde of hydrogen is the type, and its behaviour to certain oxydisable bodies, as well as to ozonides, has been examined by Schönbein.

70. If a solution of iodide of potassium be quietly mixed with a few drops of oxy-genated turpentine, precipitation of iodine begins after a time to take place sooner or later according to the amount of oxygen in the turpentine, or the quantity of turpentine added. But the moment that a drop of a solution of sulphate of iron is added, the precipitation, whether it has commenced or not, takes place at once and completely. Its behaviour is in every respect similar to that of spathwater after the free antozone has been removed, and, therefore, must contain some inducing

substance similar to sulphate of iron, as will appear from the following experiment. Take three equal quantities of a solution of iodide of potassium, mix two of them with similar quantities of a solution of binoxyde of hydrogen, and the third with the same amount of pure water. Add to the last, containing nothing but iodide of potassium, and to one of the others, a drop of turpentine. Iodine is first precipitated in the one containing binoxyde of hydrogen and turpentine, and later where there is only turpentine, while in the other, in which there is nothing but iodide of potassium and binoxyde of hydrogen, no decomposition takes place. Binoxyde of hydrogen has no effect on the iodide, the turpentine but little and that gradual, while the turpentine and binoxyde of hydrogen together have an immediate and complete effect; moreover it would appear that the turpentine induces the binoxyde, and not the latter the turpentine, to precipitate the iodine.

71. Non-oxygenated turpentine has no effect whatever on iodide of potassium.

72. If acid be added to the mixture of iodide of potassium and oxygenated turpentine, there is no effect when the acid is first added to the turpentine, and the decomposition is only hastened when the turpentine is added to the acidified solution of the iodide of potassium. This behaviour of the turpentine corresponds to that of binoxyde of hydrogen.

73. We now proceed to enquire if water can be so oxydised by antozone produced by electricity as to form binoxyde of hydrogen, which may be done in the following manner. If electrified air be passed through a saturated alcaline solution of pyrogallic acid, and then through a small quantity of water, the ozone is completely absorbed and the antozone not affected by it: if the solution of pyrogallic is perfectly saturated and the tubing dry, no mist is formed before the arrival of the electrified air in the water: but above the water a dense mist appears, which shows that the antozone has not been absorbed by the pyrogallic acid. If the air containing antozone be passed in this manner for some hours through water, the latter has the reactions of a weak solution of peroxyde of hydrogen. By itself it has no action on a solution of iodide of potassium, but the moment that a drop of a solution of sulphate of iron is added, iodine is precipitated.

74. For this production of binoxide of hydrogen, however,

everything must be favourable; the air perfectly dry, the electricity strong, and the deozonised air must be quite dry when it passes into the water, which must be small in quantity. It is, moreover, advisable to add a small quantity of a solution of sulphate of iron to the iodide solution, and then to add the fluid to be tested for binoxyde of hydrogen, or, better still, first to examine the testing fluid with a little dilute solution of binoxyde of hydrogen of known strength, to make sure that the quantity of iron is not too great. If a second and third washer be adapted, though strong mists are formed over both of them, there is, but rarely, a very minute quantity of binoxyde formed in the second, and never any in the third. Should the solution of pyrogallic acid not be perfectly saturated, the peroxyde of hydrogen is found in that and the fluid washer plays the part of the second. The probability indeed is, that more binoxyde of hydrogen is formed in the solution of pyrogallic acid, than in the washer.

75. The fact that binoxyde of hydrogen exists in the water through which the electrified and deozonised air or oxygen has been passed, and which contains nothing but antozone in it to distinguish it from common air or oxygen, is sufficient to prove that antozone has the power of oxydising water. This action is evidently an exercise upon water in the fluid state of the same attraction between water and antozone, by virtue of which antozone condenses aqueous vapour to form mist. When water and antozone unite to form binoxyde of hydrogen, it is a more intimate union than that with vapour to form mist; the first is a true chemical combination, while the mist is no such thing but only a certain condensation of water on the surface of the antozone, as such attractions and condensations of one substance on the surface of another often take place previous to true chemical combination. Of binoxyde of hydrogen we may affirm that the antozone is taken up in the substance of the water; while with mist the very reverse is the case, the vapour being taken up in the gaseous substance of the antozone.

76. Whether binoxyde of hydrogen or mist is produced by the contact of water and antozone, depends upon the following circumstances. Binoxyde of hydrogen cannot exist in the gaseous state; so soon as it is expanded by heat it is decomposed. Of course, therefore, antozone and vapour cannot possibly produce binoxyde of hydrogen, but only mist. This, however, cannot be the only reason which determines the formation of binoxyde by antozone, for the latter may be passed through a series of washers with water, and only in the first is there any notable quantity of binoxyde: a large portion of the antozone appears as mist in the first washer, while in the following one the antozone forms nothing but mist and no binoxyde, although the antozone comes into contact with nothing but fluid water. It is, therefore, partly due to the condition of the antozone.

77. As binoxyde of hydrogen is a chemical combination, while mist is a mere agglomeration of vapour to a certain density, it follows that a more energetic attraction between water and antozone is necessary for forming peroxyde of hydrogen than for forming mist: not that the attraction for water is less in the latter than in the former, but less energetic, less concentrated. Now it is known that antozone in contact with water gradually loses its attraction for water, and that it slowly lets fall its moisture which it had attracted together, and that in consequence of this abklinging it forms mist which is less and less dense, while it requires other conditions to be more and more favourable. That by this abklinging antozone should also lose the property of forming binoxyde is perfectly comprehensible, as well as that this property should be sooner lost than that of forming mist, which requires less energy.

78. The formation of binoxyde of hydrogen, therefore, depends on the antozone not being far advanced in abklinging, and in the water being fluid. The antozone in chemical combination with water in the form of binoxyde is a stable compound compared to the mere aggregation of antozone and vapour which forms mist. The explanation, therefore, is simple; in contact with the small quantity of moisture over the saturated solution of pyrogallic acid, the antozone abklings so little that it is still in a state fit to form binoxyde in the first washer, but after this only to form mist. Should the solution of pyrogallic acid, however, not be saturated, little or no binoxyde is formed even in the first washer.

79. Antozone produced by electricity is not to be brought to act upon water in its original state, especially if, as hitherto, it is to be first separated from ozone; we can obtain nothing but an antozone already somewhat advanced in abklinging. It need not be mentioned that no subsequent drying restores it to its original state. Nor is it possible to remove ozone by any dry substance, as ozone has no effect on any substance in the absence of moisture.

80. Neither neutral nor electrified air nor antozone have any effect on pyrogallic acid. For examining mist and its formation, however, iodide of potassium is much more convenient than pyrogallic acid to deozonise the air, while for other purposes pyrogallic acid is preferable, as the use of the former is attended with a peculiar drawback, which is of no consequence in observations about mist, but may lead to great mistakes in other researches.

81. When dry electrified air is passed through a solution of iodide of potassium and then through water for some hours, the presence of binoxyde may be demonstrated by a drop of a solution of sulphate of iron added to a mixture of the water and a solution of iodide. But a suitable acid is found to give a much stronger reaction, which is not the case when only binoxyde is present with the iodide. As the air was passed through caustic potash between the iodide of potassium and the water, iodine or iodic acid were not to be thought of, though it seemed impossible that it could be anything else. However, after the electrified air deozonised by iodide of potassium had been passed through liquor potassæ and then through water for *eight* successive days, the water had a decidedly acid reaction, and on evaporation gave a chrystalline precipitate, which being re-dissolved gave with sulphurous acid a solid precipitate of iodine, and all the usual reactions of iodine. Iodine reactions were afterwards easily obtained when the air had been passed through the water only a few hours.

82. It might be suspected that the reaction attributed above to the presence of binoxyde of hydrogen was due to iodic acid: this, however, is not the case, as though a large quantity of iodic acid precipitates iodine, it takes much more sulphate of iron to precipitate it where no binoxyde is present.

83. It is well known that when ozone is passed through a solution of iodide of potassium, iodine is separated and iodic acid formed, but the solution takes an alkaline reaction. The iodic acid forms with the potash a very insoluble salt, and in such large quantities, as to occasion serious inconvenience. A large quantity of iodic acid is also formed in the solution, but this by no means accounts for its being in the deozonised air. The iodic acid is not united with potash, but free: it cannot depend on a mechanical disruption of the iodate of potash collected in the tubing: the iodic acid is found when the solution is so alkaline that no

iodine is precipitated as such, although the ozone is completely absorbed. The iodine which is separated by the ozone unites with the iodide to form biniodide of potassium, and causes the red-brown colour of the solution, which limits without preventing the volatility of the iodine, which is, however, absorbed by the caustic potash.

84. We can, therefore, only imagine that iodine, as the bubbles pass through the solution, is evaporated in them as the ozone sets it free: this precipitation of iodine by the ozone evidently takes place at the circumference of the bubbles: we must then assume that the iodine vapour meets with more ozone inside the bubble which converts it into iodic acid, which, though not volatile, is carried on by the mist formed by the antozone through the liquor potassæ. If it be dried, so that mist no longer exists, the iodic acid is transported no further but disappears, is dropped. If deozonised air be passed through a concentrated solution of iodide of potassium with a little sulphate of iron, no decomposition ensues, but if the solution be diluted decomposition takes place, but it is not advisable to use this as a test.

85. There is a difference between the antozone produced from peroxyde of barium or Welsendorf flusspath, and that produced by electricity. The former has an intense smell, while the latter has none, which may be explained in the following manner. The antozone produced by electricity cannot be examined in its original state, as it is then mixed with ozone, the smell of which is very similiar; after the ozone has been removed, the antozone has lost a large share of its original properties, being far advanced in abklinging, which abklinging is a gradual conversion of the antozone into ordinary oxygen, which has no smell. The antozone from peroxyde of barium and flusspath likewise lose their smell as they abkling. The smell of antozone differs from that of ozone, inasmuch as the former produces choking and a feeling of suffocation and spasm of the throat, which ozone does not: the antozone from flusspath, however, may possibly have some unknown substance mixed with it.

86. In examining the action of ozone and antozone together on water, we must distinguish between ozone produced from oxygen and that produced from common air. When pure oxygen is electrified as above directed and passed through several washers, a considerable amount

of binoxyde of hydrogen is, after several hours, formed in the first, less in the second, and very little in the third, but the reaction is perfectly neutral. The presence of ozone by no means prevents, however it may limit, the formation of binoxyde. It is never the case that the whole of the antozone unites with the water to form binoxyde of hydrogen, but only a portion, and always less the longer it has been in contact with moisture, and the farther advanced it is in abklinging. If the antozone be produced under water as from peroxyde of barium by carbonic acid, a much larger portion unites with water to form binoxyde, contact being so intimate that it becomes combined with the water before it comes into contact with vapour: but if antozone in large bubbles be passed through, water only the periphery comes into sufficiently intimate contact with water to form binoxyde of hydrogen.

87. The action of electrified oxygen on free nitrogen is one of the most important.

88. If dry electrified air be passed through water, the latter, in the course of an hour or two, gets an acid reaction which increases the longer the experiment is continued. This acid is, and has all the reactions of, nitric acid. If the electrified air be passed through, a second and third washer, both after a time, contain nitric acid, but while the second vessel contains very much less than the first, the third contains very nearly as much as the second, which is doubtless due to the abklinging of the antozone. In addition to nitric acid the water, of course, contains peroxyde of hydrogen, and very much more peroxide is produced with pure electrified oxygen when no nitric acid is produced than, with common air.

89. Schönbein fancied that he found nitrite of ammonia, but Meissner could find no conclusive proof of the presence of nitrous acid, and no greater traces of ammonia than are to be found in everything exposed for any time to the atmosphere; nor is the existence of a nitrate probable in the presence of ozone, as nitrites are speedily converted by that substance into nitrates,—an oxydation in which antozone takes no part.

90. It is next to be seen whether this nitric acid is produced in the water or in the tube where the electric discharges take place. This is Cavendish's old experiment, which was explained on the supposition that nitric acid was formed from the oxygen and nitrogen of the air by the direct action of electricity. But as we know that ozone and antozone are

produced by the action of electricity, it is possible that nitric acid is produced not by the direct action of electricity, but secondarily by the action of ozone or antozone, or of both together. Should this latter surmise be correct, nitric acid may be produced at a distance from where the discharges take place. That traces of nitric acid are found in the second and third washers is by no means conclusive on the subject. An experiment was therefore so arranged that dry electrified oxygen was conducted in one tube, and nitrogen, *i. e.* common air, in another tube, which met together at the very moment when the two arrived in the water, so that the bubbles from the two tubes ascended together through the water. This experiment invariably produced nitric acid in the second as well as in the first washer and in the tube connecting the two. In order to exclude the suspicion that the nitric acid was produced directly by the electric discharge through the accidental adulteration of the oxygen with nitrogen, the experiment was varied by passing the electrified oxygen through the first receptacle by itself, and bringing it into contact with nitrogen only in the second receptacle, when it was found that while there was not a trace of nitric acid in the first receptacle, the water of the second contained it, though in small quantity, owing to the abklinging of the antozone.

91. The next subject of enquiry is the part played by ozone and antozone respectively in the oxydation of nitrogen; whether the latter is oxydised by ozone or by antozone, or by both. If ozone, freed from antozone by abklinging, be left for any length of time with nitrogen and water, no nitric acid whatever is formed, but the ozone preserves all its original properties, and, among others, that of converting nitrites to nitrates. We may conclude from the above experiments that ozone by itself is not capable of oxydising nitrogen so as to form nitric acid, but that when once the nitrogen is to a certain extent oxydised, it can by itself induce the higher stages of oxydation. But when antozone by itself with common air is passed through water, no oxyde of nitrogen is to be found in the water. The antozone produced by electricity is in a state neither to oxydise the nitrogen of the air, nor to convert nitrites into nitrates.

92. We may assume either that antozone in its original state before it has become moist, is in a condition to oxydise nitrogen to nitric oxyde, or some other degree of oxydation, which is then further oxydised by ozone, or we

may assume that the oxydation of nitrogen can only take place by the joint action of the two. With either assumption may be united the view that ozone and antozone perform distinct offices in the oxydation of nitrogen.

93. We believe that the following consideration proves that an inducing action takes place on the part of the ozone. Although much more nitric acid is formed in the first than in the second washer, yet it is formed in the second, and if the antozone mist and ozone be carried on into a third dry washer, the moisture which is deposited has an acid reaction from nitric acid. Moreover, this acid is or may be produced there, rather than carried there by the antozone mist. We know, therefore, that antozone, not only in its original state but when far advanced in abklinging, can assist in the oxydation of nitrogen. This is analogous to the behaviour of antozone to water, which can at once form binoxyde of hydrogen, and is subsequently able to attract vapour when in a much weaker state. It does not, however, follow from this, that antozone in its original state has by itself the power of forming nitric oxyde. It is impossible to prove or to disprove this with antozone of electricity, as it cannot be obtained in its original state; it would have required large quantities of peroxyde of barium, of which Meissner had but a limited supply, to settle this question. It is, however, very probable that nitrogen is oxydised by 2 atoms of antozone to nitric oxyde, and then to hyponitric by 2 atoms of ozone. Nitric acid, from its chemical action, certainly contains ozone, and may be by ozone alone oxydised to nitric acid. This is the more probable, as ozone certainly has not the power of oxydising nitrogen to nitric oxyde. Moreover, whatever the amount of ozone may be, the more the antozone has advanced in abklinging, the less nitric acid is formed, *i. e.*, the less nitric oxyde, as the three latter oxydations of nitrogen are certainly performed by ozone.

94. Meissner seems inclined to assume that both nitrous and nitric oxyde are both formed by positive oxygen or antozone; but if a lighted taper be immersed in an atmosphere of nitrous oxyde it burns brilliantly, while in nitric oxyde it is extinguished. This fact gives grounds for the presumption that nitrogen first combines with ozone to form nitrous, and then with antozone to form nitric oxyde; nor does the behaviour of phosphorus and other intensely positive substances with nitric oxyde militate against this view, but if all the phenomena be considered rather supports it.

95. If the current of electrified air, instead of being passed through water be passed through dilute liquor potassæ, much more nitric acid is formed in the same time and under otherwise similar circumstances, than in pure water; this influence of a base is to be more particularly remarked in the second washer.

96. If electrified air be passed through two washers, then through a saturated solution of iodide of potassium, and, lastly, through water again, mist may be seen over the latter, provided the electricity be strong enough. If the water of the first receptacle be now warmed, while that of the second is cooled, the mist over the latter becomes weaker and gradually disappears. The amount of ozone absorbed by the iodide is also less, which shows a more rapid neutralization of the ozone and antozone. But should nitrogen be present, much more nitric acid is formed in the first receptacle than at the ordinary temperature; so that what induces disappearance of ozone and antozone, induces the formation of nitric acid.

97. As regards the necessity of water or vapour for the oxydation of nitrogen, Schönbein states that if sparks be passed through a quantity of dry gas in the proportion of one of nitrogen to four or five of oxygen, vapours arise in the vessel which their smell and colour show to be hyponitric acid, and which last as long as the electricity continues. Should there be water in the vessel, no hyponitric acid is formed, but the water contains nitric acid, and, at first, nitrous acid, which afterwards disappears. Meissner found that a larger amount of oxygen than was contained in atmospheric air was useless, and therefore made use of atmospheric air with similar results: moreover, there is neither ozone nor antozone to be found, and if the air be not passed through water, nothing but hyponitric acid is formed.

98. De la Rue, Fremy, and Becquerel state that ozone is formed when sparks are passed through pure oxygen between platinum points, as well as with von Babo's apparatus. Meissner proved that antozone likewise is formed by filling with oxygen a long tube provided with two platinum wires melted in, and a moist chrystal of iodide of potassium close to the point of the wire. When it was electrified, the ozone was absorbed by the iodide chrystal and a thick nitrate mist was produced,—an undoubted proof of the presence of antozone. Antozone may also be produced by sparks from common air in the presence of moisture, provided that the ozone

be absorbed as soon as produced, otherwise the nitrogen is oxydised and the antozone vanishes together with the ozone.

99. Two circumstances are therefore necessary for the oxydation of nitrogen in moist air, viz., the presence of ozone and antozone: if the former be not quickly absorbed, no trace of ozone or antozone is to be found, the whole having been applied to oxydation of the nitrogen.

100. Meissner found that when absolutely dry air was used, in lieu of ordinarily dry air, no nitrogen was oxydised but that ozone and antozone were produced by the electric sparks: but by electrifying air between points with sparks, the smallest quantity of moisture was sufficient to produce oxydation of the nitrogen, with disappearance of both ozone and antozone, much less moisture than with von Babo's apparatus. With respect to the necessity of moisture for the oxydation of nitrogen, it appears only to act as a medium to enable the other elements to unite, as in the case of the oxydation of metals or the combination of acids and alkalies, which cannot take place in absolute dryness.

101. When moist air is electrified between metallic points, the whole of the ozone and antozone formed disappears, with copious formation of hyponitric acid; while, when the metal is covered with glass, very little acid is formed, while there is much ozone and antozone left. If two glass tubes be provided, the one with platinum points and the other with metallic points covered with glass, and both are electrified at the same time, litmus paper is strongly reddened in the one tube by the hyponitric acid and bleached in the other tube by the ozone. Should the thin glass covering of the metal, however, become fractured, the paper is immediately reddened.

102. The main difference between the electricity from between the naked points and the covered appears to be, that in the former, sparks pass readily and much heat is evolved, while in the latter the discharge of electricity is retarded, and tension electricity, rather than heat, is produced. The following experiments would appear to show that this heat is the only circumstance which determines the formation of acid, or of ozone and antozone. Dry hot air was passed through a tube fitted with glass-covered metallic points: the heat and moisture could be so managed that neither ozone nor antozone, nor hyponitric acid were produced, or only ozone and antozone, or only hyponitric acid, or both. This experiment agrees with that in which, by heating the washer, the production of nitric acid was increased.

103. There appears, therefore, to be no grounds for supposing that in Cavendish's experiment electricity has any more direct action on the formation of nitric acid than that of electrifying the oxygen, *i. e.*, of converting it into ozone and antozone, and by the production of heat in the presence of moisture, favour the oxydation of the nitrogen. Of course, the electricity can have no action on the nitrogen itself.

104. By electrifying with sparks when fluid water is present, both nitric and nitrous acids are formed in the water, while, when cold electrified air is passed through water, this latter contains only nitric, and no nitrous, acid, because, in the latter case, so much ozone is present, which rapidly oxydises the nitrous, to nitric, acid.

105. As binoxyde of hydrogen is formed by noiseless discharges even where nitric acid is likewise formed, it is also formed, though in very small quantities, with sparks. When pure oxygen is electrified over water, more peroxyde of hydrogen is formed than under similar circumstances with common air, because in the former case there being no nitrogen to be oxydised, more water can be oxydised.

106. Where cups of mercury are employed for forming air-tight connexions, the mercury becomes gradually converted into nitrate and oxyde (red precipitate). This is entirely owing to moisture; were there no moisture, the mercury would remain shining without any pellicle, and with a convex surface.

107. We have still to enquire why it is that, *ceteris paribus*, less ozone and antozone are produced with metallic points, and disengagement of heat (where no nitrogen is present), than with still discharges without heat. The cause of this is intimately connected with the how and the why of the production of ozone and antozone, and with what constitutes the difference between these two conditions of oxygen and ordinary oxygen.

108. When dry oxygen or air is electrified by means of the apparatus described in Appendix No. 3, so that the air electrified by the negative and by the positive pole are examined in different receivers, the amount of ozone and antozone is about the same in both, as proved by the iodine precipitated and mist formed in the two washers. This apparatus, owing to the narrowness of the tube through which the electrified air passes, is well adapted for examining the effect of finely divided platinum or ozone and antozone. If

some spongy platinum sufficiently spread out be placed in one of the tubes, both ozone and antozone disappear altogether, while both appear in the other tube.

109. It would appear from what has been said above, that the production of ozone and antozone must be regarded as an act of electric tension, spreading or distribution of electricity; the less resistance there is, the less ozone is formed. The production of ozone is in an inverse ratio to that of heat, which is greater the less the action of electricity is retarded. Where the electricity can pass readily, as between platinum points, much heat is produced, but there being no resistance, there is no tension and no ozone. For the same reason the further the platinum points are from one another, the more resistance there is, and, consequently, less heat and more tendency to form ozone.

110. With the friction electric machine, the production of ozone is in proportion to the distance of the conductor from the machine, *i. e.*, in proportion to the resistance. Where the conductor is so near that sparks can pass, there is little resistance and little ozone. Discharges are not the cause of the production of ozone, but resistance to the passage of the discharges. That which causes discharges, where there is little or no resistance, produces ozone when resistance is present, and consequently tension, spreading, diffusion. But the most ozone and antozone are produced where the strongest sparks would be produced, were the resistance less.

111. Fremy and Becquerel observed ozone produced in an hermetically-sealed glass tube filled with oxygen, when placed between the points of the discharging rod of an electric machine, so that the sparks could not pass through, but only over, it. They explained that ozone was found by electric distribution. It is now plain why von Babo's apparatus is so well adapted for producing ozone and antozone. The tension, diffusion, or distribution of electricity, which form ozone and antozone, is the equivalent for the sparks which produce heat. Moisture of the air assists in the passage of electricity through it, and, so, is very unfavourable to the production of ozone and antozone, as it diminishes the resistance, not to mention, that, were they produced they would soon neutralise one another.

112. If the production of ozone and antozone is an action of electric tension, if these two states of oxygen arise, like electric diffusion in neutral bodies when brought

near to an electrified body, it is but a step to say that antozone and ozone are oxygen positively and negatively electrified, charged with positive and negative electricity.

113. As long as only one kind of electrified oxygen was known, people endeavoured to explain it by supposing it to be an allotropic condition of oxygen, which, however, did not help them out of the difficulty, as it was by no means easy to conceive of a gaseous body assuming two different forms, as a solid substance might chrystalise in two different ways. To call it nascent oxygen, was only to declare the existence of ozonised oxygen, while to call it electrified oxygen, was simply to state how it was formed.

114. From a purely chemical point of view, unconnected with the present enquiry, Lamont and Gerhardt, as well as Dumas, considered that elements in their free state might be regarded not as single isolated atoms, but as several, or at least two atoms united to form a polyatomic or diatomic molecule. Thus, free hydrogen might be regarded as (H. H.), free chlorine as (Cl. Cl.), and a molecule of oxygen as composed of at least two atoms. On altogether different grounds when enquiring into the nature of the force termed Heat, Clausius conceived the idea that in the simple gases several atoms unite to form a molecule, that of oxygen, for instance, consisting of at least two atoms. When he became acquainted with Schönbein's researches on ozone, Clausius applied this idea to explain its nature. Conceiving that if the two atoms of a diatomic molecule were similarly electrified (either positively or negatively), they would repel each other and thus form ozone, he thought that if this diatomic molecule were by this or any other means separated into its two atoms, these isolated atoms or ozone might act differently from the compound molecule. So that oxygen, as it becomes free, consists of isolated atoms, the greater number of which quickly re-unite to form diatomic molecules, while a few remaining separated, form ozone. By the slow combustion of phosphorus, for instance, the molecules may be decomposed into atoms, with which the phosphorous unites: should the phosphorus, however, unite with only one atom, the other may be repelled by the heat or electricity, and appear as ozone.

115. Gerhardt's hypothesis assumes that the elementary atoms are incapable of existing in the free state, and that whenever elementary atoms are liberated, they combine, so

to say, with themselves and separate in pairs, which pairs of atoms may be called the molecules of the elements. We thus arrive at a rigorous distinction between the terms elementary atoms and elementary molecules; the former term representing the smallest quantities in which the elements enter into combination, the latter the smallest quantity of an element capable of existing in a free state.

116. But Clausius further considered that one atom of a molecule might be positively, and the other negatively, electrified. The phosphorus might have such a strong affinity for the negative atom that the positive was easily removed. This atom might then give off its positive electricity to other particles of gas, or to the sides of the receiver, and unite likewise with the phosphorus so soon as the two were near enough to each other. In some further remarks, Clausius overthrows the view that these isolated atoms may lose their electricity without ceasing to be ozone: he also thinks that the kind of electricity may influence their tendency to enter into certain combinations, while this tendency itself depends upon the isolated state of the atoms. So ozone produced by oxygen as it is freed from chemical combination, may be active like that from other sources, just as that negatively electrified may be free. With reference to former observations of Schönbein on the reduction of ozone to ordinary oxygen by the oxygen of certain compounds, Clausius considers that the isolated atoms of ozone may remove other isolated atoms from their combination, through their great tendency to unite with them to form ordinary diatomic oxygen. De la Rue endeavoured, before Clausius, to explain the nature of ozone in a somewhat similar manner: he regarded ordinary oxygen as composed, not of diatomic, but of polyatomic molecules, the atoms of which being separated from one another by electricity, become ozone, as well as the oxygen set free from chemical combinations. De la Rue, moreover, considered each atom to have a positive and a negative pole, and that when they formed a polyatomic molecule, their relative position towards one another was such as to form an endless chain. This idea is assumed for explaining the magnetic properties that may be communicated to oxygen by a permanent electric current. According to his view, isolated atoms have not opposite electricities, but each atom has a positive and a negative pole and are all alike, but they have no magnetic property. For this reason De la Rue assumes

that electricity is evolved in the slow combination of phosphorus, and that by its oxydation ozone is produced.

117. The theories of De la Rue and Clausius, however similar in their premises, lead to widely different results. That of the former, though it endeavours to account for the magnetism of oxygen, admits of only one ozone and of no antozone, all the atoms being similarly electrified: while Clausius assumes the possibility of the atoms being differently electrified, which, though not necessary in order for the oxygen to be in an active state, *i. e.*, ozone, may influence its chemical relations.

118. When Clausius published this theory, nothing was known of antozone; but the fact that there are two excited states of oxygen agree with this theory. Were more importance attached to the kind of electricity of the individual atoms, and a greater influence claimed for the same in its chemical relations, so that these might be distinguished the one from the other, both might be regarded as having an oxydising action, *i. e.*, of being active and excited, which agrees better with facts than De la Rue's theory.

119. Schönbein, when he discovered antozone, being averse to the atomic theory, contented himself with comparing the behaviour of ozone and antozone with that of the two electricities to one another, and termed ozone and antozone negative and positive oxygen,—still maintaining the idea that the difference between these two conditions of oxygen was merely one of allotropy.

120. By these terms Schönbein did not so much mean a positive or negative state present in the oxygen, as that they behaved antagonistically to the two groups of peroxydes, the ozonides, and the antozonides, different electricities being excited by contact with other substances. This imperfectly-expressed opinion of Schönbein resembles the theory of Clausius as much as it can, a view which takes notice not only of the excitement of the two electricities, and the production of different electricities, but also of an electric charge already present.

121. The manner in which electricity produces the excited states of oxygen, decidedly shows that both ozone and antozone are oxygen, but antagonistically electrified by distribution. In what the nature of this electric state consists, is, of course, no more known than it is with other substances: according to this view oxygen exists in three different states, just as other substances may exist in a

neutral or non-electric state, a positive state and a negative state.

122. If, conformably to the above view, we suppose the compound molecule of ordinary inactive oxygen to have at least two ponderable cores, two atoms of oxygen, to be *diatomic*, and to act like a neutral body; should a positively or a negatively electrified body be brought near, it will act on the diatomic oxygen by distribution. If we now make the legitimate assumption that the property of gases as non-conductors depends solely on the arrangement and mutual relations of their atoms, we may conceive of one of the two atoms of a molecule as a conductor: *i.e.*, we may assume that electricity can move from one atom to another inside the molecule, though not from one molecule to another: were it not so, gases would cease to be non-conductors. From molecule to molecule distribution alone can take place.

123. On this hypothesis the action of the electric distribution will take place in the molecule in such a way that one of its atoms is charged with positive, and the other with negative, electricity. In this state one molecule acts by distribution on the next, and so on. If now the electric distribution be strong enough, the two atoms, of which one is attracted and the other repelled by the body causing the distribution are divided into two isolated atoms, which are differently electrified, and there is, as in the theories of De la Rue and Clausius the chemically active oxygen, the positively electrified atom being antozone in fact, and the negative ozone.

124. Faraday has shown that the influence proceeding from an electrified body, the static induction in a conductor near it is brought about by the polarisation of the intervening dielectric acting from molecule to molecule. The polarisation of the oxygen molecules in the production of ozone and antozone is this polarisation, by virtue of which the oxygen as a dielectric brings about electric distribution between an electrified body and a conductor near it. All dielectrics, all gases can do this. If we assume that those gases, in which no excited states analagous to ozone and antozone can be produced by electric distribution, consist of simple atomic, not diatomic, molecules, electric distribution can produce only two opposite poles on one atom in such a gas molecule, when, of course, electricity can never lead to a separation of two atoms charged with different

electricities: but this polarisation is quite capable of bringing about static induction towards a conductor, and this can take place with all gases: but the molecule of oxygen, being diatomic, is composed, not of two halves or zones of one atom having two poles, but of two atoms, which act in the interior of the molecule as conductors, though only for themselves,—each atom having a different pole, on which account polarisation can separate the two poles, *i.e.*, the two oppositely electrified atoms from one another. Should there be other diatomic gases, the molecules of which can be decomposed by electric distribution into positive and negative atoms, this hypothesis will be as applicable to them as to oxygen.

125. If oxygen forms the dielectric between an electrified body and a conductor, the separation of the two oppositely-electrified atoms of oxygen forming a diatomic molecule becomes less easy the more the two electricities are employed with the distribution in the conductor, and, by that means, the atoms of oxygen become fixed in their place between the distribution and the receiver of electricity. Ozone and antozone, *i.e.*, the chemical affinity of polarised oxygen so far as this polarization leads to the separation of the two atoms of a molecule, appear as an equivalent in the one case for the distribution which takes place in the conductor, and in the other for the movement of ponderable substance effected by it.

126. Oxygen in both electric states has a great tendency to unite with, and oxydise, other atoms: but it depends upon the kind of electricity with what oxydisable substance it will combine. Antozone combines readily with water, but not with potassium, iodine, &c., with which ozone, which has no particular attraction for water, easily unites. Oxydisable subtances are divisible into two groups of very unequal size, one of which, and by far the largest, unites with ozone, and the other with antozone. There are most probably, however, substances which unite with antozone as well as with ozone,—by which is meant not only that they can receive doses first of one and then of the other, but that they can combine with one as well as with the other, though not so readily. A compound molecule which already contains oxygen and is still oxydisable, inasmuch as it can take up more oxygen, may have its place in both of these groups. Thus, for instance, hydrogen belongs to the group which unites

solely with ozone, but water to the group which unites with antozone.

127. Oxygen, in an excited, active state, is either ozone or antozone, and where oxygen is found in an active state, one of these two distinctly defined states is present, and, should the excited arise from neutral oxygen, both are present. If these opposite relations are dependent on opposite electric states, if the activity of oxygen is connected with its electric condition, the simplest assumption is that this excited active state of oxygen is identical with the electrified as opposed to the neutral state, and as the electric condition may be either positive or negative there may be an electro-positive and an electro-negative oxygen, in addition to neutral non-electrified oxygen.

128. This is just the point where the facts at present known compel us to dissent from the theory of Clausius in working it out, in which the electric state of the unpaired atoms has merely a subordinate and dependent action, and the main stress is laid on the isolation of the atoms as opposed to the molecules of two atoms composing diatomic oxygen. According to the view here propounded, excited differs from ordinary oxygen not only in being electrified while the other is not, but also in the electric state being attached to the isolated atoms while neutral oxygen consists of two atoms, is *diatomic:* but the mere isolation of the atom of oxygen, which is but an illustration, does not of itself betoken the electrified state.

129. Can an electrified isolated atom lose its electricity and remain isolated, and can it then have any property distinct from that of ordinary diatomic oxygen? It is no longer either ozone or antozone, nor excited oxygen in the sense in which that term has been hitherto used. We may certainly assume that an isolated atom though perfectly non-electric would have other properties from those of diatomic oxygen, as in Clausius, and De la Rue's theory, only the isolation is to betoken the ozone state: but it is evidently by no means necessary to imagine that an isolated atom by such isolation possesses the property by virtue of which oxydation takes place. Even granted that without reference to electricity an oxygen molecule consisting of only one atom is something different from a molecule consisting of two or more atoms, it by no means follows that this difference is to be recognized in its chemical relation to oxydisable substances.

130. So long as no fourth state, different from positive, negative, and diatomic oxygen, is known, we may assume that the isolation and electrifying of the atoms are coincident, and that as soon as the isolated atoms lose their electricity they either re-unite and become diatomic, or that while electrifying alone causes the excited state, the mere isolation of itself causes no difference in the behaviour of oxygen to other atoms, *i.e.*, in reference to the oxydation process, from that of ordinary oxygen. As to the minor difficulties that we meet with in carrying out either of these theories, it must be remembered that the idea of molecules and atoms is merely used as an illustration for the easier comprehension of many phenomena.

131. If oxygen is indebted to electricity for its chemical activity; if attraction between it and oxydisable atoms exists by virtue of the electrified state of the oxygen and according to the kind of charge, this is termed its chemical affinity for oxydisable substances, electric attraction. In fact, the consideration of ozone and antozone leads us to an electro-chemical theory from a new point of view. These ideas may be extended to a number of facts, and may be modified so as to account for the magnetism of oxygen, for doing which De la Rue claims great superiority for his theory over that of Clausius.

132. Some facts as to the behaviour of free ozone, and antozone mentioned above, may be explained by accepting the view here propounded. If the two electricities are accumulated upon two bodies isolated from one another, they are mutually kept bound, an originally electrified body whose charge is kept restrained does not show the properties of an electrified body: ozone and antozone may thus be mutually restrained, this is shown in the plainest manner in the binding of antozone by means of ozone, for the reverse there are no observations.

133. The attraction between antozone and water is excited either in forming peroxyde of hydrogen or mist, which, apart from abklinging, depends upon the state of aggregation of the water, these behaving to one another very much as ozone does to an easily oxydisable and to a noble metal.

134. One of the first facts discovered by Schönbein was that by immersing gold or platinum foil in ozone it became negative. If two exactly similar pieces of platinum foil form the metallic ends of a multiplying coil which

is completed by simple or acidified water, and if one foil be removed from the fluid and dried between folds of bibulous paper, so that no deflexion of the needle follows on re-immersion, this dried foil will, after being for a moment placed in a vessel of ozone, show strong deflexion of the needle on re-immersion: its direction shows a current in which the positive electricity flows from the foil sunk in ozone through the multiplying wire to the other foil. If the ordinary platinum foil is positive with respect to that which was placed in ozone, the platinum becomes still more negative by contact with ozone than by itself, it attracts the negative electricity less strongly in contact with water than in the ordinary dry state. Platinum placed in ozone may retain its electricity for a considerable time, it loses it sooner in the circuit of the multiplier, but keeps it for some time, though gradually diminishing.

135. This evidently arises from the ozone fixing on the platinum, through the attraction existing between all bodies of the positive series and ozone, which, with the more positive of the metals, leads, under ordinary circumstances, to oxydation: as the ozone becomes condensed on the platinum, from its property as a non-conductor, it gradually yields its negative charge to the platinum or is neutralized by its positive electricity, so that the metal receives a negative charge and consequently loses its attraction for negative electricity, and holds the same relation to ordinary platinum that copper, for instance, does towards zinc. The discharging of the ozone takes place but slowly through which it disappears as its difference from ordinary oxygen depends only on its negative charge. The more easily oxydisable metals are not negatively polarised by ozone but oxydised, for these likewise attract the negative electricity but stronger so that the oxygen combines with them, it enters into the very substance of the metals.

136. If ozone prove itself negative in this manner, can antozone be proved in like manner to be positive? A plate of platinum is not charged by immersion in antozone, no matter in what way the antozone is produced or whether it be moist or dry. Schönbein, indeed, stated that it occasionally polarised platinum negatively like ozone, but this was owing to the foil being sprinkled with sulphuric acid, which makes it negative, as caustic potash makes it positive. A clean piece of platinum foil is never affected by antozone.

137. It cannot, however, be concluded from this, that

antozone has no electricity. The properties of antozone are so different from those of ozone, that because platinum is polarised by ozone is no reason why it should be affected by antozone. In fact, the test that is applicable to ozone is quite inapplicable to antozone. There is a strong attraction between all metals and ozone, by which it oxydises most of them and adheres to those which it cannot oxydise, and consequently it can make its electricity over to them. But there is no such connexion between them and antozone which can neither oxydise them nor adhere to them, and consequently cannot transfer its electricity to them. In fact, both being positive, there is no neutralization to be effected. But water, for which ozone has very little attraction, forms the counterpart to the metals, and it has a strong attraction for antozone: with water and antozone we can make an experiment similar to that with the metals and ozone, for antozone combines with and adheres to water just as ozone does to the metals. Antozone with water forms peroxyde of hydrogen which behaves positively towards pure water, as was known to Becquerel and Schönbein. But while the binoxyde of hydrogen is shown in the multiplying circuit to be positive, it is decomposed, *i.e.*, the antozone disappears, and becomes common oxygen: binoxyde of hydrogen being water positively polarised by antozone. The two experiments are strictly analogous, other ozonides and antozonides show the same antagonism that negatively polarised platinum and positively polarised water show.

138. It may naturally be asked if ozone and antozone in their free state can make their electricity apparent. If antozone and ozone are nothing but oxygen positively and negatively electrified, it may be expected that their electricity should be demonstrable by the electroscope. Meissner made many experiments like those made to show the state of atmospheric electricity, but with only negative results, which is not surprising when we consider the many sources of failure to which these experiments with the electroscope which must be very sensitive are obnoxious. When electricity of the glass walls of the tubes and receivers through, and in which the gases flow, and when electrifying of the glass by the air, etc., were avoided, charges neither of ozone nor of antozone were accumulated on the electroscope. Nor is there much probability of success should the electroscopic contrivances be even more sensitive, for if there is a receiver filled with ozone, there are particles of ozone spread

over the whole room. If the point of a wire in communication with an electroscope be immersed in an atmosphere of ozone, it comes into contact with but very few of its particles, and only those particles immediately in contact can affect it. Moreover, we have to do with ozone of so little density that we can hardly expect it to act on the electroscope. Could all the ozone in a large receiver be condensed into a small space it would doubtless affect the electroscope, as a voltaic pile may produce a vast amount of electricity but of such low tension that it only becomes appreciable by the aid of a condensator. The same remarks apply to antozone with the addition of its rapidly losing its electricity by abklinging.

139. There are, however, in these negative results, which can easily be accounted for, no grounds for rejecting this electric view of ozone and antozone, which is rendered so probable by other circumstances.

140. It is well known that ozone is produced in the decomposition of water by electrolysis, and as it is also known that oxygen can combine with hydrogen to form water only in the state of ozone, it seems not unnatural to suppose that all the oxygen produced by the electrolysis of water should make its appearance in the form of ozone. Such, however, is not the case, nor indeed can it be, as the ozone can be released from its combination with hydrogen only by becoming neutral diatomic oxygen, ceasing to be ozone, for so long as it is ozone it remains combined and inseparable from the hydrogen. The electrolysis of water would appear to take place in the following manner. The hydrogen exists in water as an electro-positive and the oxygen as an electro-negative body, and when the two poles of a battery are brought into contact with water they can only decompose it in one way. The positive electricity of the battery unites with the negative electricity of the ozone, thus converting the latter into ordinary diatomic oxygen which has no particular affinity for hydrogen, morever this action is probably assisted by the negative electricity, at all events rendering the hydrogen less positive. There is, however, another fact to be accounted for: antozone in the form of binoxyde of hydrogen is produced in proportionally much larger quantity than ozone. We have shewn that no ozone as such could possibly be directly eliminated from its combination with hydrogen, and most certainly antozone cannot. It would appear

that while the electricity of current is engaged in electrolysing the water, there is much electricity of tension at the poles of the battery, and that this electricity of tension electrifies a portion of the ordinary diatomic oxygen as it is separated from the hydrogen, polarising it into ozone and antozone. Should the positive pole be formed of an easily oxydisable metal, zinc, for instance, it rapidly condenses and unites with the ozone to be oxydised, and should it be a noble metal as platinum, we know that the latter has the property of attracting and condensing ozone, and thus converting it into ordinary diatomic oxygen, *i. e.*, the platinum removes from it its negative charge of electricity.

PART II.

THE POLARISATION OF OXYGEN BY COMBUSTION.

141. If a current of air be passed over some sticks of phosphorus lying in and half covered by water in a suitable apparatus (which it is not worth while to describe), then through a saturated solution of iodide of potassium to absorb the ozone, and, lastly through water, thick white mists make their appearance over the water and look like little clouds long after they have passed into the atmosphere.

142. The air is certainly misty before its entrance into the iodide solution, but if care be taken that the water in which the phosphorus is half immersed is perfectly still and not high enough for bubbles to be formed, the mist before the air is deozonised is trifling compared to the dense mist which afterwards forms over the water. There may be mist too over the solution of iodide, though much slighter than over the water. The mist forming air may be passed through several washers, without the mist suffering any considerable diminution. When the phosphorus is not red, and much ozone is produced, a glass receiver, containing one or two pints, when filled with this mist, becomes quite opaque.

143. This mist, as may be supposed, is nothing else than antozone which has attracted and condensed moisture. In fact, this mist formed by the slow combustion of phosphorus is precisely the same substance as that formed by the antozone produced by electricity. If the mist formed by first deozonising the air and then passing it through water, be

collected in a dry receiver, it disappears in the course of 30 or 45 minutes, the lower part of the receiver being bedewed with a fine rain from the precipitation of the water of the mist: by the introduction of more water no more mist is produced. If the mist be passed through a dry receiver for some hours, so much water is produced that it runs together in large drops. If the mist be passed through a tube with chloride of lime or sulphuric acid, and then through a dry receiver, no mist appears, provided the drying tube acts properly. But no sooner does this air again come into contact with moisture in a vessel or in the atmosphere, than the mist reappears. These appearances, however, only take place provided that sufficient time has not elapsed for the antozone to abkling.

144. The behaviour of ozone to antozone is in every respect different in air passed over phosphorus from what it is in dry electrified air, the relative amount of ozone being so very much smaller in the former. The amount of ozone is no comparison greater in electrified air, than in air passed over phosphorus, and under the most favourable circumstances the density of the mist as formed in the electrified air is always much less than in that passed over phosphorus.

145. It was before mentioned that the water of mist might be withdrawn from antozone produced by electricity by means of concentrated solutions of salts, just as on the other hand these concentrated solutions permit the formation of but slight mist or of none at all, according to the quantity and condition of the antozone. The antozone from phosphorus behaves in just the same manner, but it must be remembered that we have to do with a much larger proportional amount of it, and much dense mist, so that the means which amply sufficed to withdraw the moisture from antozone of electricity would be quite inadequate with that of phosphorus. The difference in the behaviour of ozone to antozone in the two cases is everywhere apparent, and must be taken into consideration. Should the moisture have to be withdrawn from antozone so that the mist should disappear, the time during and the intimacy with which it comes into contact with the drier must be taken into consideration, and above all, the density of the mist. It depends very much on the amount of the antozone present whether there is any mist in air which contains but little moisture. It may happen that very dense clouds arising from phosphorus after having been passed

over extensive sheets of sulphuric acid, liquor potassæ or saturated solutions, suffer no remarkable diminution. But when mist is brought into intimate contact with the fluids named, it is much lessened or entirely disappears without losing the power of again forming mist, provided the antozone has not gone too far in abklinging.

146. That air passed over phosphorus immediately forms mist, is of course dependent on the moisture caused by the phosphorus being half covered with water: and the disproportionately large amount of antozone is dependent, not on the small proportional amount of ozone originally produced, but on the large portion of this ozone which becomes united with phosphorus. Phosphorus produces ozone by polarising the air, it is true, but then it immediately unites with a large portion of the ozone produced and to a great extent deozonises the air, so that the air passed over phosphorus is so far in the same state that electrified air would be, were it but partially deozonised by iodide of potassium.

147. As a large amount of moisture and a small quantity of ozone are both favourable to the permanence of antozone when the three are present together, the antozone produced by phosphorus is more permanent than that produced by electricity under these circumstances. For this reason, a large amount of antozone forming mist can be preserved almost in its integrity until the small amount of ozone present has been removed by iodide of potassium; the antozone, moreover, is in such quantity that notwithstanding the drying action of a saturated solution of iodide, a thick mist appears over the latter: with electrified air the same may take place, though less in degree, where the antozone is large in amount and possessed of great energy.

148. If the antozone from phosphorus be passed through a strongly heated glass tube, it disappears whether dry or in the form of mist. The same takes place if it be passed over peroxyde of lead or of manganese, provided that the contact be sufficiently intimate.

149. Phosphorus shines only by combustion, and never in consequence of mere evaporation. If a gas free from oxygen, as nitrogen, hydrogen, or carbonic acid, be passed over phosphorus, the latter does not shine, and no ozone or mist is produced, but the moment that oxygen is added, the phosphorus shines and mist is formed in the moist air.

150. With a three-branched glass tube (vide Appendix No. 3) an experiment bearing on the same subject may be

so managed by properly apportioning the relative amount of oxygen with some other gas to dilute it, that the phosphorus takes up all the ozone produced, and nothing but antozone remains, which is never the case when common air at the ordinary temperature is passed over phosphorus in sticks without any very extended surface. There is so much oxygen that more ozone is produced than the phosphorus can take up, a mixture of oxygen with nitrogen, &c., may be so proportioned that the phosphorus shines and combustion takes place so slowly that no free ozone is produced, while the mist formed shows the presence of antozone. Since just as much phosphorus is volatized in air which is poor, as in air which is rich in oxygen, and as by slow combustion in common air a considerable proportion of the ozone originally produced is taken up, there is nothing extraordinary in finding a certain strength or dilution of oxygen in which the amount of phosphorus vaporized is just sufficient to combine with all the ozone produced.

151. When the surface of phosphorus is made perfectly smooth, so that it burns slowly in pure oxygen (but which soon enters into rapid combustion), both ozone and antozone are formed.

152. People have taken much trouble in investigating the insolubility of the mist formed by the antozone of phosphorus. In fact, when a bottle full of mist is shaken with water, it cannot be made to disappear within 15 or 20 minutes. Should there be any other substance dissolved or suspended in the mist, that is quite another thing; mist being nothing but water, it is absurd to talk of its being dissolved in water, what has been termed its solubility being nothing but its disappearance through the gradual abklinging of the antozone, i. e., the cessation of the peculiar property which positively electrified oyxgen has of attracting and condensing vapour. If a dry receiver be filled with mist it disappears of itself, almost as quickly as when shaken with water.

153. From the above it will be seen that the antozone of phosphorus and that of electricity agree in all their characteristics, the slight differences in their behaviour arising from the former being produced in air saturated with moisture, and from the relative amounts of ozone and antozone.

154. If air which has been passed over phosphorus be first deozonised by iodide of potassium and then passed (for at least several hours) through washers, both iodic acid

and binoxyde of hydrogen are to be found, as in the corresponding experiments with electrified air. The presence of iodic acid and its formation are easily explained: the ozone oxydizes the iodine and the antozone carries it along with it, either dissolved or in a state of suspension. By passing the antozone through liquor potassæ, the iodic acid is not prevented from subsequently making its appearance, though, of course, in diminished quantity. The proportion in which iodic acid and binoxyde of hydrogen are found in experimenting with air polarised by electricity, and that polarised by phosphorus, are reversed: in the former the relative amount of iodic acid is so great that the binoxyde may be overlooked, while in the latter the proportion of binoxyde is so great that the iodic acid may be overlooked. This difference corresponds to the different quantities of ozone and antozone in the two experiments. There is, relatively, little ozone in the air passed over phosphorus, while in electrified air there is much ozone, and the proportion of antozone, even if equal in amount to the ozone, is still very much less than in air passed over phosphorus. It is the ozone which forms iodic acid, and the antozone which forms binoxyde of hydrogen. In the tube leading from the iodide of potassium much iodate of potash is quickly deposited when electrified air has been passed through it, while, with the air from phosphorus, the iodic acid formed is so much less that it is scarcely perceptible till after several hours. This depends upon the deozonising action of phosphorus. If the air from phosphorus be deozonised by pyrogallic acid, the water through which it is afterwards passed contains binoxyde of hydrogen just the same, but neither nitrous acid nor ammonia.

155. Phosphoric acid, also, is unexpectedly met with in the water through which the deozonised air has been passed. If the air, after having been passed through water be led into a dry receiver, the drops of water deposited have an acid reaction dependent not upon iodic but on phosphoric acid as reagents demonstrate. Should the air be passed, through liquor potassæ, phosphoric acid is still present though in smaller quantity. It is evidently owing to the antozone that the phosphorus acid is transported so far where it attracts oxygen from the diluted solution and becomes phosphoric acid. A current of air, incapable of forming mist, if it did not lose every trace of phosphorus in the iodide solution, would assuredly do so in the liquor

potassæ, but antozone mist, as was mentioned when speaking of the transport of iodic acid, has the power of enveloping and conveying substances, which, like iodic and phosphoric acids, are formed in it from iodine and phosphorus vapours, through fluids which would otherwise easily dissolve them, as these fluids come into contact with the bubbles of air as they pass through.

156. When the air is passed direct from the phosphorus tube through water, it still contains ozone, and forms thick mist as it comes out. The amount of ozone is, however, but small, and is occasionally altogether wanting, though it was present before its entrance into the water. This can, of course, only take place when there is so much phosphorus vapour present that it combines with the whole of the ozone. It must not, however, be forgotten, that in former experiments where antozone disappeared quickly in the presence of ozone and moisture, ozone likewise disappeared though not to any great extent. As the quantity of ozone produced from phosphorus is but small, it may all be removed by equalization and only antozone remain, while the ozone produced by electricity is so disproportionately large that it neutralizes all the antozone without being itself notably diminished. With phosphorus the quantity of antozone is so great that dense mist is formed, notwithstanding the presence of ozone though much less dense than when deozonised, even this small quantity of ozone influencing the action of antozone.

157. If we compare the water through which electrified air has been passed, and that through which air previously led over phosphorus has been passed, we shall find that both contain binoxyde of hydrogen and that the former contains besides nitric acid and the latter phosphoric acid. For the formation of nitrous acid both ozone and antozone are necessary, and the previous dryness of the antozone is of great importance. The air passed over phosphorus contains but little ozone which is further diminished by the phosphorus vapour which combines with it and the antozone is moist, neither of which circumstances favour the oxydation of nitrogen.

158. The water in which sticks of phosphorus have been allowed to remain, the method employed by Schönbein differs in many particulars from that through which water previously led over phosphorus has been passed. If a stick of phosphorus one or two inches long be allowed to remain

in a loosely covered vessel some 10 or 12 hours half covered with water, the so-called phosphatic acid is formed as is well known, while the air above it contains ozone and mist. It is well known that this strongly phosphatic acid contains phosphorus and phosphoric acids. Schönbein demonstrated the presence of binoxyde of hydrogen, and knowing that nothing but antozone could oxydise water he concluded that antozone as well as ozone was produced by the slow combustion of phosphorus. The amount of binoxyde is so great that the less sensitive reagents show it. When the phosphorus and phosphoric acids have been precipitated by lime or barytes water, so that litmus paper is no longer reddened, binoxyde of hydrogen is easily demonstrated in spite of the dilution. The amount of binoxyde of hydrogen is incomparably greater in phosphatic acid than in water through which air previously led over phosphorus has been passed for days, whether first deozonised or not.

159. Schönbein also found a small quantity of nitric acid in phosphotic acid. Nitric acid is easily demonstrated by sulphuric acid and sulphate of iron if the fluid be first neutralized by an alkali and evaporated. It is to be remarked that the quantity of nitric acid produced in, say, 24 hours, by the slow combustion of phosphorus, is much less than that produced in a single hour by passing electrified air through water, while in the latter case the proportion of antozone is but small.

160. Phosphatic acid contains phosphorus and phosphoric acids, binoxyde of hydrogen, a very little nitric acid and still less nitrous acid, but no ammonia produced by the action of electricity on nitrogen and hydrogen.

161. The slow combustion of phosphorus therefore produces ozone and antozone, the greater part of the former at once combining with the phosphorus, some of the antozone in its nascent state unites with water and forms binoxyde of hydrogen, while the remainder of the antozone coming into less intimate contact with water forms mist. Phosphorus vapour and ozone are also suspended or dissolved in the antozone, and these again form phosphorus acid, so that should the ozone not be too abundant, it may all be absorbed by the phosphorus.

162. After what has been already said about the production of nitric and nitrous acids, it is only necessary to add that phosphorus merely polarises the oxygen and produces some of that caloric so favourable to the formation

of nitric acid. The small quantity depends on the small amount of ozone produced.

163. The differences between phosphatic acid and the water in the washer is easily and simply explained. The air in motion vaporizes more phosphorus than still air, while the antozone in its nascent state is at once removed, on which account less binoxyde is found in the washer, while the large amount of phosphorus in the air makes more phosphorus acid in the water, and the merest trace of nitric acid, because nearly all the ozone was employed in oxydising the phosphorus.

164. When a little diluted acid is added to a weak solution of perfectly pure iodide of potassium, a gradual decomposition of the iodide with the precipitation of the iodine takes place after a few minutes: the stronger the acid the quicker the decomposition. This certainly does not depend on iodic acid, for if that be present, decomposition takes place the moment that the acid is added. Now, if phosphatic acid, freed from phosphoric and phosphorus acid be added to this solution, this decomposition either takes place not at all or much later and weaker. If we take two equal quantities of a weak solution of iodide of potassium, and add to one a certain amount of pure water and to the other the same quantity of this fluid, and then add to each a drop of dilute sulphuric acid, the iodine is precipitated much stronger and copiously in the former than in the latter.

165. This fact is the more surprising, inasmuch as this fluid contains a large quantity of binoxyde of hydrogen which in pure water decomposes the acidified solution of iodide of potassium. If the same experiment be performed with iodide of potassium containing iodic acid, the same thing in effect takes place, viz., with water it takes place at once, but with this fluid slowly and imperceptibly, or not at all. Precisely the same thing takes place with nitrous as with iodic acid. There is something in phosphatic acid which hinders, delays, limits or prevents the oxydation of iodide of potassium by various oxydising substances, nor do any of its known constituents show anything like it.

166. When a large receiver full of air strongly ozonised by phosphorus is so thoroughly washed out that no trace of any of the ordinary constituents of phosphatic acid is perceptible, and a little distilled water is added and allowed to remain some time, this fluid possesses this peculiar

limiting action on the decomposition of iodide of potassium, though to a less extent. Whether antozone mist is present or not makes no difference, so long as it contains ozone. The ozone produced by electricity confers the same peculiar property upon water. Great care must be taken not to add too much acid, or this preventive action of the ozone is overpowered.

167. But this fluid can not only prevent oxydation from taking place, it can even reduce oxydation that has already taken place. If a little iodic or nitrous acid with iodide of potassium has been decomposed by acid, so that but very little iodine has been precipitated, this free iodine partially or totally disappears when a little of this fluid is shaken up with it, which is not the case when pure water is used, but this experiment requires great nicety.

168. For the sake of brevity, this fluid may be termed ozone-water. It has an action antagonistic to that of antozone upon water, the latter conferring upon water an oxydising, the former a reducing property, both of which are destroyed by heat.

169. If two equal portions of a solution of binoxyde of hydrogen prepared from peroxyde of barium be mixed with similar quantities of iodide of potassium solution, and to the one be added a little pure ozone water and to the other a similar quantity of pure water, iodine is precipitated from the latter on the addition of a little acid, while none or but very little is precipitated from the other. The same thing happens, though not so readily, when iodide of potassium is decomposed by binoxyde of hydrogen with the assistance of sulphate of iron, as much more ozone-water is required. Nor is there anything contradictory in this, for the acid acts on the iodide, and the binoxyde on the iron; ozone-water, however, under all circumstances, exercises a preventive influence. It might be supposed that the binoxyde is decomposed by the ozone-water, but such is not the case, and ozone has much less action on water than antozone.

170. Phosphatic acid shows beautifully the reaction of binoxyde of hydrogen with iodide of potassium and sulphate of iron, though it contains ozone-water: but this is due to the large amount of binoxyde present, so that the ozone-water can only influence the action of a portion of it. If a pure solution of binoxyde, prepared from peroxyde of barium, of such a strength that it precipitates the same

amount of iodine from iodide of potassium and sulphate of iron, as a similar quantity of phosphatic acid, so that in both experiments the same amount of binoxyde of hydrogen is decomposed ; and if the two be then tested for binoxyde by peroxyde of manganese and acid, it will be found that the fluid from phosphatic acid contains much more binoxyde than the pure solution, the extra quantity being held in abeyance by the ozone. Binoxyde of hydrogen and ozone-water may be mixed in such proportions, that the former has no action on the test of iodide of potassium and sulphate of iron.

171. As binoxyde of hydrogen is decomposed by peroxydes which belong to the group termed ozonides, viz, peroxyde of lead, &c., while the antozone unites with the ozone of the peroxyde to become neutral oxygen, ozone-water, in which ozone appears to be united to water, and behaves antagonistically to binoxyde of hydrogen, may be decomposed by an antozonide in which the antozone is combined with some substance other than water, viz., by peroxyde of barium. For, just as binoxyde of hydrogen loses its antozone property by being shaken with peroxyde of lead, does ozone-water lose its peculiar properties by being shaken with peroxyde of barium, which causes the evolution of much neutral oxygen, for not only does this fluid now cease to prevent the decomposition of iodide of potassium, but it even promotes it, the decomposition of the contained binoxyde of hydrogen being no longer hindered by the ozone. In fact, the full amount of the binoxyde present only becomes apparent after the removal of the ozone.

172. But as ozone-water interferes with the decomposition of iodide of potassium by binoxyde of hydrogen, it is, on the other hand, due to the latter that the ozone-water cannot exert its whole influence in preventing the reaction between iodide of potassium and iodic or nitrous acid, as it would do were the oxydising action of the binoxyde not added to that of the acid. If the fluid be shaken with peroxyde of lead instead of barium, the binoxyde is destroyed, and now the fluid interferes much more with the reaction by iodic or nitrous acid. Shaken with peroxyde of barium this fluid retains only its oxydising properties with peroxyde of lead, only its reducing or preventive action remains, and both with increased power. In both cases, diatomic oxygen is given off by the union of ozone and antozone, or by their neutralizing one another. Binoxyde of hydrogen is an antozonide, ozone-water appears to be an ozonide, though they do not decompose one another, probably owing to their being both united to the same base, viz., to water. There appear to be sufficient grounds for the assumption that ozone-water is water united with negative oxygen, and binoxyde of hydrogen water united with positive oxygen. By these means, therefore, phosphatic acid, from which phosphoric acid, &c., have been removed, can be made to have either the property of ozone-water or of binoxyde.

173. This reducing action is only relative and not absolute, as it does not take place under all circumstances. There is no substance known which induces an oxydising action in ozone-water, as sulphate of iron induces such action in binoxyde of hydrogen, but there are oxydising substances which decompose iodide of patassium, and which are in no way prevented in so doing by ozone-water. It is decomposed by peroxyde of lead, as the oxygen, which forms the higher grade of oxydation, ozone oxydises iodide of potassium. This oxydation, which takes place with a true ozonid, is rather promoted than retarded by ozone-water.

174. It would appear, therefore, that ozone-water behaves in the very opposite manner to a peroxyde which is an ozonide, and to one which is an antozonide : and in this sense, iodic acid though formed by ozone and not by antozone is not a true ozonide. Ozone-water has no retarding influence on free ozone.

175. The same antagonistic action is shown with other oxydisable reagents. Freshly prepared tincture of guiaaun mixed with a little sulphate of iron becomes blued on the addition of binoxyde of hydrogen, which is prevented when ozone-water instead of pure water is used to dilute the tincture. Ozone-water has likewise the power of removing the blue colour if the experiment be nicely adjusted.

176. Schönbein found that ozone-water is always negative, and binoxyde of hydrogen always positive, with respect to pure water, and still more so towards one another. Compared with antozone, ozone has but little attraction for water, the oxydisable metals are the reverse, as they have great attraction for ozone and little or none for antozone.

177. It does not appear that ozone prevents antozone from forming binoxyde of hydrogen with water further than that ozone and antozone when moist neutralize one another with a disproportionately large loss of antozone, but the

presence of binoxyde of hydrogen may in some reactions be cancelled by ozone-water. Nor does this contradict the behaviour of ozonides to antozonides, as here the ozone and antozone are united to different substances, while in the former they are united to the same, *i. e.*, water.

178. Phosphorus polarises the oxygen in its vicinity producing ozone and antozone and acts as a positively electrified body, inasmuch as it attracts and becomes united with negative oxygen. Great affinity for oxygen is ascribed to phosphorus, which means that the latter causes the polarisation of the former, the two atoms forming a molecule of passive oxygen being polarised, the negative attracted and the positive repelled. With the former the phosphorus unites, while the latter forms binoxyde of hydrogen and mist. Of how the free ozone is produced hereafter.

179. If electricity be collected and diffused over a substance which does not unite with oxygen, and which is a bad conductor like the glass covering of a metallic conductor (wire), the oxygen is converted into free ozone and antozone. If a metal like copper, which, when moist at ordinary temperature, has no particular action on oxygen, and does not become oxydised, be highly charged with positive electricity, so that it acquires a powerful attraction for negative electricity, it polarises the oxygen uniting with the ozone. If the positive electrode in the circuit of a battery be formed of copper, it acts like phosphorus in its natural state.

180. Many metals as zinc, cadmium, lead, in the presence of water, act like phosphorus towards oxygen becoming slowly oxydised by the air with the formation of binoxyde of hydrogen. These have a greater attraction for negative than positive, like copper, when positively electrified or phosphorus in its natural state to a very much greater extent. The water, as stated by Schönbein, appears to act chiefly, though not exclusively, by attracting the antozone, and thus freeing the ozone, by which means it assists in supporting the polarisation of the oxygen.

181. We may compare the action of zinc and water upon neutral oxygen to that of the positive and negative electrodes of a battery upon the interposed electrolyte water: the negative constituent, oxygen, and the positive, hydrogen, are respectively attracted to the positive and negative electrodes, and separated by the double impulse. The oxygen and hydrogen lose their electric charge in the

circuit as they definitively separate, for even this electric charge produces the excited electricity termed current, where it meets the circuit, while it becomes extinct itself. When zinc and water polarise oxygen, both enter into chemical combination with the bearer of the attracted electricity, chemical action taking the place of electric current. The air is the electrolyte, the zinc the positive, and the water the negative electrode, the circuit being completed by the air or by the contest of the zinc and water.

182. The metals of the alkalies have a similar but much more energetic action on oxygen, and behave more like phosphorus though with greater intensity. There is one peculiarity, however, with these metals, their oxydes very readily form peroxydes with antozone, so that when combustion takes place a peroxyde is immediately formed. The metal polarises the oxygen, and combines first with the ozone and then with the antozone, the same thing, though to a less extent, takes place in the oxydation of hydrogen, which first forms an oxyde with ozone and then a binoxyde with antozone.

183. The noble metals, gold and platinum, form the other extreme of the metals arranged electrically, their attraction for negative electricity being too little for them to act on neutral oxygen in their natural state. Platinum may be made to polarise oxygen by being properly electrified, but even then there is no more tendency to chemical combination between the positively electrified platinum and the negative electricity of diatomic oxygen, than when the latter is polarised, *i. e.*, converted into ozone, and the platinum in its natural state. Ozone merely becomes condensed upon platinum, as vapour upon antozone. [Meissner's assertion appears to be too sweeping, if Nobili's rings are, as is generally supposed, the result of the oxydation of platinum.]

184. It depends upon the molecular state of a metal whether ozone can penetrate between its molecules to oxydise it, or whether the ozone can only become condensed upon its surface, the first step towards oxydation, just as it depends upon the molecular aggregation of water, whether it forms binoxyde of hydrogen, or merely mist with antozone. This molecular constitution may be changed by the addition of heat, inasmuch as this expands, loosens the aggregation, alters the molecular arrangement, the relations of metals and other oxydisable substances to oxygen by increasing their oxydisability, and rendering it possible for

oxygen to enter into chemical combination with them, (with the exception of water, which, in so many respects, behaves unlike other substances.) While common platinum at ordinary temperatures has no action on passive oxygen, the latter is polarised by a red hot platinum wire just as the slow oxydation of ether is promoted by one: although, under these circumstances, platinum cannot unite with oxygen, it may promote oxydation by producing ozone and antozone: in the one case it is the electric tension in the platinum, in the other the caloric communicated to the platinum wire by the excited electricity. Davy has observed nitric acid formed from atmosphere air by a red hot platinum wire.

185. The co-operation of water is necessary in all oxydations with atmospheric oxygen, at a low, though not at a high temperature heat like a copious supply of electricity increasing the action between oxygen and other substances: at a low temperature, water, by its attraction for antozone, favours the action between the ozone of the oxygen and other substances.

186. The behaviour of good conductors to the two electricities is expressed by their position in the tension series,* inasmuch as the combination of heterogeneous bodies induces electricity of motion or current. There is the most intimate relation between the electric arrangement of the elements and their behaviour to oxygen: if they are arranged according to their electric difference, it is the same as if they were arranged according to their attraction for oxygen. Oxygen, as ordinary neutral passive, diatomic oxygen, does not form the negative end of this series but ozone or negative oxygen. All members of this tension series have a greater attraction for negative than for positive electricity, though differing in degree. Oxygen unites in itself the opposite properties of being like other gases a dielectrice, and also since it is diatomic of being a conductor in consequence of its permitting the diffusion of the two electricities on its isolated atoms: which atoms again behave as non-conductors preserving intact their different electricities, when diffusion of electricity and consequent separation of its atoms has once taken place. For this reason, oxygen in the form of ozone being absolutely negative, may exist in a state of opposition to or form the negative end of the series just as well as negative electricity itself.

* The elements electrically arranged.

187. Ozone being absolutely negative oxygen can have no attraction for negative electricity: the other members of the series are arranged according to the difference of their attraction for negative and positive electricity, those having the least attraction for negative being placed nearest ozone, while those having the greatest attraction for negative and the least for positive, are placed towards the other end of the series. Here, again, oxygen, positively electrified oxygen, in the form of antozone, forms the other end of the series.

188. The polarising action of any substance on neutral oxygen is, and its union with oxygen takes place readily, in proportion to the difference of its attraction for the two electricities. The substances belonging to this class possess collectively very great attraction for negative electricity and consequently for ozone, for this reason oxydation is attraction, for and combination with ozone, and any substance polarises oxygen and becomes oxydised in proportion as it is positive. It follows that other oxydisable substances which do not unite exclusively and proportionally with ozone, but with antozone, polarise oxygen, as their attraction for positive is greater than that for negative electricity.

189. We might expect ozone and antozone as the two extremes of this series of oxydisable substances to have a powerful polarising action on oxygen: but this is not the case, for ozone and antozone being diffused as gases in neutral oxygen and being equally dispersed between its molecules, one particle of ozone annuls the distributing action of the other. Electrified oxygen acts on other non-gaseous substances, susceptible of electric distribution when it comes in contact with them, ozone acts on platinum and gold to both of which it adheres, and antozone acts upon water which it condenses.

190. Of substances of this class which are the furthest removed from ozone and being highly positive have very great attraction for ozone are the easily oxydisable metals potassium and sodium: as oxydes they are new and different substances with no resemblance to metals, since they have a strong tendency to combine with antozone to form peroxydes.

191. After a number of similar substances follow zinc, iron, lead, &c., which polarise neutral oxygen and unite with the ozone at ordinary temperatures in the presence of water which attracts the antozone. Then follow nearer to ozone

platinum, gold, charcoal, &c., which being more negative have less attraction for negative electricity, and under ordinary circumstances do not polarise oxygen, and are not oxydisable, the difference between their attraction for positive and negative electricity being too little. At the negative end of this series are the ozonides, metallic peroxydes, which can combine with no more ozone, but have a strong attraction for antozone, and being unable to unite with it, withdraw it from its base, the ozone of the peroxyde uniting with it to form diatomic oxygen. That the electric order of these substances has a reverse relation to ozone and antozone, is proved by platinum which decomposes binoxyde of hydrogen much more readily than zinc, from its having more attraction for antozone than the easier oxydisable metals.

192. When a metal like zinc, in conjunction with water, polarises oxygen and unites with the ozone while the water unites with the antozone, it is essentially the same phenomenon as when zinc in contact with water receives negative and the water positive electricity. The oxydation in the one case and the electricity on the zinc in the other are both caused by the difference in its attraction for the two electricities which, with every substance, has a particular value either positive or negative. In the one case, electric difference causes polarisation of the neutral oxygen, separation of the ozone and antozone, as well as production of chemical affinity of which the chemical process is the consequence, in the other case electric difference causes the disappearance of chemical affinity (between the elements of the water) decomposition of the chemical combination, and, inasmuch as electricity disappears, disturbance, current electricity, as soon and as long as this disturbance meets with no resistance: wherever this disturbance, having been once produced, again becomes extinct, electricity, chemical affinity of the electrolyte oxygen, again arises. The slow oxydation of zinc with water, and the slow combination of phosphorus under similar circumstances, are essentially the same. Both in conjunction with water produce ozone and antozone, uniting with the former while the latter unites with the water: the appearance of free ozone and antozone, by the slow combustion of phosphorus, is dependent on other and peculiar conditions.

193. What is termed the chemical affinity of phosphorus for oxygen is the same thing that takes place, though to a

less extent, when zinc is slowly oxydised in moist air: that which makes zinc immersed in water show negative electricity is essentially the same thing; the chemical affinity of phosphorus for oxygen is its different attraction for positive and for negative electricity, the chemical affinity is great because the difference of attraction is great, because the attraction for negative electricity vastly predominates.

194. If phosphorus, from its excessive attraction for electricity, polarises oxygen, it must act similarly on other substances. Schönbein found, when platinum foil was immersed in phosphorus vapour, or when a piece of phosphorus was rubbed over the foil, that it acted positively towards clean foil in water. The film of phosphorus, by attracting negative electricity and consequently ozone, renders the metal over which it is rubbed positive, and should it form one end of a multiplication coil, of which clean metal forms the other, it behaves towards the latter as a positive metal, zinc for instance, would, so long as any phosphorus remains unoxydised and produces the usual electric phenomena.

195. Brodie was of opinion, that when two atoms unite chemically, a certain chemical relation takes place, which may be designated positive and negative, one atom behaving positively towards the other. Silver is not directly oxydised by ordinary oxygen, but when chloride of silver and potash are made to re-act upon one another, the result is oxyde of silver. Brodie thinks that ordinary oxygen and silver do not possess the chemical relation, the polarity requisite for combination. The atom of silver by its union with chlorine, and the oxygen by its union with potassium, have acquired this certain chemical relation or affinity, so that they can unite, the chlorine, having rendered the silver positive, and the potassium the oxygen negative. Brodie's chemical relation or affinity has been termed above electric tension, opposition or difference. If negatively electrified oxygen, ozone, be brought into contact with silver, or if the latter be positively electrified so that it can polarise oxygen, combination ensues.

196. All electro-chemical theories are agreed that chemical affinity is the same as electric attraction or difference of attraction. The process of oxydation is the starting point and goal of all chemical theories, round which everything else revolves, and yet a very important, perhaps the most important fact for thoroughly comprehending oxygen and the process of oxydation was wanting until Schönbein's discovery.

For, although these theories satisfactorily reconciled many disconnected phenomena, they could not explain many well-known and simple facts. Every attempt to analyze chemical processes, to trace chemical appearances to their causes, will, as heretofore proceed from oxygen, but from oxygen as ozone and antozone, in which states alone it can enter into chemical combination, this oxygen will form the foundation of general chemistry hereafter. The effect of ozone and antozone have long been known, but Schönbein's discoveries first showed that researches into their production and origin might lead to some knowledge of the causes of many appearances hitherto incomprehensible.

197. But to return to the slow combustion of phosphorus, we must enquire how it is that some of the ozone, instead of combining with the phosphorus, becomes free. As what is termed the slow combustion of phosphorus consists of two distinct processes—first, the polarisation of the oxygen and then attraction of ozone, there is always the probability that only the first process should take place with some portion of the oxygen, *i. e.*, that after polarisation has taken place, other influences may intervene and prevent the union of the phosphorus with the ozone: some portion of the ozone may be drawn away by the upward motion of the air, caused by the heat set free by the combination of the phosphorus with the ozone, and so be removed out of the sphere of attraction of the phosphorus. This upward movement may be beautifully observed in the antozone mist from slowly burning phosphorus: after the above explanation we must expect that before sufficient phosphorus has been oxydised to produce heat, there will be no free ozone, and such is the fact. If a piece of phosphorus half covered with water be placed in a flask, mist is immediately produced but does not ascend, and contains no ozone, or nothing like so much as it does afterwards when an increase of temperature near the phosphorus causes a continuous ascent of the mist.

198. This slow combustion of phosphorus must be regarded as the type of all processes of combustion, and every oxydation may be explained by comparison with this combustion, the analysis of which is so easy and simple. Of course, nothing can more nearly resemble the slow combustion of phosphorus than its rapid combustion with flame, and there can be no doubt but that the two are essentially one and the same.

199. If a piece of phosphorus be burnt under the chimney of the apparatus described in Appendix No. 4, and the gaseous products passed through concentrated liquor potassæ, and then through water, the mist produced is very dense, and contains so much water that it can be dried but with the greatest difficulty: by actually burning phosphorus as much antozone is produced in a few moments as is produced by its slow combustion in several hours, but this antozone has not the property of forming binoxyde of hydrogen, which is not surprising, as the heat produced destroys the pristine energy of the antozone, which energy alone enables it to oxydise water. The heat evolved is so great that it vaporises sufficient phosphorus to take up all the ozone produced; so that none remains in a free state, of course without ozone there can be no hyponitric acid. The reason that the same thing may happen during the slow combustion of phosphorus in air, which contains but little oxygen, is that the amount of oxygen present does not influence the quantity of phosphorus vaporised.

200. Nitrogen can never be obtained perfectly free from oxygen by burning phosphorus in common air over water any more than a perfect vacuum can be formed. The phosphorus polarises the oxygen uniting with the ozone say half, and leaving the antozone, which abklings, *i. e.*, becomes neutral oxygen which the phosphorus again polarises again uniting with the ozone, and so on. Nitrogen could be obtained absolutely pure only by using some substance which absorbed the oxygen without polarising it, which is impossible or by using some substance which absorbed the antozone as well as the ozone. Future experiments must determine how this example applies to the procedures employed for the absorption of oxygen from a mixture of gases.

201. Supposing that all oxydations take place in the same way as the slow combustion of phosphorus and that the polarisation of oxygen must precede oxydation, Schönbein examined the slow oxydations of some hydrocarbous particularly of turpentine, which take place at ordinary temperatures under the influence of light. Turpentine is known to absorb oxygen by exposure to the air, by which it obtains an acid reaction, and the peculiar oxydising property of binoxyde of hydrogen while rosin is produced. Antozone is undoubtedly contained in turpentine that has been exposed to slow oxydation. As this must be formed from ordinary

oxygen—ozone likewise must be formed, the question naturally arises : is this ozone free, and do the elements of the oil unite only with antozone, or does the oil of turpentine unite with both ?

202. If air be passed through freshly distilled turpentine free from rosin and antozone, it becomes oxydised somewhat quicker than if it had been exposed to the air, and now contains antozone. If electrified deozonised air be passed through the oil, it is no more oxydised than with non-electrified air, the antozone by itself having no peculiar action on it. But if ozone be then passed through it, large quantities are absorbed, and the oil becomes converted into rosin with extraordinary rapidity, so that any turpentine in a glass tube is soon converted into a solid cake of rosin ; and if ozone be passed through turpentine vapour a thick cloud of finely divided rosin is formed. But if the oil is quite free from antozone when the ozone is passed through, the latter has little more effect upon it than common air. The probability, therefore, is that the ozone oxydises the oil and converts it into rosin : water too is most probably formed which the antozone oxydises to binoxyde, and which remains dissolved in the turpentine.

203. Schönbein has also shown that binoxyde of hydrogen is produced during the slow oxydation of œther in the presence of water, and thinks that he has found some of the ozone produced by the polarisation of the oxygen, which precedes this oxydation, combined with olefiant gases. As the polarisation takes place before the combustion of the ether and as this process takes place in a similar manner to that with turpentine already described, Schönbein lays great stress on the similarity of the appearances. If œther mixed with water be shaken with ozone it affords signs of having been oxydised by the ozone, and becomes sour ; but there is no appearance of binoxyde of hydrogen, because ready-formed ozone was used, and the polarisation of the oxygen was not allowed to take place in the same place as the oxydation of the œther. Pure water, on the contrary, absorbs binoxyde of hydrogen without becoming oxydised. The polarisation of the oxygen by ether and oxydation of the latter takes place at the ordinary temperature under the influence of light, but quicker with the co-operation of heated platinum. It may here be mentioned that the binoxyde formed by the slow oxydation of zinc in moist air, should it remain in contact with the zinc, more particularly if

amalgamated, slowly disappears, the metal being further oxydised at the expense of the binoxyde. This is one instance out of many of an oxydisable substance uniting with antozone as well as with ozone : the attraction for ozone is stronger, and combination takes place quicker and more energetically than with antozone. Zinc attracts both electricities but one stronger than the other. Where oxygen is polarised by zinc and water, the former attracts the ozone so decidedly, because the latter removes the antozone : but where the zinc has no choice from the absence of ozone, it attracts the antozone and slowly destroys the binoxyde. Different metals behave very differently in this respect but act upon antozone according to their place in the tension series, the noble metals acting the most powerfully as they are the most negative, and we all know how energetically binoxyde of hydrogen is destroyed by spongy platinum, though no chemical combination ensues.

204. Rapid must follow the same course as slow combustion, but analysis of the latter being so easy affords a starting point for the examination of rapid combustion. It is evident, from what has been already stated, that the appearance of antozone, either as binoxyde or as mist, is enough to show that wherever antozone has been produced ozone must likewise have been produced, and should none of the latter be perceptible, it only proves that the whole has been absorbed.

205. One of the most simple combustion is that of hydrogen. If a strong hydrogen flame be brought under the narrowed opening of the chimney of the apparatus described in Appendix No. 4 and if a strong current of air be maintained with an air pump through cooled washers, both these and the receiver are filled with thick white mist of the same temperature as the washers. This remains some time, and gradually disappears. It is important so to manage the experiment as not to allow the air around the flame to become too hot, therefore the stream of air at its entrance into the chimney must move pretty quickly past round the flame. The stronger the heat near the flame the weaker and more evanescent the mist carried by the current of air. Should this mist not appear it is only necessary, after the receiver has been filled with air which has passed near the flame, to sprinkle its inside with water by turning the cock, and to raise the piston of the air pump, when strong mist will immediately appear. The reduction of tempera-

ture, consequent on the sudden rarefaction of the air is the proximate cause of this appearance of mist. There can be no doubt but that hydrogen, ignited by the electric spark polarises oxygen, as antozone is produced, and Priestly observed that the vessel in which the water was formed by the electric spark was filled with a thick white mist : this was nothing but antozone mist. The presence of binoxyde of hydrogen may be demonstrated by the usual tests.

206. The antozone produced by any other flame may be made apparent in the form of mist as well as that of hydrogen, with proper precautions. This is easily enough done with the flame of a spirit lamp and with a gas light, provided the latter does not contain too much soot. Binoxyde of hydrogen may likewise be formed with the antozone from these flames, though it is very difficult to avoid the evolution of an amount of heat, which by destroying the pristine energy of the antozone prevents the formation of binoxyde of hydrogen. The best way of procuring binoxyde with all these flames is to hold a narrow-mouthed globe, wetted inside, over the flame, in such a way that excessive heating of the air is avoided. The water collected has an acid reaction and, after being neutralised, gives the ordinary reactions for binoxyde of hydrogen. The antozone which is borne away from all these flames cannot arise from the interior of the flame because the heat is too great, but must be produced in the neighbourhood of the flame where the polarisation of the oxygen must likewise take place. The heated burning substance, by the combustion of which the flame arises, acts on the neutral oxygen just like a red hot platinum wire, which however sets free both ozone and antozone, while the former retains the ozone, leaving the antozone to be united with the water in part produced by the combustion. As latent heat becomes free during the combustion, the whole or the greater part of the antozone is, under ordinary circumstances, immediately destroyed. Under all circumstances this happens with a large portion of the antozone, so that but a small portion of it ever gets into the atmosphere.

207. But when combustion is so retarded that it takes place without excessive heat, large quantities of antozone are evolved in a condition to form mist. One of the best known is tobacco smoke in which a variety of substance are suspended or dissolved, for the sake of which people smoke,

but the essential part without which it could not exist is the antozone mist : tobacco smoke is antozone mist with the products of combustion arising from the oxydation of the tobacco suspended in it, just as the smoke from slowly burning phosphorus is antozone with the substances produced by the combustion suspended in it. If a cigar be made to smoke by means of an air-pump, the greater part of the products of combustion may be withdrawn by a suitable apparatus from the smoke : but the mist remains and is increased in density by passing through water. The cold mist or smoke may be collected in a receiver, where, after some time, it slowly disappears, depositing the water. The water, with which the antozone arising from the slow combustion of tobacco forms mist, comes, in a great measure, from the tobacco itself which contains much moisture, but much more may be attracted and condensed since the smoke from the mouth is much denser than that from the pipe or cigar. The often-mentioned property of antozone mist of enveloping and dissolving the suspended products of oxydation, and preserving them from absorption, enables tobacco to be smoked through a hookah without losing its flavour.

208. The thick smoke from the ignition of gunpowder, that from chimneys, or from a wick which requires snuffing, &c, are constituted precisely like tobacco smoke. In all, the main constituent is moisture condensed by antozone mist, in which carbon and other products of combustion are suspended, and which, however much they may increase the density of the smoke, never of themselves form mist any more than hot steam condensed by cooling : the density of this mist is rather increased than diminished or destroyed by being passed through water, and when perfectly cool, maintains its appearance as mist for some time either in vessels or in the atmosphere.

209. As oxygen is polarised wherever combustion or oxydtaion takes place, and as the antozone thereby produced for the most part unites with water, the two compounds of antozone with water, viz., binoxyde of hydrogen and mist must be among the most widely spread phenomena of nature. But as binoxyde of hydrogen requires more favourable and rarer fulfilled conditions for its formation, it is produced in much smaller quantity than mist, which is on this account all the more widely spread over the surface of the earth.

PART III.

OZONE AND ANTOZONE IN THE ATMOSPHERE.

210. When air is supersaturated with moisture, the latter is condensed in the form of mist or cloud, just as the vapour from boiling water, as it mixes with cold air, forms the mist or cloud, termed steam. The different expressions used for aqueous vapour condensed, not on the cooler surfaces of other bodies, but in the atmosphere, indicate different degrees of condensation from the merest cloudiness to dense opaque clouds.

211. Halley supposed, and Kratzenstein from their optical behaviour proved, that aqueous vapour in the atmosphere, as it became water, was always first condensed into mist, as fog vesicles of various sizes with walls of varying thickness, which become aggregated as they are precipitated. These vesicles resemble soap-bubbles, inasmuch as being light in proportion to their size, they sink slowly, remain long in the air, and are easily moved by winds. As they sink into warmer air, they are evaporated to be formed afresh, as they again rise into cooler regions, so that clouds, which appear stationary, are in reality being continually dissipated and reformed.

212. Saussure, standing in a cloud, could, with a lens or even with the naked eye, see these mist vesicles, as opaque well-defined whitish corpuscules, which, with a dark ground, are also visible in the steam from boiling water, more particularly as the steam begins to condense, the vesicles being then larger than when first produced, at which time the steam is an homogeneous whitish mass, in which these corpuscules gradually make their appearance.

213. This coincides with what Forbes observed, when he examined the behaviour of sun-light, as seen through a column of steam, in the process of condensation, at different heights, as it ascended from the safety valve of a locomotive. Just over the valve, the steam transmitted only the red and yellow rays, and was of a deep orange red: higher up, where more condensed, the steam if dense enough was quite opaque, and when less dense, transparent but colourless. Forbes regarded this orange colour of the steam with transmitted light as characteristic of a particular stage of condensation, forming a transition state between transparent and condensed vapour. And he thought this a satisfactory explanation of the morning and evening gloaming: this orange colour corresponds to what was above termed homogeneous cloud. The assumption, in other respects probable, that the vesicles at the commencement of their condensation are very small and thin walled, would explain how mist, apparently homogeneous, might transmit some white light; and then by a gradual enlargement of the vesicles with thickening of their walls, become perfectly opaque. This change from perfectly transparent mist to that which is quite opaque, may not inaptly be compared to the gradual deposition of a substance from a fluid in which it was dissolved, the opalescence or semi-transparency indicating the transition stage.

214. The formation of vesicles, instead of the aqueous vapour of the atmosphere being at once condensed into drops, is of great importance, as it explains the removal of water from one portion of the earth's surface to another, without which there could be little or no rain on continents, and none of the changes from a clear to a cloudy sky, on which the ordinary changes of temperature greatly depend. The gradual formation of mist or cloud, and its transformation into drops, occupies the time between the moment when the aqueous vapour ceases to exist as gas in the atmosphere, and when it is precipitated in the form of rain. Here the mist vesicles resemble an opalescent fluid, as the substance causing opalescence follows the motions of the fluid which it does not when precipitated.

215. It may be asked whether water, in passing from the gaseous to the fluid state, when not precipitated on the surface of a solid or fluid substance, is invariably condensed in the form of vesicles, and whether it is deposited in this peculiar manner on the surface of every gas: the condensation of aqueous vapour in the interior of a space filled only with gas either permanent or mere water, may be termed a precipitation on the surface of these gas molecules, just as dew is a precipitation on a solid substance. The opalescence of a solution depends as much on the menstruum as on the substance dissolved: a substance forming an opalescent solution in spirit may be precipitated on the addition of water.

216. Much less importance is attached now than formerly to the influence exerted by the kind of air on the changes which take place in meteoric water. The co-operation of chemical relations was ignored, not as contrary to fact, but because hydrometeorological appearances were more satisfactorily explained by the effects of currents of air and changes of temperature: but experience shows that this was

a mistake, and that the circulation of water on and above the earth is less simple than was supposed. The life air, the oxygen, plays as important a part in meteorology as in organic or inorganic nature.

217. If a piece of ice or some cold air be introduced into a bell-glass filled with air saturated with moisture, more or less mist is formed, a portion of the aqueous vapour being condensed into vesicles.

218. Air may be quickly cooled by rapid evaporation. If air saturated with moisture in a tolerably-sized receiver of an air-pump be rarefied by raising the piston, so that a few inches of pressure are taken off, this rarefaction cools sufficiently to induce a very perceptible, though evanescent, condensation of the moisture. If a shallow cup of water, with blotting paper so folded as to have a large evaporating surface, be placed in the receiver of an air-pump, which holds some two quarts, and the piston raised, white streaky clouds may be observed, particularly if the background be dark, which soon disappears as the air in the receiver becomes warmed. If air be introduced from without, though saturated with moisture, these clouds instantly disappear. As the observer must be looking at the receiver when the rarefaction takes place, the piston must be raised by an assistant.

219. Cullen, of Edinburgh, and Lambert, first observed and examined this reduction of temperature in a receiver, the air of which was quickly evacuated. Kratzenstein had already observed mist formed in a receiver, the air of which was quickly evacuated. He had already observed mist formed in a receiver, when air saturated with moisture was first condensed, and the pressure suddenly removed, while that formed by sudden rarefaction had been frequently observed. De Saussure was the first and last who made this mist the subject of special examination. By using the same methods of examination by which Kratzenstein showed the vesicular nature of steam, he found that this mist consisted of aqueous vapour condensed to vesicles, and observed that the hygrometer showed a drier condition of the air, at the moment when the mist was formed, than before or after it had disappeared.

220. In this experiment, the mist or cloud seen in the receiver is precisely the same as the clouds and mists in the atmosphere. If the experiment be made in pure gas instead of in common air, condensation must take place when the gas saturated with moisture is suddenly cooled, but the

peculiar state of condensed vapour termed cloud is only formed when the gas is or contains oxygen.

221. For this often-repeated experiment, a receiver like that figured in Appendix No. 4 may be used, which discharges itself into a glass tube provided with a cock, by which it is connected with a gasometer. If this receiver be filled, in the usual manner, with pure nitrogen saturated with water, there is not the smallest trace of a cloud perceptible when it is suddenly cooled, but a fine transparent, almost invisible, rain is immediately formed from the condensed vapour, without any transition stage. The same thing takes place with carbonic acid or hydrogen; as no vesicles are produced there is no cloud, no mist, but the vapour on being cooled is immediately precipitated in the form of very fine rain, such as is discharged from the clouds in the atmosphere, except that the drops are very much smaller. So if the receiver be filled with nothing but aqueous vapour without gas, no vesicles are produced by the condensation of the vapour, but transparent little drops of rain.

222. In pure oxygen, however, the same mist, but more dense, is formed as in air, while a mixture of oxygen with carbonic acid or hydrogen behaves exactly like atmospheric air. Oxygen is the one thing necessary for the formation of cloud or mist: oxygen, and oxygen alone, has the power of forming the peculiar aggregation termed cloud or mist, when it comes into contact with vapour, which can no longer exist as such, owing to diminution of temperature: moisture is precipitated in the form of vesicles only in or upon oxygen. In the above experiments care must be taken absolutely to exclude every trace of oxygen, as the smallest quantity forms delicate whitish streaks of cloud. As the atmospheric oxygen is gradually displaced by pure nitrogen, these clouds become weaker and weaker every time the piston is raised, until, in a favourable light, nothing but transparent little drops are to be seen, in the act of being precipitated.

223. A much smaller proportion of oxygen, than exists in the air, is sufficient, when saturated with moisture, to cause cloud to appear when the receiver is cooled by diminishing the pressure a few inches: with this diminished pressure, if the interior of the receiver be again saturated with moisture, and again cooled by raising the piston, cloud again makes its appearance.

224. In Meissner's experiments, by once raising the piston of the air-pump, the pressure was reduced from 28 to 20

'nches, corresponding to 8,240 feet above the sea, while cloud was produced in the air. The air being again saturated with moisture, the pressure was reduced to 15 inches, corresponding to a height of 15,300 feet, by another stroke of the piston, by which cloud was again formed, though much less dense than before. When, after re-saturation, the piston was raised a third time, the pressure was reduced to 13 inches, corresponding to a height of 18,800 feet above the sea, when slight cloud was still produced. The next time the piston was raised, the pressure was reduced to 11 inches, corresponding to 22,880 feet, but with a very slight cloud indeed. By once more quickly raising the piston, the pressure was further reduced to between 8 and 9 inches, corresponding to the enormous elevation of 27,000 feet, but the cloud was now not to be perceived but with difficulty. When the piston was again raised, after re-saturation, no cloud was produced, but the vapour was precipitated in the form of very fine transparent drops, without any vesicular or transition stage.

225. All this corresponds with what Saussure observed, but he, being under the impression that the moisture was dissolved in the air, thought that the latter, when rarefied, could not dissolve so much moisture as before, and overlooked the fact that the amount of moisture is not diminished because the air is rarefied, nor did he observe the minute drops of water which took the place of the vesicels.

226. These observations show that ordinary neutral oxygen, as it exists at the surface of the earth, is in a state to influence the form, in which moisture is precipitated, and that even at an elevation of 27,000 feet, it has sufficient density to form clouds: but the denser the oxygen, and the nearer the surface of the earth, the thicker are the clouds formed. The behaviour of the clouds in the atmosphere, and their height as ascertained by observation, agree very well with these observations. Cirri, the lightest and most evanescent form of clouds, have, according to Kämtz, a medium height of 20,000 feet. This form of cloud is the highest, and Kämtz names 24,000 feet as the highest at which he had observed them; according to the above observations, however, the extreme limit, even with very incomplete means of experimenting, and in the absence of one very important condition, should lie still higher, and Cirri have been observed at a very much greater elevation. Heavier clouds arise at lesser heights, according to the density of the oxygen, and all the denser forms of cloud are far below the region of Cirri, while

8,240 feet, the lowest height imitated in the foregoing experiments, is by no means the lowest in which the denser forms of cloud are seen: Kämtz considers 5,000 feet as the average height of cumuli above the plains.

227. As the steam above boiling water differs from cloud only in the greater difference of the temperatures, and in the more rapid condensation of larger quantities of water, we may conclude that the cloud termed steam could not be produced without oxygen, and that were no oxygen present, the vapour would be condensed into foam like that of a waterfall. It is obviously impossible to prove this by experiment, as the observer could not exist in a room without oxygen, and were the experiment tried on a small scale in a glass receiver, this could not be sufficiently cooled to produce condensation, except from the outside, which would render the glass opaque.

228. We must now return to the consideration of antozone mist and make a few remarks, hitherto omitted as until now, of no special interest. The mist formed from moisture by antozone has all the chacteristic peculiarities of cloud. When the dry, deozonized antozone of electricity is saturated with moisture, an homogeneous mist is formed, in which the vesicular structure is not to be discerned, even with the help of a lens. The same is true of the mist formed by the antozone of phosphorus. If antozone mist be set in motion in a glass receiver, it forms undulating, defined, round or folded, veil-like masses, and shows an inclination to shapes indicating an attraction towards a centre. If left to itself, the antozone mist is gradually decomposed into vesicles, like steam, but much more slowly, which either combine to form drops, or are evaporated. The antozone mist of electricity is not dense enough to show the phenomena of transmitted light, which, however, may be very well observed with that from peroxyde of barium and sulphuric acid.

229. When antozone mist in a close vessel has completely disappeared with deposition of its water, a mist far denser than that formed in common air, or even in oxygen saturated with moisture, may be produced, even some time after, by suddenly cooling it. In the same way, if the receiver of an air-pump be filled with antozone mist, which has been allowed to abkling, the mist is re-produced, though not so dense as before, as soon as the piston is raised, and this may be repeated several times, and each time mist is produced much denser than where no antozone is present, though ant-

ozone is every time removed: such is the power of a very minute quantity of antozone to produce mist, or to increase the density of that produced by rarefaction.

230. To avoid loss of antozone in cooling, and to enable the experiment to be frequently repeated, we may use a globe, having a long tubular prolongation, filled with antozone mist, and, through this, close the globe under mercury or water, in which the tube is immersed as deep as possible: by quickly raising the tube the air is rarefied and cold produced. In this experiment we see very plainly that the cloud formed at the moment of cooling becomes weaker and weaker the longer the time that has elapsed since the antozone lost the power of forming mist by itself. If the experiments detailed in para. 224 be repeated with air, which originally contained antozone, the mists produced by an amount of rarefaction, corresponding to any level above the sea, are much denser than with ordinary air.

231. When antozone mist has deposited its water, and disappeared without change of temperature, the antozone peculiarity of oxygen is by no means quite gone, and is again shown so soon as sudden cooling assists it to condense moisture, and thus enables it to do what it could originally do of itself by its attraction for water, which attraction acts in the same way as a reduction of temperature with the important difference, however, that the condensation induced by antozone enables more water to be converted into vapour. Where antozone condenses moisture, it has a drying action, but where it precipitates water, it has a contrary effect, and thus assists in circulating water over the earth.

232. As antozone at a high temperature loses its attraction for moisture sooner than at a lower temperature, while the tendency of water to assume the gaseous form is increased, no particular mist is formed in the neighbourhood of flames, as of oxygen, spirit, hydrogen, &c., unless with the assistance of great and sudden reduction of temperature. If the receiver of an air-pump be filled with air from near a flame, and the air saturated with moisture, a dense cloud, which makes the receiver opaque, is formed the moment that the piston is raised, so as to lower the temperature. This mist is much denser than in ordinary air, and more resembles that formed by the antozone of electricity, or by that of slow combustion, without diminution of temperature. The antozone from flame and fire under ordinary circumstances produces no particular mist in the lower regions, unless the

air is saturated with moisture, because the high temperature has so reduced its electric tension: the halo round the flame of a candle, in a very wet room, is a case in point; but a considerable and sudden reduction of temperature, in air loaded with moisture, causes even this antozone to form dense mist.

233. Oxygen may exist in a series of states, imperceptibly passing from one into another, in all of which it attracts moisture, and forms vesicles, mist and cloud: it acts as an hygroscopic gas, and in all these conditions its action differs only in the intensity with which it condenses moisture to vesicles. This attraction for moisture is strongest with dry, freshly produced antozone free from ozone, but exists, with gradually diminishing energy, until it has apparently disappeared; but this antozone power is re-produced by rarefaction, and its consequent lowering of temperature, until the antozone ceases to have more condensing power than ordinary oxygen or air, it is evident that the mist from antozone, and that produced by rarefying ordinary air, differ only in amount and energy, and not in quality, and moreover that ordinary air owes this property to antozone (in other words, to positive electricity). It may moreover be permitted to assume, that the atmosphere, when clearest and most transparent, contains minute watery vesicles, an assumption not without confirmation from other sources.

234. Ozone, which not only possesses no attraction or moisture, but has even the power of preventing antozone from exerting its peculiar property to its full extent, is the very opposite of antozone. Ozone is not subject to abklinging, and oxygen either possesses the property of ozone in its entirety, or not at all. If antozone in its action resembles a diminution of temperature, the action of ozone may be compared to an increase of temperature: in fact, ozone causes antozone mist to part with its water, just as raising the point of saturation does. In short, oxygen in the one state forms mist, while in the other state it hinders such formation: antozone is the cloud maker κατ' ἐξοχήν, and possesses this property of oxygen in every degree, from antozone artificially produced, in which it exists in the greatest perfection, to ordinary air, in which it exists to the smallest extent possible. There is no necessity for discussing here, whether or no ozone and antozone are negative and positive oxygen, and the less that many well-known facts in meteorology support this view.

235. When the property of antozone is ascribed to atmospheric oxygen, it is meant that the latter is positively electrified, though in a very slight degree, compared with antozone. We may fancy, either that particles of antozone are sparingly diffused among those of ordinary oxygen and nitrogen, or that the whole of the oxygen is very slightly charged with positive electricity. The most probable assumption appears to be, that the electricity of the particles of antozone becomes equally diffused over all the oxygen. With ozone the contrary is the case, as its particles lose none of their pristine energy, by being diffused among those of neutral oxygen, to which they do not appear to communicate any of their negative tension; it is, as though we mixed two different elements which had no action upon one another [ozone may be compared to an insoluble substance diffused through water, which remains unaffected by it, and antozone to a soluble substance, which must impart its property to water, however imperceptible its effects may be to the senses, or to reagents, owing to infinite dilution.] Abklinging is nothing but diffusion of the positive electricity on other molecules, particularly on those of neutral oxygen.

236. We are, therefore, justified in ascribing to atmospheric oxygen a weak charge of positive electricity equally diffused over all its particles.

237. Observations have further shown, that ordinary atmospheric oxygen, as its exists at the surface of the earth, even when it possesses only the density, which air has at an elevation of 27,000 feet, has the property of condensing moisture when suddenly cooled, and of forming a perceptible cloud, but that this property diminishes as the density of the atmosphere diminishes. We also know that this capacity of forming cloud is vastly increased by the addition of positive electricity, or by the admixture of positively electrified oxygen, which increases its antozone property, and it may be presumed that what is lost in its capability of forming cloud, may be more than compensated for, as regards the density of the cloud, by imparting to it stronger positive tension. That portion of our atmosphere in which the air is most dense, is by no means that in which the densest clouds are formed: fogs, *i. e.*, clouds at the surface of the earth are comparatively of rare occurrence: the proper cloud region lies several thousand feet above the earth's surface, being

higher over the continent than over the sea. Now, if the sudden and extensive minglings of large quantities of damp air of different temperatures, which induce condensation of moisture, are greater in frequency and amount in the cloud region than near the surface of the earth, the power of the oxygen to form clouds must be proportionately great, and it is no improbable assumption that this power is greater above, where the density is less than below where the density is greater. Hence we are necessarily led to the conclusion that the positivity of the atmosphere increases with its elevation.

238. All observations show that indications of positive electricity are obtained at all times, seasons, and places, where the sky is clear and cloudless, and that this positivity increases with elevation. The numerous observations of Read, &c, confirm the first of these statements. It is true that Read obtained indications of negative electricity 323 times out of 987, but the number of negative indications decreased, as his methods of observation improved, while many of these were only apparent, different portions of the instrument being differently electrified—a circumstance deserving consideration, when examining the electricity of clouds, or when taking observations in cloudy weather. Herschel states that out of 10,500 observations at Kew, taken between 1845 and 1847, no less than 10,176 indicated positive electricity, while of the 364 instances, in which there were negative indications, the greater number were accompanied by heavy rain.

239. That positive tension increases with the height is equally certain, since this has been proved by numerous observations made during balloon ascents. Moreover, the lower strata ordinarily examined are generally negative as regards the higher, and positive with respect to the earth.

240. We may here mention other phenomena dependent on the positively electric state of the atmosphere, when the sky is clear. It has already been shown that vesicles may be formed and maintained by positive oxygen, without being necessarily cognizant to our senses. However clear the atmosphere may appear to be, when there is positive oxygen in a moist place, there must be vesicles. Clausius thinks that the blue appearance of the sky cannot be otherwise satisfactorily accounted for, than by assuming the existence of vesicles of extreme tenuity, just as the morning and evening gloaming depend upon vesicles of greater density.

241. The chemical relation of water to oxygen being essentially concerned in the condensation of aqueous vapour to vesicles, it must be identical with electric attraction, the oxygen being positive: and this brings us back to the views of former times (long exploded) as to the part taken by electricity in the phenomena of meteoric vapours.

242. In 1752, when Franklin had demonstrated the identity of electricity and lightning, and as Mazeas and le Monnier had soon afterwards shown that the clear cloudless atmosphere was positively electric, it is known what great importance was, on more hypothetical grounds, attributed to electricity in the meteorological systems of the last century, and what expectations were raised that it would explain everything puzzling, both in the atmosphere and on the earth's surface: but these expectations were never realized. More exact observations with improved instruments took the place of mere conjecture and hasty assumptions, while many phenomena, thought to the electric, were explained without its assistance. The source of atmospheric electricity not being ascertainable, as at first supposed, the assumption was gradually made, that atmospheric electricity, as a primary cause, had nothing to do with certain phenomena, and, moreover, that with other appearances, explicable by other means, such as the formation and disposition of clouds, electricity was an effect rather than a cause, and therefore of secondary importance. This reaction against former meteorological systems was both necessary and useful, inasmuch as it caused many problems in meteorology to be viewed in a simpler and clearer manner, and to be subjected to exact experiment, while it also showed how much could be explained without the aid of electricity. So much was this the case, that Peltier and Lamont maintained that the positively electric state of the atmosphere was entirely due to the negatively electric state of the earth, an opinion, however, opposed by Dellmann, as inconsistent with many observed facts.

243. Formerly, too much was attributed to electricity, but now, independently of Lamont's extreme views, all influence whatever was denied to it. Great importance, however, must be assigned to electricity, in its uncombined state, in those regions where the phenomena of meteoric vapours take place; moreover, thoughtful and sober enquirers have there observed phenomena, which they considered inexplicable, except on the supposition of the existence of

some electric or chemical force: that electricity, however, was not so necessary for their explanation, as was supposed is evident from the fact, that many of them have been otherwise explained.

244. When Saussure became acquainted with Kratzenstein's observations on the vesicles of steam and clouds, he was naturally led to enquire how aqueous vesicles were formed and maintained. He says, that having seen these vesicles move over the surface of water without becoming adherent to it, or mixing with it and without becoming diffused over it, he concluded that they were surrounded with an invisible envelope, which prevented them from coming into immediate contact with the water: an attraction acting, from within, upon the aqueous envelope, would have the same effect as this envelope of Saussure, who thought that these vesicles might perhaps be formed and maintained by electricity. Saussure says that vesicular vapour is under some especial influence, by which it can be maintained in the form of fog or cloud, many degrees below freezing point, without being frozen, a fact confirmed by Barral and Bixio in their balloon ascent, and this fact formed the foundation of Vogel's theory of the formation of hail. For this reason, the assumption that vesicles are formed by a diminution of temperature, is not a satisfactory explanation, and their existence must be described, rather to some peculiar state, either of the contents of the vesicle, or of the atmosphere surrounding it. Saussure adds, that the assumption that these vesicles are formed and maintained by electricity, would be in accordance with the fact of heavy rain so frequently following electric discharges from the clouds.

245. Hube and others also came to the conclusion that vesicles were formed and maintained by electricity, by the gradual or sudden removal of which the vesicles were transformed into drops. These views, however, appear to have been long since forgotten, from their having been united with much that was untenable and worthless.

246. We must, in fact, adopt Saussure's supposition, the truth of which has been unanswerably demonstrated by the results of the above experiments, as to the formation of vesicles. As far as these researches go, it is oxygen which, by being positively electrified, and by possessing antozone properties, forms vesicles. Parrot supposed oxygen to be the cause of aqueous aggregations in the atmosphere, but

then he thought that the water was dissolved by the oxygen. In fact, from ignorance that antozone had the power of condensing moisture, all their hypotheses were more or less wide of the truth.

247. Atmospheric oxygen, as it is positively electric, or possesses the property of antozone, attracts moisture and condenses it to vesicles, which being collected in large quantities form mist or cloud. The more positive the oxygen is, the less necessity is there for the temperature to be below, or to sink towards, the dew-point in order to condense moisture to vesicles. Strong electric tension acts hygroscophically, and may, to some extent, take the place of a reduction of temperature: antozone may lessen the amount of aqueous vapour in the atmosphere, so that the relative dampness is diminished, without the point of saturation being lowered, while fresh moisture may be again taken up by the warm, dry air. Now, as positive tension increases with elevation, while the amount of moisture may diminish, here is a simple explanation of what long has been, and still is, a subject of discussion in meteorology: many hygrometric observations have shown that the relative moisture decreases in the higher regions, and that there is often absolute dryness among the clouds, but people have tried to avoid recognizing the inevitable conclusion, because it appeared irreconcilable with other well-known facts.

248. Supposing that the state of moisture in the higher regions may be exposed to sudden extreme changes, in consequence of very dry winds, people could only assume that the point of saturation was exceeded in a corresponding degree; that where the air is less dense the moisture must be more quickly diffused, and as so many observers, Gay Lussac, Humboldt, and others, had always found the most extreme dryness, nothing remained but to presume that this dryness was accidental, rather than characteristic of the higher regions. Those strata of the atmosphere which are peculiarly the region of clouds, and which almost always contain moisture in a state of condensation, are shown by observation (unless the observation be actually made in a cloud) to be relatively the driest, while if the state and distribution of the meteoric water is dependent only on temperature, they must be relatively the most moist. A law regulating the humidity of the air, as the elevation increases, corresponding on the one hand to temperature, and on the other to observations on the formation of clouds, has been in vain

sought for. As electric tension increases with elevation, it has more influence on the humidity of the air, so that this humidity depends less on temperature as the height increases, and consequently conforms less and less to the rules attempted to be laid down.

249. The electricity of the atmosphere has evidently much to do with the movement and distribution of its moisture: this view may be maintained on the strength of the experiments, related in the first part, without undervaluing the importance of the causes to which they have been hitherto entirely attributed. According to this theory, which is by no means new, the aggregations of vesicles termed mists or clouds are positively electric, and much more so than the damp, cloudless atmosphere, and we may expect them to be more so, the sharper and more defined the forms of the clouds. All clouds must be positive with respect to the earth, even though negative towards another cloud, since clouds have different degrees of tension, and clouds near the surface of the earth are always negative, with respect to those in the higher regions.

250. As mists are nothing but clouds on the surface of the earth, conclusions may be drawn from their properties, as to those of clouds in the sky: the examination of mists being much easier than that of clouds. Observation shows that mists are always electric, generally strongly so, and that the electricity is, without exception, positive.

251. According to the observations of Volta, &c., the denser the mist, the stronger is the positive electricity: or, in other words, the stronger the electricity, the more antozone there is present, and the denser the mist. The electricity of light, summer clouds, too, is not weaker than that of winter clouds, because the former are less dense, but the winter clouds are more dense because the lower strata (where there is much moisture) are more electric in winter: the positive tension of the clear cloudless sky, too, has been found to be greater in winter than in summer. The region of clouds is depressed, and more clouds are formed in the lower regions in winter, because, at that time, stronger tension prevails low down in the atmosphere, mists which are diffuse compared with the compact sharply defined clouds of summer, and yet are strongly positive show what enormous tensions must prevail in the higher regions.

252. The electric behaviour of clouds may be inferred from that of mists, and, besides, observation shows that clouds

act like positive electricity on the electrometer, as long as no rain is falling, which point deserves more special consideration. According to the observations of Volta and others, the electrometer generally shows negative electricity when it begins to rain or snow, particularly at the commencement of sudden heavy downpours, but less when the rain has lasted some time. The electricity may also continue positive, as it was before the rain commenced; but this is unusual. According to Schübler, rapid interchanges of the two electricities also take place during passing showers, snow-storms, and thunderstorms. The rain or snow precipitated behaves in the same manner as regards electricity.

253. This appears at first to contradict the assertion, that all clouds are positively electric: but the appearance of negative electricity during rain can be easily explained without presuming that the clouds were originally negative. When it was assumed that the vesicles, as they were formed, became positively electric in consequence of the condensation of moisture, there was a reason for maintaining that they were positive, even though the assumption was not in accordance with fact. Schübler explained the negative electricity, apparent during rain, as something secondary, caused partly by electric diffusion and partly by the evaporation of the drops of water, as they fall, to which he attributed the negative electricity in the neighbourhood of a waterfall. There is no proof that electricity is produced by evaporation, but the supposition that electricity is excited by the friction of the drops of water is in accordance with Faraday's observations on this subject, and to this Tralles had formerly attributed the electricity near waterfalls, while Herschel, who maintains that clouds are positive, considers this sufficient to explain the negative electricity when it rains.

254. Meanwhile, with reference to the fact that rain is not always negatively electric, and to some observations on the arrangement of the electricity in clouds, we may notice a second cause already pointed out by Hübler, so far as he noticed its effects.

255. When a vesicle is formed by positively electrified oxygen, the attraction of this tension acts from the centre towards the aqueous envelope, diffusion takes place, and the exterior of the vesicle becomes positive. This free positive electricity may be given off, as the existence of the vesicle does not depend directly upon this, but upon the positive

tension of the interior not at once uniting with the negative electricity attracted by the aqueous envelope: this union takes place as the positive electricity, at the surface of the vesicle, escapes. Now, if we regard a cloud as a collection of such vesicles, those at the exterior of the cloud will gradually yield their positive tension to the less positive particles of air, surrounding the cloud: the positive tension being weaker at the exterior than in the interior, the latter gives up its tension to the periphery, only as that of the latter is diminished, and, therefore, becomes relatively negative. But when the amount of tension in the centre, and at the periphery, differs very much, the centre may act on the periphery, the positive electricity at the periphery be driven off into the atmosphere, and the periphery, *i. e.*, the water of the vesicles, become negatively electrified. This must hasten the junction of the maintaining tensions of the vesicles, and consequently their conversion into drops. But when the centre of the cloud acts strongly on the periphery, and under its influence the cloud begins to dissolve into rain, the drops will, of course, be negative: in other cases, where there is but little difference between the central and peripheric tension, the rain may just as well be positive: and were rain at its commencement, from the above cause, negative, this negative electricity might diminish, as the cloud went, on raining, from diminution of the central tension. Therefore, rain which commences suddenly, and that of thunderstorms, should be at first highly negative, but less so after some continuance; while slowly falling rain from diffuse clouds, as well as dew, should be positive, which is, in fact, the case.

256. The above considerations have more particular reference to the following observations. Negative tension has often been observed at some parts of the periphery of a cloud while the cloud, as a whole, behaved positively at some distance. Palmieri says that dense clouds, as nimbi and thunder-clouds, are positive in the centre, surrounded at the periphery by a negative girdle, which Hube attributed to the friction induced by its passing through the air. In opposition to the groundless assumption of Gay Lussac, that the tension of a cloud must be greatest at its circumference, Dellmann found the positive electricity, in the centre of a cloud, much stronger than the negative at its circumference.

257. Diminution of the positive tension of a cloud promotes its conversion into water, by hastening the discharge

of the electricity by which its vesicles are formed and maintained. The electricity of a cloud may, according to its own intensity, and the moisture of the surrounding atmosphere, be either gradually lost by diffusion, or suddenly by being discharged into other clouds, or into the earth. The only difference between thunder and other clouds is, that in the former the tension is greater, while the surrounding atmosphere is dry, which prevents gradual diffusion of its electricity. Thunder-clouds arise frequently in summer from strong electricity, suddenly condensing all the moisture present, so that the air surrounding the cloud becomes very dry, and a bad conductor, while the isolation of the cloud is very complete, from the absence of evaporation and wind. Thunder-clouds are strongly electric, not from the quantity of electricity produced by the condensation of moisture, but because they are formed by electricity, which is intense from the presence, or the addition of highly positive oxygen, not omitting to take into account diminution of temperature. According to this view, thunder-clouds are formed essentially in the same manner as other clouds.

258. All clouds with strong tension in their interior, when it acts by diffusion on the periphery, and makes it negative, may bear in themselves the cause of their sudden and rapid conversion into rain, sudden discharges, flashes of lightning from the interior of the cloud must promote the conversion of the vesicles into drops, but as regards rain being heavier immediately after lightning, the old view, that the electric discharge makes the rain heavier, is not satisfactory. Hube has satisfactorily explained, that when it lightens without rain, it does so because the tension is excessive and greater than is necessary for maintaining the cloud-water in the vesicular state. Achard observed a cloud gradually lose its positive electricity before being transformed into drops: diminution of positive electricity in clouds betokens their speedy conversion into rain, because this same tension is the very and essential cause of their existence.

259. In 1752, Eales pointed out how very little electric tension it was necessary to ascribe to each minutest constituent of a cloud, fully to account for the enormous tensions which suddenly burst forth at particular places, from the discharge of a large number of these electric elements. Supposing that 1,000 of these minutest elements unite to form one globule of water, and that the surface of the globule, is

100 times as great as that of the element, the quantity of electricity being 1,000 times as great as that of a single element, the tension at the surface of the globule will be ten times as great as that of the elementary constituent. Such globules unite to form drops and so on. The result becomes still more striking, if we begin with the hollow vesicle, of which it must take very many to form a globule of similar size.

260. As regards the origin of the positive oxygen of the atmosphere, it was formerly assumed that the atmosphere was positively electric, just as the sea was salt, and no further enquiries were made as to its cause. But, as continual losses take place in the positive tension of the atmosphere, while the tension itself remains a constant quantity, some restitution must take place, and as oxygen of strong positive tension, antozone which gradually abklings, and diffuses its tension, is necessary to form clouds, there must be a continual expenditure and re-production of it. There can be no doubt but that positive electricity is continually passing from the clouds to the earth, more or less according to the humidity of the lower atmospheric strata and of the earth's surface.

261. Negative electricity and negative oxygen must be produced wherever positive electricity and positive oxygen are produced. The cause of the electrifying of the atmospheric oxygen must be sought for either in the atmosphere itself, or on the surface of the earth. Causes doubtless exist in the atmosphere capable of electrifying its oxygen, and it was formerly attributed to the friction of masses of air of different temperatures, by which the upper and colder strata became positive, and the lower and warmer negative: but there is no sort of proof that atmospheric electricity is ordinarily produced in this manner. Polarization of the atmospheric oxygen, with formation of positive and negative electricity, must therefore take place in some other manner.

262. When the atmosphere is in such a state that there are clouds, there is no doubt but that their electricity is communicated by influence to other portions of the atmosphere, and, if oxygen is polarized, ozone and antozone must both be produced. We know that ozone exists and is produced in the atmosphere, as is proved by the formation of nitric acid, which can take place only by the union of ozone and antozone in the presence of moisture; Schönbein found that the quantity of ozone was greatest in the neighbourhood

of thunder clouds : the quantity increases with elevation, and is greater in winter than in summer, just like electricity. Observations on this subject are much needed.

263. If the antozone produced by the action of a large thunder cloud, so far as it is not expended in the oxydation of nitrogen, be considered of importance for the maintenance of positive electricity in the atmosphere, and for the further formation of cloud, it must be shown that the ozone, produced along with the antozone, is removed from the atmosphere, for ozone prevents antozone from attracting moisture, and neutralizes it. Should there be easily oxydisable substances suspended in the air with which the ozone can combine, the antozone may be at liberty to attract moisture, and the power of purifying the atmosphere from certain organic oxydisable substances, injurious to animal life, is usually ascribed to ozone. The experiment in which air is first electrified, then deozonised, and then passed through water, affords an example of what takes place in the presence of a thunder cloud, ozone and antozone are produced in its neigh bourhood, in proportion to the amount of electricity present, but as the cloud is discharged, this action is weakened, while lightning, when it strikes objects on the earth, again produces strong tensions, which again polarize the oxygen at the surface of the earth.

264. The ozone perceived, where houses, &c., have been struck by lightning, is produced in this manner, numerous observations showing that antozone is likewise produced. A thick white mist has often been observed in houses and places where a thunderbolt has fallen ; and the sulphur or phosphorus smell, as that of ozone has been termed, was perceived. Nor was this mist merely the smoke of combustion, for then no notice would have been taken of it. Apart from the carbon and other products of combustion suspended in it, the smoke arising from the combustion is undoubtedly an antozone mist, just as much as that from phosphorus : but the steam or mist, arising near places that have been struck by lightning, is more particularly an antozone mist, and strictly analogous to that produced by electrified air, when it comes suddenly in contact with moisture, the manner in which the antozone is produced being in both cases precisely the same.

265. Reimarins mentions a great many instances, in which a mist like tobacco smoke accompanied lightning. Schönbein himself saw two cases in which antozone mist was observed.

The tower of a church, near which Schönbein was standing, was struck by lightning : on entering it, he observed a smell of ozone, while the church was filled with a blueish vapour. In the other case a bridge 150 paces from Schönbein's house was struck, the house was immediately afterwards filled with a suffocating smoke.

266. If the tensions instantaneously produced, by lightning but once striking an object on the earth, be so great as to produce sufficient antozone mist to fill the whole interior of a church, those of the clouds must be sufficient to produce large quantities of ozone and antozone in the atmosphere. The polarizing cloud being positive, some of the ozone produced may be neutralized.

267. Of course, the antozone produced in this manner is but a mere fraction of that contained in the cloud, which has by the discharge lost the same amount : we are speaking neither of increasing the electricity present, nor of restoring what is lost, but only of a residue of that with which we stated, and the source of which is to be explained.

268. But considerable local influence may be produced, when a cloud with strong tension gives up its electricity in the form of antozone, *i. e.*, of oxygen strongly electrified, as opposed to tension widely diffused, and therefore weak in its individual parts : for if the tension of the antozone remains concentrated, fresh clouds may possibly be formed, and that more than once or twice in the same place ; we may imagine this to take place in some other way, though arising from the same cause. These remarks may explain how, in certain valleys like those by the Lago de Como, when a thunderstorm takes place without wind, it leaves the air in a state, suited to the formation of fresh thunder clouds in similar localities, when such storms had taken place the day before, the sky being clear, Contigliachi observed the electric tension to be much greater than usual.

269. Were atmospheric electricity produced by friction of the different strata, both positive and negative electricity would be produced in equal quantities, which would anything but explain the constantly positive state of the atmospheric oxygen. As there is no other way of producing electricity in the atmosphere worthy of a thought, we must look to the surface of the earth, as the place from which positive tension is supplied to the atmosphere. Nor is this conclusion opposed to the view that the earth receives positive electri-

city from the atmosphere, independently of sudden discharges, since the circumstances which return positive electricity, to the earth act with less continuance and intensity. If the origin of atmospheric electricity is to be sought from the surface of the earth, the most probable supposition is, either that the surface of the earth itself, or substances upon it, take up the negative electricity so that only the positive enters the atmosphere.

270. People have long imagined the electrifying of the atmosphere to take place in this manner. One circumstance, on account of the universality and the immense scale on which it takes place, at all times, places, and seasons, deserves to be, and often has been examined, as the probable cause of the electrifying of the atmosphere, viz., evaporation.

271. Volta, Saussure and Beccaria found by experiment, that when water was evaporated, the vessel was negatively, and the vapour positively electrified, and hence it was concluded that every change of molecular condition was accompanied by evolution of electricity, and the positive electricity of the atmosphere appeared to arise from the large quantity of aqueous vapour streaming from seas, lakes, rivers, land and vegetation into the atmosphere. Nor was this opinion shaken by Pouillet's finding that no electricity was produced by evaporating pure water, since the vapour from evaporating solutions, particularly those of salts, was positive, and most meteoric vapour originates from such solutions, more or less diluted. Pouillet, therefore, considered the evaporation from the large surface of water on the earth, and from plants, to be the source of the positive electricity of the atmosphere. In spite of later experiments opposed to these results, this view is not yet generally relinquished, as Herschel in his Treatise on Meteorology upholds it.

272. In Pouillet's, as well as in former experiments, water or aqueous solutions were quickly evaporated by heat: Reich and Gaugain, while they found these experiments correct as to fact, ascertained the cause of the electricity to be the friction of the water against the sides of the vessel, or the friction of the heterogeneous particles of the fluid against each other, and not evaporation. Reich observed this electrifying, only when the fluid was boiled, not when it was slowly evaporated. Experiments with the hydro-electric machine prove that its efficacy depends, neither on the formation nor condensation of steam, but upon friction. All former experiments, therefore, for explaining the electrifying of the atmosphere with positive electricity, may be regarded as of no consequence.

273. Instead of enquiring into the origin of atmospheric electricity, let us enquire into the origin of positive electricity, of antozone in the atmosphere. Experiment has proved, so far as so general a proposition can be proved by a limited number of undoubted but typical instances, that polarization of oxygen precedes every process of oxydation in atmospheric air, in slow oxydations, as well as in actual combustions, with inorganic as well as with organic substances.

274. As a rule, an oxydisable substance polarizes oxygen by itself at a high temperature, or with the assistance of water at a low temperature, and unites with the ozone, leaving only the antozone to unite with water, either at the time or afterwards, and form mist. So very few substances have any affinity for antozone that oxydation practically means combination with ozone; water is the only widely spread substance which has any strong attraction for antozone, and by which binoxyde of hydrogen is formed. But abklinging of the antozone soon takes place, by which the tension of the particles of oxygen is so much diminished, that it has no longer the power of forming binoxyde; in this state the antozone remains free, but still possesses sufficient tension and attraction for moisture to condense vapour to vesicles, be it however without this tension, or without any corresponding diminution of temperature, additional tension or a further decrease of temperature may still enable it to form mist: this abklinging is nothing but diffusion of the positive electricity of freshly formed antozone or molecules of oxygen, which are very little, if at all, electrified; and by this abklinging, the air of the atmosphere generally, and as a whole, becomes positively electrified, with disappearance of the antozone, applying this term to that substance in its original state, immediately after it has been produced by polarization.

275. Under the influence of light, heat, and moisture, both slow and rapid processes of oxydation take place uninterruptedly, and to an enormous extent, and as far as we can judge from the experiments above related, this process consists essentially in the polarization of atmospheric oxygen by substances which combine with the ozone, leaving the antozone to be diffused in the atmosphere, and

maintain its positive tension: this antozone is, in the great economy of nature, of just as much importance as the ozone separated from it, on which all life on the earth depends: for without this antozone, neither vesicles nor cloud could be formed, which are just as necessary for the maintenance of life on the earth as ozone itself.

276. A piece of phosphorus, with water and the air in which it slowly burns, is a type of the earth with oxydisable substances and water on its surface and its surrounding atmosphere: the white mists which arise from the phosphorus are, omitting particles suspended in it, not only chemically the same as the mists and clouds in the atmosphere, but both originate in the same manner.

277. No allusion is here made to those antozone mists, such as the smoke and vapours from chimneys, volcanoes, &c., which, though visible and tangible, are limited as regards both time and place, nor to ordinary combustions, which though occasionally of local importance, are nothing in the vast economy of nature. The slow, imperceptible, invisible, but incessant and widely extended processes of oxydation, the processes of decomposition, induced in everything composing the vegetable kingdom, are more particularly intended. The enormous amount of substance, contained in the vegetable world, spread over the whole surface of the earth, becomes oxydized sooner or later, in some way or another, as animal substance, as fuel or as mould, and so long as the vegetable kingdom on the earth is yearly renewed, an equivalent amount of vegetable matter must be exposed to oxydation, for by this oxydation the elements are re-arranged in such a manner, that by their re-transformation into a substance, which is again oxydisable, the activity and the very development of the plant is maintained.

278. The oxydation of vegetable substances takes place in the organisms of animals, as well as directly upon the surface of the earth. The oxydation of vegetable substance, *i. e.*, of the constituent parts of wood, leaves, &c., is combination with ozone: experiments with rapid combustions teach us that antozone is left: and from rapid combustions may be deduced what takes place in slow combustions, since the properties of the substances acting upon one another are the same, whether the action takes place quickly or slowly. By this disintegration of organic matter, extending over nearly the whole earth (not excepting the sea)

with its vegetables and animals, which latter are always destroying what plants are constantly renewing, antozone is produced, which is diffused in the atmosphere, and hereby its relations with vapour provides for another important thing in the economy of nature, by promoting the circulation of that water, so necessary for the preservation of animal and vegetable life.

279. The earth need not on this account smoke or produce mists like a piece of phosphorus, for the quantity of antozone produced at any one time and place is but small, and may arrive unperceived in the uper strata of the atmosphere, where it is collected together, while diminution of temperature assists its action on the vapour which ascends along with it. By these remarkable relations of oxygen, organic nature is furnished with its breath of life, by these also the clouds necessary to its preservation are formed, by which, from their mobility, assisted by heat, the water of the sea is continually distributed through the atmosphere upon the surface of the earth.

280. No one can consider the antozone, produced by the unceasing oxydation to which organic compounds on the surface of the earth are exposed, as insufficient to make the atmosphere positive. If we consider that of one being alone, man, there are about 1,000 million individuals on the earth, whose consumption of organic matter is so large, that 1,500 million lbs. of oxygen are daily expended in oxydizing it, we may conceive to what an enormous quantity it would amount, if we could but estimate how much is required for the millions of other animals, and for the various putrefactive and decomposing processes constantly taking place. In all these oxydations, the same substance is burnt that burns in a stove, a spirit lamp or a cigar, the oxydation of carbon or of hydrogen is nothing but combination with ozone, by which a large, probably an equivalent, quantity of antozone is set free: in the same manner, where oxydations take place slowly, an amount of antozone equivalent to the enormous amount of ozone, expended in these oxydations, must be given off into the atmosphere.

281. But if the amount of positive oxygen continually given off into the atmosphere is absolutely large, it is comparatively small compared with the whole amount of gas in the atmosphere, and did the atmosphere never lose any of its positive electricity, the amount of antozone would be increased but by a very small percentage:

but, in order to understand how the formation of cloud can be ascribed to such a very minute quantity of antozone, we must consider how thick the mist formed by the antozone of oxygen, electrified in *v* Babo's apparatus, is ; when only one four-hundredth part of the oxygen present is changed into ozone, and presumably the same quantity into antozone, clouds are formed, which, though barely perceptible when only a few inches thick, would, with the thickness that clouds have, produce total darkness if spread over the earth : we may consider too the thick mist formed by the combustion of small pieces of phosphorus : we must further reflect how very perceptible the mist is, which oxygen, as found at the surface of the earth, and which is but very slightly positive, may be induced to form in the receiver of an air-pump, when the air in it is rarified, to the extent that it is in the region of clouds, where considerable positive tension too prevails : the thinnest mist in the receiver of an air-pump would be a dense cloud, if some thousands of feet thick, and a cloud that is dense when seen from the valley is but a mist to a person standing in it on the hill, and is very weak and thin compared to those produced in our experiments, in a confined room, of which it might literally be said that they prevent us from seeing our hands before our eyes.

282. Plants restore oxygen, since, under the influence of light, the green parts of plants secrete it, this must be the same oxygen that, when vegetable substance is decomposed and oxydized, unites with it, and so again makes it reducible : it must therefore either be, or represent the ozone, which in oxydizing non-vegetable organic substances, unites with them, while it is separated from the antozone which remains in the atmosphere. But let us follow out this conclusion somewhat further before we question experience. If we suppose all the oxygen secreted by plants to be ozone, the quantity of ozone by this means given off into the atmosphere, say in the course of a year, must be exactly equivalent to the antozone furnished to the atmosphere, during the same period, in consequence of oxydation, provided that in the course of a year no more is oxydized than the plants restore in the same time, and that not less is oxydized than the plants have previously restored ; presuming in fact an equilibrium. The production of ozone by plants and that of antozone by oxydation, would neutralize one another. Should an excess of antozone result, there must be more

oxydation than is equivalent to the oxygen secreted by plants, or we must presume, that while this oxygen represents all the ozone expended in oxydising them, it is not all secreted as ozone, but some at least as neutral oxygen.

283. As regards the first assumption, that in a given time more matter is, on the average, subject to oxydation by ozone formed by polarising neutral oxygen than is again restored by plants, it may be advanced, that the inorganic matter, which, as well as that from plants is continually exposed to slow oxydation, is seldom or never restored in the great economy of nature ; as there is more or less water in the superficial strata of the earth, it may be surmised, that oxydisable inorganic matter may be brought to the surface, from the lower of such strata, as are impregnated with water : we may suppose that some of the oxygen, secreted by plants in the form of ozone, serves for the permanent oxydation of these inorganic substances, and hence, there results an excess of antozone from the oxydation of vegetable matter. The quantity of inorganic matter, as protoxyde of iron for instance, is however most probably too trifling to be mentioned. Secondly, may not more organic matter be yearly oxydised than is produced ? which would result in an excess of antozone : by assuming this we should deny that the different antagonistic chemical processes are so proportioned as to maintain things in their present state, though the disturbance occasioned by this supposed cause would take centuries to become appreciable.

284. The second supposition, that all the oxygen secreted by plants may not be ozone, may be admitted or rejected without reference to the former. Scoutetten's repeated experiments shew that all the green parts of plants secrete ozone during the day under the influence of light. It commences in the morning, increases until noon, ceasing at night or by the artificial withdrawal of sunlight. Scoutetten has also observed ozone evolved from natural, but not from boiled or from distilled water.

285. If but the merest trace of secretion of ozone by plants is observed in experiments made with a few leaves and a glass shade, this is so infinitely small compared with what takes place on the earth's surface, that it must be regarded as no insignificant or trifling cause in the great whole of nature : where a blade of grass shows imponderable braces, a whole forest may produce overwhelming quantities. The question whether plants secrete only ozone,

or whether they secrete both ozone and neutral oxygen, is of importance, but there are no experiments on the subject, and the qualitative testing of ozone is one of extreme difficulty, but the probability appears to be, that the green parts of plants secrete both ozone and neutral oxygen.

286. This ozone may either at once oxydise some of the oxydisable substances on the earth, thereby anticipating the oxydation that would otherwise only take place by polarising oxygen, or it may neutralise some of the antozone, already formed in the atmosphere ; in either case plants, by secreting ozone, tend to prevent the collection of positive tension, though the latter at all times and places maintains the superiority.

287. The circumstances to which the atmosphere, according to the above view, owes its positive tension, are regular, neither as regards time nor place, and depend upon various causes, though, of course, a rich and exuberant vegetation is equally favourable to the secretion of ozone, and to processes of oxydation, both of which diminish from the equator to the poles. Were the parallelism of these two antozonistic causes invariable, we might subtract one from the other, leaving the remainder as a constant magnitude. This is, however, disturbed in two ways, for though light and heat influence both oxydation and vegetation, they do so to a very different extent, as, while vegetation ceases when these are at a minimum, such is not the case with oxydation. It is also affected by the winds, which cause changes, originating in one place, to be felt in another. Both combined enable the ozone produced by vegetation, and the antozone produced by oxydation mutually to act upon one another, so that a variable as well as a constant mean is the result at all times, and in all places, and, although the production of antozone invariably exceeds that of ozone, the latter is of no trifling importance. However fluctuating the relations of one to the other may be, this fluctuation must be regular, since the causes of it, the periodicity of the winds, is mostly regular.

288. Aqueous vapour may be condensed to vesicles by positive tension, and so borne into the air. By increasing the positive tension, more moisture is maintained in the atmosphere, and either the quantity of moisture, condensed by a certain decrease of temperature is increased, or less decrease of temperature is required to condense a certain amount of moisture : oxygen, with much positive tension, antozone, dries the damp atmosphere by condensing the

vapour, even where the amount of moisture does not exceed, or even reach, the point of saturation. It may also diminish the relative amount of moisture in a stratum of the atmosphere, but we must not, therefore, conclude that the amount of vapour is necessarily small, wherever strong tension prevails, for, if moisture be freely supplied, it may still be at a maximum in the very place where a large amount is being condensed by strong positive tension, and transported to a great height, notwithstanding its humidity, and in this manner antozone assists in circulating water from one part of the earth to another. In this respect the fact that positive tension increases with height is of vast importance, and easily explained by the facility with which the positive tension may be neutralised in, and removed from, the lower strata: this increase of positive tension with height also compensates, or more than compensates, for the diminution of temparature, since, though there is less water in the state of vapour, there is more in the vesicular form. The upper strata are precisely those in which the winds, which transport meteoric moisture, blow with the greatest freedom and intensity.

289. Some of the positive tension in the air will be neutralised by the ozone secreted by plants. With diminished positive tension, there is less vesicular moisture, some of the vesicles disappear, either by the evaporation of their water, should the amount of moisture be but small, or by their conversion into drops, should the air be saturated with moisture, or should the decrease of tension be too great and sudden, to admit of the vesicles being reconverted into vapour. This decrease of tension may either cause disappearance of the clouds with clearing of the sky, and increase of moisture, or it may cause rain : the former taking place most frequently in the upper strata, and the latter in the lower.

290. Should the wind cause an increase or a decrease of positive tension by mixing two portions of air together, it will also cause change of temperature, appearances will become more complicated, as increased temperature, and diminished positive tension act in a similar manner and vice versâ. By the admixture of portions of air of different temperature, and positivity, the influence of the change of temperature may either increase, or diminish the action of the electric charge upon vapour and vesicles.

291. As vegetation is reduced to a minimum in winter, the production of ozone from that source is likewise reduced : while oxydation, and the consequent production of ant-

ozone, though diminished, are so to a much less extent, we may expect the lower strata of air to be more positive than in summer, which is consonant with fact. As the warm weather, in which much moisture is taken up, leaves us, positive tension is increased, at the very time when the relative amount of moisture is great, even beyond the point of saturation, more particularly in the lower regions of the atmosphere, where every thing is favourable to a copious formation of vesicles near the earth, in other words of autumn clouds, which are known to be highly positive. For the same reason there is greater tendency to the formation of clouds, near the earth, in winter than in summer. Single clouds of very strong tension being more frequently found in summer than in winter, and the number of storms being greater towards the equator, than nearer the poles, do not militate against the above, as apart from strong tension not being the only thing necessary for the production of thunder storms, these take place in the upper regions, the electric state of which is different from that of the air near the earth, and but little known.

292. Increase of positive tension is coincident with an increased tendency to form, or the actual formation of mist. According to Schubler, the positivity of the air increases with the rising of the sun, and during the early morning, as evidenced by the increase of mist, in summer mere haze, but in winter often dense clouds, in the lower strata, which is afterwards dissipated. The sky clears from diminution of positive tension, and owing to the heat the vesicular water is evaporated, but may again form cloud in the higher regions where the positive tension is greater. Towards evening positive tension again descends, and the atmosphere again becomes misty. Two very different causes may be cited as influencing this double periodic oscillation, in the course of each day. As the diminished positive tension of summer may be referred to the neutralising action of the ozone from plants, so may the minimum positive tension at noon, or a little after, be referred to the same cause, as it is the time of the greatest secretion of ozone by plants. But night in some measure corresponds to winter, when oxydation and its consequent production of antozone is at a minimum, in the early morning this production of antozone increases much faster than that of ozone, for which light is more particularly necessary. Towards evening the secretion of ozone by plants again relaxes, sinking at night to zero,

while the production of antozone continues; thus producing a second maximum after sunset.

293. This daily periodical oscillation may of course be influenced by local peculiarities, more particularly where causes, arising in one place, influence other places, owing to the action of wind, thus, in Germany, in some places an east wind causes an increase, and at other places a decrease of positive tension. But observations are much needed on the electric condition, and the barometrical state of the atmosphere particularly in the higher and more inaccessible regions, where positive tension exerts the greatest influence on meteoric water.

294. If plants, by secreting ozone, diminish the positive tension of the air, and if this secretion is proportionately more increased, by increase of light and heat, than the production of antozone by oxydation, and since in summer a diminution of positive tension is generally dependant upon local causes, we may expect less tension where there is an exuberant vegetation, than where vegetation is more scanty, supposing this difference not to be obliterated by winds. To prove this by an electroscope among trees would be beset with the same difficulties as electric observations on board ship, owing to the masts and rigging. Nor must we forget how people are more or less affected by electric disturbances in the atmesphere, the sultriness and oppression then felt are much more than are accounted for by the mere heat and dryness: the amount of disturbance or tension is probably of more importance than its kind: the freshness and liveliness of the air after a thunder-storm, as opposed to the sultriness before it, are felt where the vegetation is rich, where, among other causes equally active, there is but little positive tension.

295. The earth's surface being negative as regards the atmosphere, the positive electricity produced, where intense oxydation is prevalent, will generally be removed to where the production of positive tension, *i. e.*, of antozone is less. But if the oxydation processes on the earth's surface, to which the electrifying of the atmospheric oxygen is attributable, is greater at the equator than towards the poles, some movement of electricity must take place from the equator to the poles, and be subject to periodical changes, which may perhaps account for the variation of the magnetic needle.

296. Antozone being occasionally produced in enormous quantities, in confined localities, from cultivation, ex-

tensive fires, &c., may have great influence on the air and its moisture, particularly in the lower regions. Every city produces, from its chimnies, more or less smoke or mist, by which it is enveloped, and in the larger, the antozone from the large collection of decomposing matter, organic substances, and what may be designated putrefaction, may be united to that produced by burning wood, coals, &c. A certain amount of moisture and stillness of the air are alone requisite for this antozone to form abundance of mist over cities.

297. Such mists, generally known as London fogs, but often seen over smaller cities, differ from other mists only in that the antozone, from the manner in which it is formed, contains particles of coal, and various products of combustion, suspended or dissolved in the vesicular vapour, being on a large scale, just what tobacco smoke is on the small; and which differs from antozone mist produced by electricity, only in containing the products of the combustion of tobacco, just as antozone mist from phosphorus contains the products of its oxydation. But the most important thing is that antozone, when suddenly produced in large quantities, has a particular drying action on the neighbourhood, and if it cannot become saturated with moisture from other sources, it dries the lower strata of the air as it rises. Kämtz from the Righi observed this mist over Switzerland. In the early morning the air was clear, but at 5 or 6 when the fires were lighted, a flat thin cloud of smoke was seen, which gradually extended, increasing in density and height, so that the whole valley was filled with haze. Kämtz says that this never took place to any extent but when the air was dry: but he mistook effect for cause: the mist was not formed, because the air was dry, but the air was dry, because the antozone had dried it, in forming the mist.

298. The drying action on the atmosphere of antozone produced by combustion is remarkable, because we are not accustomed in the lower regions to high posifive tension, which causes such energetic attraction for moisture, formation of cloud, and consequently has such a drying action, and not because of any difference between this antozone, and that of oxydation, which forms the clouds in the upper regions. In fact, the high positive tension which is normal in the higher regions, is abnormal in the lower, and therefore remarkable.

299. The grandest of these drying or dry clouds are the

yellow fogs of north west, Germany, termed Höhe-rauch or Heer-rauch from large quantities of antozone produced by fires, united with the aqueous vapour of the lower strata of the atmosphere, or with moisture from the earth's surface. These fogs depend upon the burning of moors or forests, or upon volcanic eruptions, or to a less extent upon fires in large cities, and may be contaminated with particles of carbon, and with the volatile products of combustion, which may be transported to a considerable distance. The combustion of thousands of acres of bog, of a heap of potatoe haulm, and of a cigar, are one and the same phenomenon, differing only in degree, and the antozone produced by these only differs from that produced by electricity, inasmuch as they are contaminated by foreign substances, while the latter is pure. The hotter antozone is, the quicker it loses its tension, particularly in the presence of moisture, and of course its power of condensing moisture into cloud, unless assisted by a synchronous diminution of temperature. For this reason there is no mist over a clear flame, except with abundance of moisture, and even then but little, but if the same flame burns slowly, and with but little heat, dense mist is formed. The difference between the rapid combustion of phosphorus, and the ignition of gunpowder is but apparent and easily explained, for by the latter such an enormous amount of oxygen is instantaneously polarised, that dense antozone mist is formed in spite of the heat. Nor is antozone absent from other flames, and it may be collected, and demonstrated if the amount of vapour, and the diminution of temperature be sufficient and sudden. Moisture acts by causing the substance that is being burnt to smoulder and burn without flame, and with but little heat, as well as by offering abundance of vapour to the antozone, as formed when its tension is at its greatest. These bog fires, though rapid compared to the process of decomposition, are but slow combustions without any clear flame, and are only permitted when but moderate dryness prevails, both which cause the antozone to have strong tension, and to have power to attract and condense moisture for a long time, and as it cannot be saturated with moisture where it is formed, it dries the air through, and the soil over, which it passes.

300. Since positively electrified air can absorb twice as much moisture as that which is not electrified, it is not extraordinary that the enormous quantity of antozone, evolved by the burning of some 60,000 acres of moor-land,

which are yearly burnt in north west, Germany, producing from 1,800 to 2,000 million pounds of ashes, &c., should have a strongly drying action wherever a steady wind blows for any continuance. The useful property, by which the atmospheric oxygen of the higher regions condenses moisture into clouds, is injurious to vegetation when it acts on the surface of the earth. Independently, too, of the action of the dry cloud, the season may, and often will be otherwise dry, as conflagrations arise easier in dry seasons : in many places, particularly in Westphalia, there can be no doubt as to the drying action of Höhe-rauch, and of course this drying effect is felt more near where the cloud is produced than further off.

301. From the solid substances contained in them, Höhe-rauch, and other smokes darken the atmosphere more than other clouds, containing the same amount of moisture, and like other vesicular vapours of a certain fineness, admit the red rays, so that the sun seems red towards the horizon. Like all other drying clouds, they are strongly positive as, according to Dellmann is the smoke from a furnace. These clouds were in former times attributed to electricity.

302. If the positive electricity shown by drying clouds and smoke is the positive tension of antozone, by which oxygen obtains the power of conducing moisture, there can be little doubt but that this is one of the electrical phenomena obtainable from flame. A platinum spiral brought near any flame, from whatever source obtained, invariably becomes positive, while if immersed in the flame it becomes negative, moreover, a current of air containing mist forming antozone may be obtained from every flame, all which agree with the supposition that the oxydation of all these substances is combination with ozone, while the antozone remains in the atmosphere.

303. Every substance during oxydation, *i. e.* combination with ozone, produced by the polarisation of oxygen, is a type of the earth with its oxydisable crust in the act of being more or less quickly oxydised, such oxydation being created and maintained by the vegetable world : the positive electricity resulting from every flame for its own small atmosphere, is the electricity of this very antozone, the steam or mist, more or less dense according to the temperature, arising from every substance that burns in moist air, is caused by the same antozone to which the terrestrial atmosphere owes its positive electricity, its vesicles and consequently its clouds.

PART IV.

ANTOZONE IN THE TROPICS.

304. Meissner appears to think the various processes of oxydation, taking place on the surface of the earth, sufficient to account for the positivity of the atmosphere, while the importance which he ascribes to the property which plants have, of secreting ozone during the day, would rather lead to the conclusion, that at least as much ozone as antozone was given off by organic substances into the atmosphere. He has not omitted to notice the friction from different currents of air in the atmosphere as a possible source of electricity, and has with reason denied to this cause the power of producing any large amount of electricity.

305. The learned Professor, however, has omitted to notice two sources of frictional electricity capable of producing an amount of electricity compared to which that from oxydation must be trifling. These are the friction of the winds and waters upon the surface of the earth, and of the particles of water upon each other.

306. The oppression and sultriness which so often precede thunderstorms, and which are said to be frequently present during epidemics, may be due not so much to any electric disturbance as to an abnormal quietude to a deficiency of that mutual interchange of the two electricities which is the usual state of things. The calm which precedes a storm may be as true of electricity as of the visible state of the atmosphere, and the thunderstorm may clear the air and restore its normal elastic condition, not by restoring the equilibrium, but by re-producing this interchange, this electric play which had been in abeyance. Or it may be due to an abnormal positivity of the lower strata of air, which is overcome by the electric disturbance and by the ozone produced by electric discharges.

307. That positive electricity or antozone has the power of producing an unnatural stillness in the air, is evidenced by the effect of cannonading at sea ; the accounts of naval engagements very often mention this calm to leeward of where the firing took place, and before the introduction of steam Commanders were careful to avoid getting their vessels into a position where they were likely to be calmed. The only cause assignable for this calm is the large amount of antozone produced by the combustion of the great quantity of gunpowder that was used.

308. Electricity, when it evolves heat in the presence of moisture and atmospheric air, is known to oxydize nitrogen, and nitric oxyde or peroxyde of nitrogen once formed appear to have the property of indefinitely producing ozone.

309. Neither nitrous nor nitric oxyde can be formed by any mere admixture of nitrogen with oxygen, nor have such mixtures the physiological effects of the gases chemically united. The former gas would appear to owe its peculiar properties to its oxygen being in the form of ozone, so that the lungs are saved the trouble of polarizing the oxygen and have only to absorb the ready made and condensed ozone.

310. Nitric is in many respects the opposite of nitrous oxyde, and is generally regarded as a more permanent substance, but the reason of this appears to be that it is a highly positive substance, and very few negative substances have any strong attraction for oxygen. Should it be found hereafter that the first oxydation of iron is combination with antozone, this would explain the decomposition of dentoxyde of nitrogen by moistened iron filings, as well as the extreme proneness of the latter to attract a second atom of oxygen, and be converted into a peroxyde. It is not improbable that the insolubility in acids of many peroxydes is dependent on the different electric states of the oxygen forming the first and subsequent stages of oxydation, a supposition borne out by the occasional union of an oxyde and peroxyde forming what have been termed *saline* oxydes, *e. g.*, the electric state of Pb. O must be different from that of Pb. O_2 or they could hardly unite. The rapidity with which iron is oxydized by dew, which we know to be highly positive, supports this view.

311. Dentoxyde of nitrogen, though containing twice as much oxygen as the protoxyde, is not, under ordinary circumstances, a supporter of combustion, because it is so positive a substance. It appears to have sufficient positivity to polarize oxygen and unite with its ozone, though not enough permanently to retain it in combination, thus exercising an important influence on the condition of the atmosphere, and enabling us, with a bit of copper, some nitric acid and some water, to produce ozone at will, and this is the best of all disinfectants. Nitric acid does not affect ozone test-paper, because it does not part readily enough with its ozone. The explanation given of the part performed by dentoxyde of nitrogen, in oxydizing sulphurous to sulphuric acid, of its acting as a "carrier of oxygen

to the sulphurous acid" is peculiarly unintelligible. The fact is, that sulphurous acid, like many other substances that do not unite with oxygen, unite readily enough with ozone, and that the dentoxyde converts oxygen into ozone.

312. In the same manner, and for the same reason that dentoxyde of nitrogen cannot support combustion, is antozone irrespirable, though when combined with moisture in the vesicular form it mostly loses its injurious properties, or rather air containing antozone does so, because the molecules of antozone become enveloped by thin films of water. A very positive fog, however, often induces sneezing and more or less constriction of the throat. There can be no doubt but that the antozone, formed by the decomposition of peroxyde of barium, would extinguish a taper, at least before it had lost its pristine energy.

313. The sirocco at Malta exhibits many of the peculiar properties of antozone. Man and beast are greatly depressed while it lasts, the sky is hazy, and any continuance of this wind is, from its extreme dryness, injurious to vegetation, notwithstanding the proximity of the sea in such a small island. As air, which is estimated to have no more than $\frac{1}{100}$ part converted into antozone, has double the drying power of the same amount of perfectly dry non-electrified air, the drying power of this antozone air of the desert, where all the conditions are so favorable to an intense development of positive electricity, must be enormous.

314. In the desert as with an ordinary friction electric machine, the negative extremity is the earth, the dry air of the desert is nearly as good a di-electric as the glass by the friction of which the electricity is polarized. There may be nothing, in this vast electric machine of nature, exactly corresponding to the metallic conductor, but Clausius and others have shown how oxygen, in its diatomic form, may be a non-conductor, and when polarized a conductor of electricity. If, to this friction of the mind, be added that of the shifting sands against the surface of the earth, the total amount of electricity produced by the deserts must be enormous, and one would think far exceed that developed by oxydation.

315. Dr. Cook, of the Bombay Service has, in a pamphlet* collected together several instances of the effect of the simoom. "At the close of the hot weather in 1856, a party

* Geological report on a part of Beloochistan. By Assistant Surgeon H. Cook, M.D., page 22.

of five men were crossing the Put of Shikarpoor, being on their way from Candahar to that city; the blast unfortunately crossed their path; killed, if I recollect rightly, three of them, and disabled the other two.

"In the year 1851, during one of the hot months, certain officers of the Sind Horse were sleeping by night on the top of General Jacob's house at Jacobabad. They were awakened by a sensation of suffocation, and an exceedingly hot, oppressive feeling in the air, while at the same time a very powerful smell of sulphur was remarked to pervade the atmosphere.

"On the following morning, a number of trees in the garden were found to be withered in a very remarkable manner. It was described as if a current of fire, above 12 yards in breadth, had passed through the garden in a perfectly straight line, singeing and destroying every green thing in its course. Entering on one side and passing out on the other, its tract was as defined as the course of a river.

"Major Green's Moonshee is a native of Bhag in Cutchee, and gave the following description of the effects of one of these blasts, of which he was both the eye-witness and sufferer. He was travelling in company with two others near Chilgherry, the site of a buried city in Cutchee, about 7 miles south east of Bhag: they were all mounted. About 2 A. M. the blast struck them. He was sensible of a scorching sensation in the air like the blast of an oven, but remembers nothing further, as all three were immediately struck to the earth. They were carried to Bhag where every attention was afforded them, and they ultimately, after some days of sickness, recovered.

"He states that such phenomena are frequent in the desert; that the hot blast is generally preceded by a cold current of air; that it destroys every green thing in its course, and is most frequently fatal to human life. That the bodies of the dead quickly decompose, their flesh is withered, its firmness and consistency destroyed, so that it falls or may be plucked off from the bones; and this, not after decomposition has commenced, but immediately on death taking place.

"The treatment they adopt is, at once to wrap up the sufferer in a poshteen or warm woollen clothes, and to administer a mixture of onions and pepper with a view of inducing perspiration; as soon as this is established, the hope of recovery returns.

"The current passes *like a knife* through the air, leaving a well-defined narrow track.

"During the past hot season, many (upwards of 15) lives have been lost in the desert to the N. W. of Jacobabad. Many of these may undoubtedly be attributed to sunstroke, but that the following is a well-marked case of the effects of the simoom admits of little doubt.

"Two syces with two camels were sent to Minooti (20 miles to the N. W. of Jacobabad) for grass. Not returning at the proper time, it was feared that some accident had happened, and search was made. All four bodies were found lying together in one spot, perfectly dead. Their death had been evidently instantaneous.

"We may glean then the following items of information respecting it:—

1st. It is sudden in its attack.
2nd. It is sometimes preceded by a cold current of air.
3rd. It occurs in the hot months (usually June and July).
4th. It takes place by night as well as by day.
5th. Its course is straight and defined.
6th. Its passage leaves a *knife-like* track.
7th. It burns up or destroys the vitality of animal and vegetable existence in its path.
8th. It is attended by a well-marked sulphurous odour.
9th. It is described as being like the blast of a furnace, and the current of air in which it passes is evidently greatly heated.
10th. It is not accompanied by dust, thunder, or lightning. If it be then neither a phase of sun-stroke, lightning, malaria or miasmata in a concentrated form,—and who would believe that it is? what is it? or to what is it to be referred?"

316. Dr. Cook attributes this to "a very concentrated form of ozone, generated in the atmosphere by some intensely marked electrical condition." As, when the above was written, the properties and effects of antozone had not been distinguished from those of ozone, Dr. Cook is undoubtedly correct in his surmise, and it might *a priori* be asserted that, could any intense form of antozone be by any means produced, its effects when respired must be instantaneous death.

317. Respiration is nothing but a combustion or an oxydation, electrically and chemically the same as the combustion of phosphorus or the oxydation of potassium. We

inhale the air, polarize its oxygen, appropriate to our use that which is negative, the ozone, to oxygenate the blood, while we exhale the positive, the antozone. This antozone envelopes and removes from the lungs effete matters, which would be injurious were they allowed to remain, by the same property by which it envelopes iodic acid, and during its passage through liquor potasse prevents it from combining with the alkali. Respiration is invariably, and combustion and oxydation almost always, combination with ozone.

318. Under ordinary circumstances, however, it does not appear that inconvenience is experienced in the desert from any excess of antozone or from any deficiency of ozone. The air of the desert is often spoken of as exhilarating, rather than depressing, to such as are not inconvenienced by the heat. The hot winds of India are not depressing as we might expect them to be, were we to judge of them merely from their temperature. The probability is that, as ozone and antozone are given off at both poles when oxygen is polarized by an induction apparatus, so both are produced by the friction of the wind on the desert. The testing for ozone in the desert, unless by some humid process, would be difficult, as some degree of moisture is necessary to enable ozone to displace iodine from its combination with potassium. Moreover, as the upper are always more positively electric than the lower regions, it is not unlikely that positive electricity has an inherent tendency to ascend. This is only what might be expected: as positive electricity is little needed and in any large amount is injurious in the lower regions, but much required in the upper regions, it would be strange if no provision were made by nature to induce it to go from where, were it to accumulate in any quantity, its influence would be highly injurious, to where its presence was absolutely necessary for many most important processes in nature's economy.

319. The sea covers some two-thirds of the surface of the earth, and the greater portion of this large expanse of water is more or less subject to storms or to winds having sufficient force to produce a large amount of friction on the surface of, and between the different particles of the water. If the breeze which blows from the sea, when agitated but enough to whiten the crests of the waves with foam, contains ozone, as evidenced by its freshness and by its effect on test-paper, how much must be produced by the billows which

break in fury against the rocks or by the surf along the shore? and what large quantities of oxygen must be polarized during a storm in which the water has the power (and consequently friction) to move stones of many tons weight.

320. To these sources of free friction electricity may be added that of the winds on trees, rocks, &c., as well as that produced by rivers flowing over the earth, for the most part a constant rather than one intermitting source of friction. In most tropical countries (not intertropical) it rains but during 4 or 5 months of the year, and, for 3 or 4 months, vegetation, and, it may be added, oxydation are at a stand still, as evidenced not only by the dried-up and parched appearance of the country during the dry weather, but also by the greater healthiness of malarious districts. There are many places to go through which is death from June, when the monsoon commences in the northern hemisphere, to December or January, but which from February until the monsoon again commences are as healthy as other portions of the same country.

321. Observations on the connection between malaria and polarized oxygen are, however, reserved for a future occasion, and it is believed that most of the phenomena of malaria may be explained by applying the knowledge which we now possess of electrified oxygen to their elucidation.

APPENDIX.

No. 1.

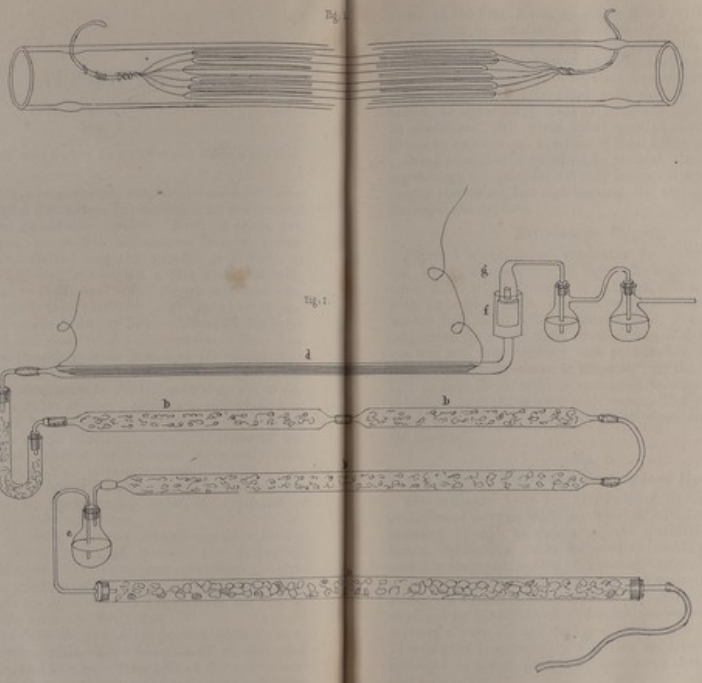
Description of von Babo's apparatus for electrifying air or oxygen.

Twelve very fine copper wires such as are used for covering violin strings 5 decimeters (20 inches) long are inserted into the thinnest glass tubes possible. Each of these five, thin-walled tubes, about 0·3 millimeters (nearly 1 line) wide is at one end melted over the wire so as to cover it, and into the other end is inserted a fine platinum wire, which is soldered to the copper wire: the glass is then carefully melted round this platinum wire, so that it projects a few centimeters (about an inch). These 12 fine tubes are so arranged in a glass tube, 6 decimeters (2 feet) long by 7 millimeters (3 inches) wide that 6 of the tubes have the ends, from which the wires project, to the right, while the other 6 have these ends to the left, and they are so distributed that the tubes of one bundle are placed, as uniformly as possible, among those of the other. The external surrounding tube is just wide enough to hold these 12 fine tubes, lying close together, and should leave only room enough for a current of air to pass through.

The wires may, of course, be altogether of platinum, but as the fine tubes are hermetically sealed, no oxydation of the copper can possibly take place.

The 6 wires of either side are wound round a thicker platinum wire, which is carried through the wall of the large tube for the purpose of being connected with the ends of the secondary spiral of an induction apparatus. The sides of the tube are open, so that a current of air can be passed through between the five tubes.

As the utmost dryness attainable, in fact absolute dryness is necessary to obtain all the phenomena of electrified air in perfection, and as a gasometer offered the only means of forcing the air through the electrifying apparatus (suction not being found to answer) the most complete and perfect arrangements for drying the air were necessary. These con-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sisted, in the first place, of tubes filled with small pieces of chloride of calcium, followed by tubes filled with Bohemian balls covered with sulphuric acid. These tubes were succeeded by a washer, half filled with sulphuric acid, to enable the operator to regulate the current of air, and lastly, by another tube filled with chloride of calcium as before, to absorb any trace of sulphuric acid in the air to be electrified. All these tubes were, in short lengths, connected by caoutchouc, to admit of their being easily changed.

Great attention is required to prevent the air from flowing through too quickly, not only because it would be insufficiently electrified, but also because the air would not have the requisite dryness.

Reference to Figures.

Figure 1 is von Babo's apparatus for polarizing oxygen, and which is marked *d* in figure 2, in which *a* and *c* are tubes filled with chloride of calcium, and *b*, *b* tubes filled with Bohemian balls, covered with sulphuric acid, *e* is a washer half filled with sulphuric acid, *f* and *g* are an arrangement for an air-tight continuation of *d* where caoutchouc was not, but mercury was permissible, from moisture being requisite for ozone to affect it. Of the 2 washers, the first is half filled with a saturated solution of iodide of potassium, and the second with water. The gasometer (than which a double bellows would have done much better) is not shown.

No. 2.

Tests for binoxyde or dentoxyde of Hydrogen.

The ordinary tests for binoxyde of hydrogen, *e. g.*, the evolution of oxygen with peroxyde of manganese, not being sensitive enough to detect minute quantities of this substance, Schönbein made many experiments on some very sensitive reagents capable of detecting the minutest quantity of binoxyde, of which iodide of potassium with sulphate of iron is the best. A weak solution of iodide of potassium is oxydized by binoxyde of hydrogen the moment that a few drops of a very dilute solution of sulphate of iron are added. This reagent is sufficiently sensitive to detect binoxyde of hydrogen in water containing not more that $\frac{1}{10.000}$ part of that substance.

Certain substances, which are instantaneously and strongly oxydized by free ozone and by the excited oxygen contained

in the metallic peroxydes termed ozonides, are not oxydized, or but slowly and slightly, by the metallic peroxydes termed antozonides, by oxygenated turpentine, or by binoxyde of hydrogen. But Schönbein observed that the co-peration of certain other substances gave to antozonides the same oxydizing power as ozonides; he stated that iodide of potassium was slowly decomposed by binoxyde of hydrogen, and showed that phosphatic acid contained it. Subsequently, however, having submitted a mixture of phosphorus acid and binoxyde of hydrogen to examination, he asserted that a very dilute solution of binoxyde of hydrogen did not, but that a more concentrated solution did, displace iodine from its combination with potassium.

Meissner, however, maintains that a perfectly pure solution of peroxyde of hydrogen has no power whatever to decompose iodide of potassium, and that when it appears to do so, it is by the co-operation of some distributing substance like sulphate of iron. A protosalt of iron enables dentoxyde of hydrogen to decompose iodide of potassium with certainty and celerity, there is no other test so sensitive, and though with very minute traces of dentoxyde of hydrogen the reaction takes place but slowly, it is perfectly trustworthy, as sulphate of iron neither decomposes iodide of potassium by itself, nor induces any other substance to do so, which cannot of itself effect the decomposition. And but a very small quantity of sulphate of iron is necessary, as too much not only renders the reaction incomplete, but may even entirely prevent it.

If a number of test tubes are filled with a certain quantity of a weak solution of iodide of potassium, binoxyde of hydrogen and starch, and, to the first, one drop of a very weak solution of sulphate of iron be added, to the second two drops, and so on, all behave differently. The first does not become blue, or but slowly and slightly, the second becomes blue instantaneously though slightly, and this increases with the increased quantity of sulphate of iron to a certain point, after which it decreases until no iodine whatever is precipitated. The smaller the quantity of binoxyde of hydrogen, the more careful must we be not to add too much sulphate of iron: enough should never be added to decompose all the binoxyde, as in that case the test becomes decolorised and dull.

This behaviour of the solution of iodide of potassium and dentoxyde of hydrogen with sulphate of iron depends on

the protoxyde becoming oxydized at the expense of the dentoxyde of hydrogen: the sulphate decomposes the dentoxyde, and has the power of at once transferring the oxygen of another portion of it to the potassium. If too much sulphate is present, it appropriates so much dentoxyde to oxydize itself, that little or none is left for the potassium, while the basic sulphate of the peroxyde renders the fluid turbid; the subsequent disappearance of the free iodine is to be attributed to its forming hydriodic acid with the hydrogen of the water, decomposed by the protoxyde of iron in becoming a peroxyde.

If two equal quantities of a dilute solution of pure sulphate of iron are mixed and shaken, the one with water and the other with a solution of dentoxyde of hydrogen, the latter immediately becomes turbid from peroxyde of iron, while the other remains clear for a long time. By shaking a solution of dentoxyde of hydrogen with the proper quantity of sulphate of iron, all the dentoxyde may be decomposed, and all the protoxyde converted into peroxyde, after which the combination loses its peculiar reaction.

There must be no trace of acid in the fluid to be tested for binoxyde of hydrogen, and the smaller the quantity of binoxyde the more important is this precaution, as though decomposition of a mixture of iodide of potassium and binoxyde is occasioned by any suitable acid, these acids are known to increase the permanency of binoxyde of hydrogen. The anomaly is simply explained. Let equal portions of a solution of binoxyde of hydrogen be poured into two test tubes, and into other two tubes equal portions of a solution of iodide of potassium, and a drop of delute acid be added to one of each. If now, the solutions without the acid be added to those with the acid, it will be found that iodine is freely precipitated where the acid first comes into contact with the iodide, but none in the other, provided the acid be not in excess.

To understand this, we must bear in mind that a solution of perfectly pure iodide of potassium is decomposed after a time by any of the acids kept in laboratories, except carbonic acid, which, though it neither decomposes iodide of potassium nor prevents the decomposition of binoxyde of hydrogen, does, nevertheless, when added to a mixture of the two enable the binoxyde to oxydize the potassium. It makes no difference whether this acid be added to the binoxyde before, or after the iodide of potassium.

Sulphate of iron and acids act in a manner altogether different, the former by decomposing the binoxyde of hydrogen, but the latter by weakening the affinity between the iodine and the potassium. It appears probable that binoxyde of hydrogen enters with the greater number of acids into some sort of combination, but of so feeble a character, that when a substance so prone to decomposition as iodide of potassium is first offered to the acid, the union of the latter with the binoxyde is prevented: but carbonic acid, as it forms no combination with binoxyde of hydrogen, is not prevented from weakening the union between the iodine and the potassium, even when added first to the binoxyde.

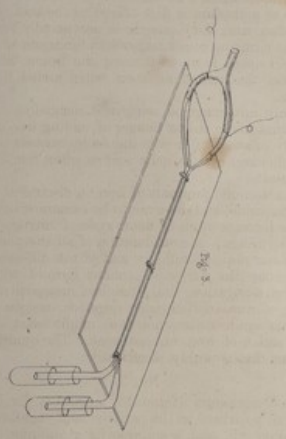
The only advantage of using acid instead of sulphate of iron is, that there is less danger of adding too much; but that with sulphate of iron is the more trustworthy, as not being influenced by the iodic acid so often found in iodide of potassium.

[This action of a protosalt of iron on electrified oxygen is very remarkable, and deserves to be examined in connexion with the decomposition of dentoxyde of nitrogen by moistened iron filings. A consideration of all the phenomena of negative and positive sulphur, and of the different varieties of phosporous (the red or amorphous form of which is probably electro-negative, and, therefore, incapable of combustion, *i.e.*, of combination with negative oxygen or ozone, until it has again become positive) might assist in elucidating this action of iron on antozone. The question is evidently one that is purely electrical.]

No. 3.

Figure 3 represents Meissner's apparatus for examining the oxygen polarized at the positive and negative poles of an induction coil, and is suitable for examining the action of spongy platinum on polarized oxygen.

Two similar glass tubes are drawn out very and equally thin in their middle portion, and the thick ends of both so bent, that the two when placed together, with the thin parts in apposition, form a figure like a long X. They are tied together by thread or thin wire, and being very fragile are fastened to a thin board. Platinum wires covered, where inside the tubes, with glass are then inserted along the whole length of the narrow part of each tube, and project from the ends, where a caoutchouc pipe connects



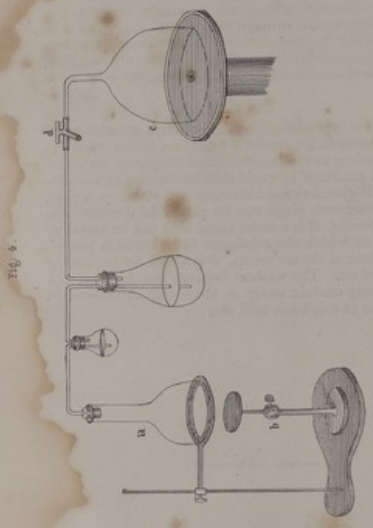


Fig. 4.

these tubes with a 3 branched tube, by which the current of dried air or oxygen is to enter.

When the free ends of the wires are connected with an induction coil, the electric charge must pass from one wire to the other through their glass coverings, through the walls of the tubes, and through the external air. The free ends of the tubes are bent downwards over the edge of the board, and open into a dilute solution of iodide of potassium, which absorbs the ozone and enables the antozone to form mist.

No. 4.

Figure 4 is a representation of Meissner's apparatus for burning phosphorus, &c., under a bell-glass, which serves as a chimney leading to the receiver of an air-pump, in which the antozone produced by rapid combustion can be examined. *A* is a bell-glass forming a chimney and stand on a ring, over which narrower rings can be placed to diminish the size of the opening. *B* is a small stand that can be raised or lowered and on which the substance to be burnt is placed. *C* is the receiver of the air pump. *D* is a cock for regulating the current of air. The washers between the chimney and the receiver may contain water or absorbing substances as liquor potassæ or sulphuric acid, &c.

NATIONAL

MILITARY SYSTEMS

OF

BODILY EXERCISE.

BY

ARCHIBALD MACLAREN.

Oxford:
T. AND G. SHRIMPTON, BROAD STREET.
MDCCCLXIII.

NATIONAL MILITARY SYSTEMS

OF

BODILY EXERCISE.

It has been said that we moderns have lost as much by the discontinuance of the system of bodily exercise of the ancients, as we have gained by our knowledge of physiological science. This is one of the aphorisms which men are never weary of repeating, but which will not stand criticism.

No price can be set upon our knowledge of physiological science, no estimate can be formed of its value, scarcely any of its extent. The extent, the importance, and the value of the system of bodily exercise practised by the Greeks and Romans we can appraise exactly—can gauge with almost mathematical accuracy; because we know entirely of what it consisted, and for what purpose it was organized and maintained. We can therefore tell, by a comparison of the want experienced with the thing produced to meet the want, if the object desired were accomplished.

But how can we do this? By what agency is this power placed in our hands? Chiefly, if not wholly, by the light of physiological science, which alone has revealed to us what exercise is, and what its suitable administration can accomplish in the human frame.

It is generally admitted that this system of bodily training—unguided, undirected as it was by a ray of science deserving of the name—accomplished the object desired. How did they who framed it, thus groping in the dark, grapple with and hold fast by the truth? *By the observation of results.* Let no one undervalue this source of information: it gives the seal to all experimental knowledge; it confirms or refutes all theories.

This was the lamp which guided the ancients in the selection of the exercises which formed their system of bodily training. They observed that the strength of the body, or of any part of the body, was in relation to its muscular development, and that this development followed upon, and was in relation to, its activity or employment. They did not know that man's material frame was composed of innumerable atoms, and that each separate and individual atom had its birth, life, and death; and that the strength of the body as

a whole, and of each part individually, was in relation to the youth or newness of its atoms. And they did not know that this strength was consequently attained by, and was retained in relation to, the frequency with which these atoms were changed, by shortening their life, by hastening their removal and their replacement by others; and that whenever this was done by natural activity, by suitable employment, there was ever an advance in size and power, until the ultimate attainable point of development was reached. They simply observed that the increased bulk, strength, and energy of the organ or limb was in relation to the amount of its employment, and they gave it employment accordingly.

They must have observed, however, that this did not apply in equal degree to all kinds of muscular employment, and that it applied most directly to those where the action was rapid and sustained. They did not know that this rapidity of muscular contraction and expansion was the chief agent in quickening the circulation of the blood, from which the whole body derived its nourishment—the tide on which was brought up all fresh material for incorporation into its tissues, and on which was borne away all that was effete and waste—brought up and borne away most rapidly in those parts which were being most rapidly employed—for they did not know that the blood was a moving current at all. They only observed that exercises consisting of rapid muscular movement were most conducive to strength and activity; so, without exception, the exercises composing their system were of this description.

But they must have observed, also, that there was a form of physical employment which did not give physical development, or yield its natural fruits of health and strength; and that was the slight, effortless occupations of many art-callings and crafts. They did not know that without *resistance* to be overcome there could be no full demand for volition, no full call therefore for material disintegration and renewal, with proportionate increase in bulk and power. They simply observed that development was in relation to the quality as well as to the quantity of exercise—that where energy was exacted in the practice, energy was the fruits of the practice; so for their system they selected exercises where energy was voluntarily called forth in the highest possible degree.

Other essential constituents of exercise owed their recognition to the same source—the observation of results. They observed that during certain kinds of physical exertion the act of breathing became greatly affected, that each inspiration was larger in volume, and that each followed each in quicker succession, than when the body was inactive. This they must have observed, although they may have viewed it but as a drawback to physical ability, a hindrance to be overcome, or in the same light in which our schoolboys now view it—as a condition of "bad wind" or "internal fat:" for

they could not know that in every breath they breathed a load of the wasted material of the body was given up by the blood, and its place supplied by the life-giving oxygen from the surrounding atmosphere; and that just in proportion to the rapidity and energy of muscular movement during the exercise was the rapidity and volume of the current of blood rushing through the lungs; and that, therefore, for this current of blood to be aërated, proportionately large and proportionately rapid was the current of the air respired: and that, following the natural law of development being in relation to employment, the lungs themselves were strengthened by this increased activity. They, probably, simply observed that the power to sustain this accelerated process of respiration was obtained in proportion as the exercises which excited it were practised; so exercises which required the sustaining of accelerated breathing received an important position in their system.

They must have observed, further, that energetic physical exertion and quickened respiration caused the skin to be suffused with moisture, and that this gave instant relief from a discomforting sense of heat. They did not know that this augmented heat was in a great measure caused by the accelerated breathing—the fanning of the fire which is ever burning in the living frame; and they did not know that this moisture was water drawn from the blood and poured out over the skin's surface, in order that the discomforting heat might be with it eliminated. They did not know that the skin itself was a covering of marvellously woven network, presenting millions of interstices and apertures, and that each of these apertures was the open débouche or outlet of a duct or tube which, striking deep its convoluted roots among the underlying strata of bloodvessels, separated from their accelerated currents what might prove injurious to the health of the body, and poured it forth through these myriad mouths; but they observed that these skin-exudations proved a powerful aid in the acquisition of permanent health and strength, and notably so to the health, elasticity, purity, and beauty of the skin itself. So, without exception, every exercise in their system is of that kind which readily contributes to this result.

Finally, they must have observed, that just in proportion to the amount of clothing worn during exercise, were the processes of respiration, and the evaporation of this moisture from the skin, retarded. They did not know the structure or functions of either lungs or skin; still they saw that they both acted together, were stimulated to activity by the same means, and by the same means were sustained in functional ability; and that during physical exertion hindrance to both was in proportion to the amount and weight of the garments worn: so they simply, while performing their exercises, discarded clothing altogether—and thence called their system of bodily training "Gymnastics."

Thus, then, by the observation of results were the ancients guided with sufficient accuracy in the comprehension of the chief features, and in the estimation of the relative value, of certain modes of bodily exercise; and thus were they enabled to choose, on assured grounds, those exercises which were most suitable for the system which they desired to organize. They desired a system specially applicable to individual culture, individual exertion, individual excellence, individual distinction—a system which should cultivate personal courage, presence of mind, and decision—a system possessing the utmost limit for individual effort, presenting the fullest opportunities for personal display and personal distinction. Therefore was the hand laid upon all exercises of high competitive effort—wrestling, boxing, throwing the discus, racing on foot, on horseback, and in chariot. The system is as simple, as practical, and as serviceable as the Roman sword.

But in those days, as in our own, there must have been men of unsound constitution and imperfect growth, from original weakness of organization, or from illness, ignorance, neglect, accident, and other causes. What system of bodily training was framed for their behoof? None. Here the observation of results was unequal to the requirement. They could reach no higher—they aimed no higher—than the production of a series of athletic games, suitable to the young, the brave, the active, the strong, the swift, and the nobly-born.

Our knowledge of physiological science is something more valuable than this. A system of bodily exercise which should give added strength to the strong, increased dexterity to the active, speed to the already fleet of foot, is not what is alone wanted now. It is not to give the benefit of our thoughts and observations and the fruit of our accumulating information, to the already highly favoured, and to them only, that we aim. On the contrary, it is the crowning evidence of the Divine origin of all true knowledge, that in benefiting all within its influence, it benefits most bountifully those whose wants are the greatest. It must have been the strong conviction of the value of this attribute of knowledge—so strong that it scared and scorched where it should have radiated genial light and warmth—that warped the judgment and overheated the imagination of Ling, the enthusiast Swede, when he gave the freewill offering of a laborious life to the preparation of a system of bodily exercise, in its main characteristics suitable to the invalid only.

With the perseverance peculiar to the possessor of a new idea, or of an unique and all-absorbing object of study—a quality which often outstrips genius in the race of usefulness—he laboured, unwearied and unrelaxing, elaborating and exemplifying the principles of his system of Free Exercises. Accepting that exercise is the direct source of bodily strength, and that exercise consists of muscular movement, he therefore conceived that movement—mere

motions—if they could be so systematized that they could be made to embrace the whole muscular system, would be sufficient for the full development of the bodily powers. Carrying out this principle still farther, and extending its operation to those who, from physical weakness, are incapable of executing these movements of themselves, he argued that *passive* exercise might be obtained; that is, exercise by the assistance of a second person or operator, skilfully manipulating, or moving in the natural manner of its voluntary muscular action, the limb or part of the body to which it is desired the exercise should be administered.

That this last application of his theory is sound, and most valuable for the cure or amelioration of many species of ailment and infirmity, I have had the most abundant evidence supplied by my own experience. That the first is altogether erroneous has been no less abundantly made plain to me. The error is so deep-seated, and so all-pervading, that it lies in a misconception not only of what exercise is, but of the necessity of administering it with a reference to the condition of the individual, on the plain and accepted principle which governs the administration of every other agent of health. And to argue that a given mode of exercise is fit for the healthy and strong, because it is found to be beneficial to the ailing and the delicate, is to argue against all rule and precedent. Chicken broth may yield ample nutriment to the invalid, but the soldier would make but a poor day's march upon it; you must give him the chicken too. Such exercises are but a mockery—but a tantalization—to the great requirements of a healthy individual—soldier or civilian, child or man.

Nevertheless, this system, incomplete, inadequate as it was, possessed *one* of the essentials of exercise; and, therefore, as soon as it was instituted, good sprang from it, and good report was heard of it; and, after much disheartening delay, and many rude official rebuffs, Ling saw it accepted by his country.[a] And this must be viewed as the first attempt to bring a knowledge of the structure and functions of the human body to bear upon its culture—the first attempt to lift such culture above the mere "do them good" of other men.

The echo of this good report was heard in Germany; and Prussia, eager to avail herself of every agent which could strengthen her army, adopted it, with some additions and limitations, to form a part of the training of her recruits. But, going even beyond Ling, the supporters of the Prussian system maintain that *a few* carefully selected movements and positions alone are sufficient for the development of the human frame; and "simplicity" being the object chiefly held in view, this system aims merely at giving a few exercises, these to be executed "with great precision."

[a] The Central Academy of Gymnastics at Stockholm was instituted in 1814.

There is no change in any art or branch of science, custom, or usage, common to ancient and modern times, so great as in these systems of bodily exercise. The ancient was all for the cultivation of individual energy, individual strength, individual courage; the modern aims at giving to a number of men, acting in concert, the lifeless, effortless precision of a well-directed machine.

And yet this precision of movement, tedious as it must be to the performers, has its charm to the spectator, and I have heard it loudly lauded. "It is so simple;—a few exercises, and those executed with the most clock-like regularity;—no tours-de-force." Why, what are tours-de-force? Something hard, something difficult for a man to aim at, to work at, to struggle for, to take pride and pleasure in. Every exercise, however simple, is a tour-de-force to the learner, until he can do it; and if the system of exercises be properly graduated, the hardest exercise should be no harder to the learner, when he arrives at it, than was the first attempt in his first lesson.

But the Prussian soldier's period of service is so short (three years), that every agent to hasten his efficiency must be seized; and it has been found necessary to provide means, in the shape of large buildings resembling riding-schools, in which drill may be carried on throughout the year. And as this gymnastic system is viewed but as drill, aims but at being drill, it is in winter carried on in these buildings,—the few articles of apparatus employed, for the sake of the advantages which they specially offer to the soldier, being erected in a corner of them. And this continuity of practice increases many fold whatever good it can yield; and thus, meagre and inadequate as it is, its fruits are valuable. It is found that no other form of drill so rapidly converts the recruit into the trained soldier, and the greatest importance is attached to its extension throughout the army.[b]

There is a general impression that this system forms the basis of the French. It would be difficult to make a greater mistake; for not only have they, either in principle or practice, nothing in common, but in many respects they are the very antitheses of each other. So far from the boasted "simplicity" of the Prussian system, and the desire to limit it to "a few exercises to be executed with great precision," being adopted by the French, they have elaborated their system to such an extent, that it is difficult to say where it begins or where it ends, or to tell, not what it does, but what it does not embrace. For quite apart, and in addition to, an extended range of exercises with and without apparatus, it embraces all defensive exercises, with bayonet, sword, stick, foil, fist, and foot—swimming, dancing, and singing—reading, writing, and arithmetic—if not the use of the globes. The soldier is taught to

[b] The Central School of Gymnastics was first established in Berlin in 1847.

throw bullets and bars of iron; he is taught to walk on stilts, and on pegs of wood driven into the ground; he is taught to push, to pull, and to wrestle;—and although the boxing which he is taught will never enable him to hit an adversary, he is taught manfully to hit himself, first on the right breast, then on the left, and then on both together, with both hands at once; and, though last not least, he is taught to kick himself behind, of which performance I have seen Monsieur as proud as if he were ignominiously expelling an invader from the "sol sacré" of La Belle France.

Now I know no reason why a soldier should not be taught all these acquirements, and I know many important reasons why he should be taught some of them; but it would be difficult to assign any reason, either important or particular, why they should be called Gymnastics, or included in a system of bodily training.

The fundamental idea of the French system is sound, for it embodies that of preparation and application: it is primarily divided into two parts—Exercices Elementaires, and Exercices d'Application. The first of these, designed to be a preparation and prelude to the instruction and practice on the fixed apparatus, begins with a long series of exercises of movement and position, "propres à l'assouplissement"—this idea, shared at home as well as abroad, of the necessity of suppling a man before strengthening him? What is it to supple a man? What parts of him are affected by the process, and what change do they undergo? It would be very desirable to have these questions answered, because the phrase is, I fear, sometimes made to cover a multitude of sins.

To ascertain the full meaning of a word or phrase, it is sometimes useful, first, to ascertain its opposite or antithesis; and the opposite of to be *supple* is, I think, to be *stiff*. If any one is in doubt as to what that means, let him take a day's ride on a hired hack along a country road, or, for the space of a working day, perch himself upon an office-stool, and the results will be identical and indubitable—stiffness in the column of the body, and in the lower limbs. And why? Because each and every part so affected has been employed in a manner in opposition to its natural laws. The joints, which are made for motion—which retain their power of motion only by frequent motion—have been held motionless. The muscles, which move the joints by the contraction and relaxation of their fibres, have been subjected to an unvaried preservation of the one state or the other—the muscles of the trunk in unremitting contraction, those of the limbs in effortless relaxation. Now, one of the most important of the laws which govern muscular action is, that it shall be exerted but for a limited continuous space, and that, unless the relaxation of the muscles shortly follows upon their contraction, fatigue will arise as readily, and to as great an extent, from want of this necessary interruption to contraction as

from extent of effort. And, strictly speaking, this stiffness both in trunk and limbs, although arising from two opposite states of muscular employment, results from the same cause—*i. e.* exhaustion: each has had one only of the two essential conditions of muscular action. The stiffness in the trunk of the body is caused by the ceaseless contraction of the muscles, and this state is not conducive to the rapid local circulation indispensable to the reproduction of the force expended. The opposite phase of stiffness, arising from continuous muscular relaxation, is the immediate result of causes which may be called negative—the non-requirement of nervous stimulus, the non-employment of muscular effort, entailing subdued local circulation.

The second cause of this stiffness in the trunk of the body and limbs is, that the joints have been held motionless. Viewing the joints in the familiar light of hinges, we know that when these are left unused and unoiled for any length of time, they grate, and creak, and move stiffly; and the hinges of the human body do just the same thing, and from the same cause; and they not only require frequent oiling to enable them to move easily, but they *are* oiled every time they are put in motion, and when they are put in motion only: the membrane which secretes this oil, and pours it forth over the opposing surfaces of the bones and the overlying ligaments, is stimulated to activity only by the motion of the joint itself.

But, it may be argued, stiffness may arise from extreme physical exertion, which has embraced both conditions of muscular action, with frequent motion of the joints—stiffness such as a man may experience after a day of unwonted exercise. The stiffness in this case, also, is simply temporary local exhaustion of power from extreme effort: the demand suddenly made has been greater than the power to supply—the waste greater than the renewal.

Therefore, stiffness is, first, a want of contractile power in the muscles which move the joints; and, secondly, a want of power in the joints to be moved. It may be temporary stiffness, arising from exhaustion of the parts by extreme or unnatural action, as in the illustrations just given; or it may be permanent stiffness, arising from weakness of the parts, caused by insufficient or unsuitable exercise; but the nature of both are identical. It is a lack of functional ability in the parts affected.

To supple a man therefore is, first, to increase the contractile power of his muscles; and, secondly, to increase the mobility of his joints. And as the latter are moved by the former—can only be moved by the former—all application for this purpose should be made through them.

Now, it has already been shown that mere movements and positions are altogether inadequate materially to develop the muscular system—materially to add to its contractile power: and there is

a still greater drawback than mere insufficiency in their effect upon the joints; and that is, in the danger of straining, and otherwise weakening, the inelastic ligumentary bindings, and galling or bruising the opposing surfaces of the bones. For every effort of mere position has the simple and sole effect of stretching that which, from its organic structure, object, and place in the human body, is not stretchable—is not intended to yield. To recapitulate: all exercises of mere position act directly on the joints, instead of acting on them through the muscles. Such exercise is, therefore, addressed to the wrong part of the body: it is addressed to the joint, when it should be addressed to that which moves the joint. It is the old and exploded treatment of disease revived for the treatment of an abnormal physical condition—subduing the symptoms instead of waging war with the cause.

I should consider the Extension-motions, as practised in our army, as the limit to which this mode of exertion should be carried;—I mean where the movements and positions are given as exercise in themselves, and not merely as the positions and movements of bonâ fide exercises yet to be learned, and thus practised separately for the facility and safety of acquisition.

It is also said that these exercises of movement and position have the effect of "opening the chest." That they do promote its expansion is undoubtedly the case, but it is so to a very limited extent only—quite incommensurate with the time and labour of instruction and practice. Le jeu ne vaut pas la chandelle.

The other exercises in this first division of the French system—even if they were valuable, even if they were capable of being classified under any distinct head, or arranged in any progressive order, or admitted of graduated instruction and practice—are entirely out of place here, because from their nature they court and incite to inordinate effort. It needs no argument to prove the inconsistency of directing that men, sitting or standing, hand to hand or foot to foot, singly or in batches, shall strain and strive against men, lift cannon-shot and hold them at arm's length "as long as possible,"* or sling them to their feet to cast them to a distance "as far as possible," before they are allowed to put hand or foot on an ordinary ladder inclined against a wall, or to walk along a plank raised a foot or two from the ground. It needs no argument to show that this is reversing the order of exercise when measured by the amount of effort, local or general, required for its performance.

Of what use, then is this preparatory course—this elaborate system of preparation of the bodies and limbs of full-grown men, of soldiers—for exercises on apparatus which an English school-

* "Instruction pour l'Enseignement de la Gymnastique dans les Corps de Troupes et dans les Etablissements Militaires."—Paris, 1847.

boy might be led to in his first lesson? It is simply of no use at all. I do not, of course, mean to say that all its exercises are valueless; but I do affirm, as plainly as I can get words to express my meaning, that an elaborate series of initiatory exercises like these, for men youthful in frame and sound in wind and limb, is absolutely and entirely a mistake. Nay, more, this preparatory course, as a whole, is a flat and self-evident contradiction; for many of its exercises are in themselves immeasurably harder to execute—immeasurably more liable to excite to over-exertion in their performance, than many of the most advanced exercises on the fixed apparatus to which these are presumed to be preparatory. And certain of them, such as the lifting and throwing of weights, and pushing and pulling of man against man, as they admit of the most stimulating and exciting form of emulation, if retained at all should be brought in at the very close of the practice.

The Exercises of Progression, although they belong to the second division, may be noticed here. The Leaping is excellent, in all its forms and in all its modes of practice and application, but the Walking and Running are strikingly absurd. Let the reader judge.

At the "double" or in running, the men are advised to breathe through the "nostrils only, keeping the mouth shut." That is, while the blood is driven with redoubled speed through the lungs, and the lungs are consequently excited to extraordinary activity—inhaling and expiring air in larger quantity and with greater rapidity in order to meet this sudden demand—they close as much as possible the aperture through which this air is to be admitted. Now perhaps, the first thing which strikes an Englishman in watching the natural action of Deerfoot while running, is his open mouth and hanging jaw: the very throat seems held open, giving a free passage from lip to lung. Again: "In the moderate and quick cadence the foot comes flat to the ground, the point of the foot touching it first; in the running cadence it is an alternate hopping on the points of the feet." It would be difficult for a clever man to invent anything more utterly opposed to the natural structure of the lower limbs, or of their natural action in these modes of progression, than the instructions here given; which are, indeed, only to be defended by the Irish "rule of contrary." No other rule will explain the injunctions to shut the mouth when a man most requires to breathe freely, to lift the heels as high as the hips when he desires to run swiftly, and to walk on the points of the toes when he desires to march with solidity and strength.

The Second Division of the system, consisting of applied or practical exercises (Exercices d'Application) embraces a very extended series, to be executed on a wide range of apparatus; and it may be fairly stated that all these exercises are valuable in either an elementary or a practical aspect—that is, either as they are calculated to cultivate the physical resources of the man, or as they

may be applied to the professional duties of the soldier. I repeat, that the exercises of this division of the system are intrinsically valuable in one or other of these aspects; but it must ever be viewed as a grave error, that, so far from the special aspect of each being designated—so far from their being separated and grouped, each under its proper head, they are all retained under one head, under the single designation of Practical Gymnastics.

The evil which naturally and inevitably springs from this want of arrangement is the undue importance which it gives to all exercises of a merely practically useful character, above those whose object is the training and strengthening of the body. This is emphatically the case in the earlier stages of the practice, where the whole attention of the instructor should be devoted to the giving, and the whole effort of the learner should be devoted to the acquiring, of bodily power. Increase the physical resources first, and the useful application will follow as a matter of course. A pair of strong limbs will walk north as well as south—up-hill as well as down-dale: the point is to get the strong limbs.

Let not this principle of classification be undervalued. The question of "What's the good of it when I've done it?" is one not unheard in the Gymnasium, and one not always easy to answer; and even could you be at all times ready with a physiological explanation of motive, process, and result, your questioner is not always a man who could understand it, and the difficulty is increased many fold when the exercise questioned has place among others of the practical value of which there can be no question. But such classification gives at once the answer: "It is of no use at all as a thing acquired; but if you should never do it, or see it done again in all your life to come, it has served its purpose; for *you* are altered, *you* are improved, *you* are strengthened by the act and effort of learning it." It is not every eye that can detect the crystal concealed in the pebble. Therefore, in every military system the principle should be carefully recognised from the outset, that there are two distinct kinds of exercises: the one of an elementary character, which have for nature and object to develop the physical powers—to do this without reference to any other object; and the other of a practical character, having for aim to teach the soldier to overcome material obstacles and difficulties, similar to those which he would be likely to encounter in the performance of his professional duties—each kind of exercise standing on its own merits.

It is to the want of this principle in the French system that we may, in all probability, look for the reason why a number not exceeding 25 per cent. of the learners attain to the performance of the more advanced exercises, whilst a considerable proportion fail even to reach those of medium difficulty. And it is, undoubtedly, one of the chief causes why this system has the effect of cultivating ac-

tivity, dexterity, and what is called "nimbleness," without in any corresponding degree increasing the physical resources as regards strength, vigour, and constitutional endurance.

But this classification has another advantage. If the work of the Gymnasium is to be intelligently sustained, the main features at least of the system, with as many of the minor ones as may be communicated, should be brought before the learners. Let the men be taught and encouraged to watch the effect of the exercises upon themselves—let them see that it is strong men as well as active soldiers that are desired to be produced—let each one see that a large portion of the system is thus bountifully provided to accomplish his own particular and individual health, strength, and happiness, without claim of professional serviceability; and he is no man at all in mind or body, and will never be a soldier in spirit or in power, who will hold back from such employment. I shall never forget the reply of a soldier to a question of mine, when inspecting the first squad of men who had passed through a brief course of training at the new Gymnasium at Warley Barracks. I asked him if he felt any stronger for his practice. "I feel twice the man I did, sir," was his reply; and on my further asking him what he meant by that—"I feel twice the man I did, for anything a man can be set to do."

For it was just that. The man was stronger; therefore he was not more able for this thing or that thing only; but for "anything which a man could be set to do."

But men so intelligent as those who are entrusted with the administration of the French system, have perceived the propriety of a special application of the exercises practised, at the close of the course of instruction. And, therefore, to the bonâ fide exercises of the system are added certain practices, in which the men are employed in "storming works, and in undergoing an examination of their general proficiency."

Such is the French System—a system of bodily exercise, but not a system of bodily training; based on, in many respects, erroneous principles of physical culture, yet productive of great benefit, physically and morally, to the soldier: with much that is useless, much that is frivolous, much that is misplaced and misapplied, and much that has no claim whatever to be admitted into any system of bodily exercise, military or civil—yet, upon the whole, national in tone and spirit, and, as has been proved by the avidity with which it is practised, not unsuited for the men for whom it has been organized.[4]

In pointing out the errors, shortcomings, and inconsistencies of these systems, it will have been apparent that they all spring

[4] The French System of Gymnastic Exercises was organized in 1847; and the Central School, near Vincennes, was founded in 1852.

from one cause—the absence of any clear theory of exercise itself, of any clear comprehension of what it is, of what changes it effects in the human frame, or of its mode of accomplishing them. It is now many years since I was impressed with this conviction; for before the formal adoption of either of the two last mentioned systems by their respective Governments, the elements of which they are composed were known and irregularly practised. I was impressed with the conviction, that until this were done—until a theory of exercise based upon a knowledge of the structure and functions of the body, and in perfect accordance with the laws which govern its growth and development, were formed, no system of bodily culture deserving of the name could be established.

A military system of bodily training should be so comprehensive, that it should be adapted to all stages of the professional career of the soldier; should take up the undeveloped frame of the young recruit as he is brought to the dépôt, and be to him, in all respects, a system of culture—a system, gradual, uniform, and progressive—a continual rise from the first exercise to the last, in which every exercise has its individual and special use, its individual and appropriate place, which none other could fill in the general system—a system of exercises which will give elasticity to his limbs, strength to his muscles, mobility to his joints, and above all, and with infinitely greater force than all, which will promote the expansion of those parts of the body, and stimulate to healthful activity those organs of the body whose fair conformation, health, and strength will double the value of all his after-life; which will give him the vital stamina that will be to him a capital upon which he is to depend, and from which he is to draw at all times, at all seasons, and under all circumstances of trial or privation or toil. This should be the great object to be aimed at in the early stages of the system—the strengthening, the developing of his body, muscle and joint, organ and limb: make him a man, and, as a man, give him power over himself. Give him that, and you give him the Malakhoff of the position: the activities, the dexterities of the art will fall into his hands.

But while, as experience has fully shown me, three months' training at this period of life is equal to six in any after time—by taking the body at a time when its susceptibilities for improvement are at the highest, and thereby giving an impetus, a momentum, to its development not attainable at any other—yet, as the great bulk of our army is posted in unattractive camps, or quartered in large cities, where incentives to idleness and temptations to dissipation are, to men in their position, both numerous and strong, therefore the system should be equally suitable in its higher grades to the trained soldier—should be a system which will ensure regular and unbroken practice at all times and in all seasons; and which, taking into consideration the amount and distribution of the time available for the purpose, should make

that serviceable which is now wasted. And then, but not till then, should the practical application begin—an exposition earnest, ample, and varied, which will show him how every article of commonest use may be utilized on emergencies to important purposes, how obstacles of every form and character may be surmounted, and how burdens of every size and shape and weight may be borne; which will show him also—and he will now see without much showing—how every exercise in the system has added something to this end, contributed something to this attainment, twofold in its character, single in its object—to strengthen the man in order to perfect the soldier.

For all these reasons the system should be national—that is, it should be real, it should be rational, it should be manly. Real—that is, its exercises should be exercises indeed, and not in name only; Rational—that is, befitting the soldier, befitting his age, his health, his strength, his position and purpose in life; Manly—that is, such as a man may be proud of doing, with plenty of room for winning and losing distinction, and only fair play to decide. An Englishman could no more be brought to practise the aimless formalities of the Prussian system and call it Exercise, than he could be expected to practise the elementary exercises of the French (which begin with spinning the head round and round, as a clown does in a pantomime, and end with the "Danse Pyrrhique,"—Anglicé "Cobblers' Dance"), and retain his self-respect.

These are the principles which I have held in view while preparing the system of exercise now being introduced into our army as rapidly as possible, indeed desirable, under the direction of a Commander-in-Chief whose care knows no limit for the wellbeing and efficiency of the Soldier. I have thought it compatible to produce a system of bodily culture on strictly scientific principles, with a spirit of this manly character pervading it, and giving tone to all its rules. For it is of the very essence of our organization that health and strength shall be owned—won and held—in the highest degree by him whose daily life is most directly regulated by those qualities which we call manly, which we call English. The system itself should show the "mens sana in corpore sano."

PRINTED BY H. ALDEN, OXFORD.

REPORT

ON

THE SANITARY CONDITION

OF THE

CITY OF LONDON,

FOR THE YEAR

1856–57.

BY

HENRY LETHEBY, M.B.,

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AND PROFESSOR OF CHEMISTRY AND TOXICOLOGY IN THE MEDICAL COLLEGE OF THE LONDON HOSPITAL.

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1857.

At a Meeting of the Commissioners of Sewers of the City of London, held at the Guildhall, on Tuesday, October 27th, 1857:—

The Medical Officer of Health laid before the Court his Annual Report, which was ordered to be Printed, and a Copy to be sent to every Member of this Court, and of the Court of Common Council.

JOSEPH DAW,
Principal Clerk.

THE

SANITARY CONDITION

OF THE

CITY OF LONDON.

THE NINTH ANNUAL REPORT OF THE MEDICAL OFFICER OF HEALTH.

To the Honorable Commissioners of Sewers of the City of London.

To day, Gentlemen, I have to report you of the Sanitary State of the City during the year which terminated at Michaelmas last.

And foremost of the means employed for the purpose of elucidating this, are the several tables that relate to the mortality for the year. These have been prepared so as to illustrate the subject in various aspects. One of the tables exhibits the proportion of deaths in each of the City

districts during the four seasons of the year. Another informs you of the death-rate of the people at different ages, and gives you an account of the proportion of deaths from each of the most important diseases. A third indicates the comparative mortality in the City for the last nine years; and the rest are expressive of the influence of sex, occupation, and locality on the tenure of life.

At first you will observe that out of the City population of nearly 130,000 souls, there died in the course of the year 2,904 persons. This is at the rate of 22·3 per 1,000 of the inhabitants, or it is one death among every 45 of the living. With one exception, this is the smallest proportion of deaths upon record. It is just 9 per cent. less than the general average, and it represents a saving of 286 lives in the course of the year. No doubt can be entertained of the cause of this; for on looking back over the death-roll of the City for the last nine years—the time during which your sanitary measures have been in operation—there will be seen a gradual falling off in the proportion of deaths, until from a yearly mortality of 3,763, it has been reduced to 2,904. This is a great result, and it will appear still greater when you notice that it has been chiefly effected in one district, namely, the Central. Here the improvement has been to the extent of 13 per cent. above the general average, and in some places

it has reached to 38 per cent. In the Western division of the City it has not been greater than 7 per cent., and in the Eastern it has been only 3 per cent.

This tells us that there are some places where the mortality is yet high; where in fact a cloud of death is always hanging; where the vitality of the people is slowly sapped, and where disease makes easy conquest. It is not enough that these places are the continual haunts of such endemic maladies as phthisis, fever, and the other putrid class, but often they become the seats of stronger pestilence. There it is that the powers of sanitary science must be zealously applied; for it is there the very dirt ferments, and the air becomes envenomed; and yet it is still a question *how* these powers are to be applied, for most of the denizens of these plague-nests have but little instinct for self-improvement. If to-day you give them the appliances for cleanliness and ordinary decency, to-morrow they will abuse them, and nothing can be more disheartening than the ill success of all your efforts to improve the character of such dismal dens. And yet these efforts must still be used, and perseveringly; for bad as is the physical state of these places, the moral state is worse; and children grow up to perpetuate the vices which ignorance has engendered. That which is wanted, therefore, is some means of touching

the root of these evils—of teaching the poor how to value the comforts of a decent, cleanly home—of educating them in a proper spirit of independence, and of making them know how great is their power of helping themselves. When this is done, the labours of sanitary science will be comparatively easy; for then the filthy habits, the wretched squalor, and the still worse moral vileness will quickly disappear. It does not fall within my province to discuss the means of education, whereby this may be accomplished, but I cannot help saying that there seems to me to be an easy mode of doing it. Raise up but a few houses that are well adapted for the necessities of the poor, and you will soon find that they are a strong incentive to the forming of better habits, and to the seeking for better homes. The spirit of improvement which has led to the destruction of the poor man's haunts, has had but little regard for the poor man's wants; and after all, the majesty of a great city may be but the glittering diadem upon the front of death.

If it be a satisfaction to know that there are other places in a yet worse condition than this is, I can tell you, that the mortality of the whole City is much less than that of the average of large towns. Here the mortality is at the rate of 22·3 per 1,000 of the living, and in the generality of such places it is as high as 25·6. Even in all England, it is at

the rate of 22·8 per 1,000. But this ought not to lull us into the belief that we have reached the highest point of sanitary rule; for these numbers have but a doubtful signification. In some parts of the City the death-rate mounts to 27 per 1,000, and I should ill perform my duty if I masked this fact, or left it without a comment.

And now let us see what has been the influence of age on the City mortality, and what the proportion of deaths at each of the several epochs of life. You will notice in the second table, that of the 2,904 deaths for the year, 1,163 occurred among infants of less than five years of age, 193 between the ages of five and twenty, 391 between twenty and forty, 522 between forty and sixty, 549 between sixty and eighty, and only 86 after the fifth epoch of life. Of 1,000 persons, therefore, who died last year in the City, 400 did not reach the fifth year of their age, 466 died before reaching the twentieth year, 601 before the third epoch, 781 before the fourth, 970 before the fifth, and only 30 were left to struggle on to the sixth epoch.

As in the vision of Mirza, therefore, we can see the bridge of human life, with its hundred arches, that spans the City. We can also see multitudes of people struggling to pass over it, and, as we look more attentively, we may see the passengers drop-

ping through the traps and pitfalls of the bridge into the great tide that flows beneath. But faster than in the dream of Mirza is the falling through of the crowd that struggles to pass over, for thicker and closer are the hidden traps and pitfalls that beset the way. Of the thousands who emerge from the dark cloud that hangs about the bridge's entrance, only one or two will reach to the hundredth arch; more than a third of them will have dropped through before they have traversed the twentieth part of the way; more than half before they have got to the summit of the thirtieth arch; and by the time the remnant of the crowd has reached to the middle of the bridge, there will be but three-tenths of all the number tottering on. In the fourth table of the Appendix I have endeavoured to represent these facts more clearly than I can describe them. There you will see that the mortality of young children is as high as 435 per 1,000 of all the deaths, or 93 per 1,000 of the living. In the West London Union it is 363 per 1,000 of the deaths, or 101 per 1,000 of the living; and in the City Union, it is 327 per 1,000 of the deaths, or 64·5 of the living. In all England it is 398 per 1,000 of the deaths, or 73·6 per 1,000 of the living; and in France it is just 80 per 1,000 of the living. The proportion of deaths at other ages are shown in the fifth table of the Appendix; and the general results are that in all cases, except from ten to thirty-five

years of age, the proportion of deaths in the City is much larger than in the rest of England. Between those ages the advantages are greatly in favour of a City life.

As to the influence of occupation on the mortality, I may remind you of what was said in my last Report, for the experience of another year has only confirmed the former observations. Taking the mortality of the two years, the following are the results:—of all males at twenty years of age and upwards in the City of London, the deaths per 1,000 are 22·5; but the different classes of society have contributed very unequally to the aggregate; for butchers, poulterers, and fishmongers, shop keepers, and merchants have died at the rate of only from fifteen to sixteen in the 1,000; while tailors and weavers, shoemakers, printers, and compositors, have succumbed at the rate of from twenty to twenty-three per 1,000; wine-merchants, publicans and waiters, porters and messengers, at the rate of from twenty-four to twenty-six per 1,000; blacksmiths and gasfitters, painters and glaziers, dyers, bargemen and watermen, at from twenty-eight to thirty in the 1,000; cabmen, draymen, ostlers, carmen, and stable-keepers at the rate of thirty-one in the 1,000; clerks, bakers, and needlewomen, at from thirty-four to thirty-five in the 1,000; and lastly, the harder working classes of carpenters, masons, and

labourers at from forty-three to forty-five in the 1,000. These figures may not be expressive of the exact influence of occupation on mortality, because it is impossible to eliminate all sources of error; but they represent nearly enough the general fact, that there is a great difference in the vitality of the several classes; for the well-fed butcher and the prosperous merchant die in far less proportion than do those who are more exposed to the rough usages of life; and then again there seems to be something about the close occupation of clerks and needlewomen that makes them especially susceptible of disease.

If we turn to the other modes of testing this matter, we shall find that, while in all London the mean age at death among adult males is a little less than fifty-one years, each class has its own particular longevity. The merchant, shop-keeper, and domestic servant will live to be nearly fifty-seven years of age; the butcher, poulterer, and fishmonger to be about fifty-three. Most of the other classes will reach to the age of from fifty to fifty-two; though the painter and dyer, the costermonger and hawker, the bargeman and waterman, survive only to from forty-eight to forty-nine; and lastly, the printer and compositor lives to but forty-five, and the baker and confectioner to only forty-two. Among females the differences of occupation are

not so striking, except in the case of the wives of cabmen and publicans, where instead of living to the mean age of fifty-five, they die at forty-nine; and the poor needlewoman sinks into the grave at the average age of forty.

The mean age at death of adult males in the City is fifty-one and of females fifty-five. In all England it is sixty and sixty-one; so that in one case about nine years is taken from the life-time, and in the other about six. And again, if we examine the longevity of adults at other ages, it will be seen that the contrast is equally great. At forty-five and upwards the mean age at death of the male citizen is sixty-two, and of the female sixty-five. In all England it is sixty-eight and sixty-nine. At the age of sixty-five a man with us may expect to live to the seventy-second year, and a woman to the seventy-fifth, but in the whole of England the expectancy is to the seventy-sixth and seventy-seventh. These are the numerical exponents of the strain upon a City life, and they testify of the penalties that are paid to excessive civilization.

The records of the last nine years tell us of the diseases which have contributed to these results. There it is written that of every 1,000 deaths, consumption has been fatal in 212, fever in forty-six, others of the zymotic class in 125, diarrhœa in forty, convulsions and teething in fifty-six, and

pneumonia and bronchitis in 151. As usual, the three City Unions have furnished very unequal proportions. The East London Union has been most prolific of zymotic maladies—in the proportion of 225 to 158, which is the amount of the central City district. In the Western Union, consumption has killed 247 of the 1,000, and in the City only 191; and lastly, bronchitis and pneumonia have been fatal in 174 cases per 1,000 in the Eastern district, and only in 139 in the Central. As compared with England, the chief differences in the causes of death are the amounts of tubercular disease, especially of infants; for while tabes, scrofula, and hydrocephalus are fatal with us to the extent of ninety-five in the 1,000, in all England the number is but thirty-six in the 1,000. Now as these diseases are mostly occasioned by domestic vices, it may be said that one of the great causes of the high mortality of children in the City of London is the unwholesome state of their homes. This I have endeavoured to illustrate in the eighth table of the Appendix, where I have classified the deaths from different diseases under the heads of the several trades. From that table it would appear that each class of persons had its own prevailing malady. Phthisis seems to be the chief disease of needlewomen, printers, bakers, cabmen, and policemen; fever prevails most among domestic servants, needlewomen, and cabmen; bronchitis and pneumonia among labourers, painters, butchers, costermongers, and hawkers; brain diseases among porters, publicans, watermen, and bargemen; and liver diseases are the especial attribute of the publican. There is a significance in all this, for it points to the peculiar habits of the different classes, and indicates how much might be effected by prudence and self-controul.

And now it is time that I should inform you of what has been done in the course of the year for the sanitary improvement of the City. Your Inspectors have furnished me with returns of the state of 5,294 houses; and 2,131 orders have been issued for various sanitary improvements. I have also received from your Inspectors, detailed accounts of the state of 4,718 rooms, each of which has been carefully measured, and circumstantially described in respect of its cleanliness, state of repair, rental, and the number and condition of its occupants. I have thus obtained a body of information, which will, I trust, enable me to meet some of the untoward circumstances to which I have so frequently alluded. These rooms were tenanted by 3,785 families, consisting of 3,413 males, 3,677 females, and 6,187 children: in all 13,277 persons. In 125 of these rooms I have found 624 persons: namely, 187 men, 244 women, and 193 children. Already I have described the manner in which these people have been distributed. In forty-seven cases there were two women and

one man, with their children living in the same room; in ten cases three women and one man; and three cases of four women and one man. In twenty-one cases there were two men and one woman; twenty-seven of two men and two women; four of two men and three women; three of three men and one woman; one of two men and four woman; and one of three men and three women. I have not complicated this general summary by giving you an account of the number of children in each of the rooms, but it has been a rare case not to find one or more. Certificates have been issued of the indecent over-crowding of these rooms, and I hope soon to have them all registered upon your books as Common Lodging-houses; when this is accomplished, and your Inspector of Lodging-houses is appointed, you will have the means, through the salutary powers of your Act of 1851, of putting a check on the unwholesome practices of such places.

Among other sanitary proceedings of the year, have been the abating of many trade nuisances; and, except in two cases, this has always been accomplished without interfering with the progress of industry or the concerns of commerce. This, indeed, has always been my aim; for it is impossible to disregard the fact, that the wealth and commercial importance of this great City have been mainly derived from a free and unfettered

exercise of trade, and it would be rashness to use the functions of my office in such a way as to put an unnecessary check upon its progress. Those who imagine that the sanitary condition of the country would be improved by a meddlesome interference with the industrial operations of it, have taken a very narrow view of the great cause of the evil they would remedy. The high mortality of large towns, and the frequent spread of epidemic diseases, are caused not so much by the unrestricted exercise of trade as by the habits of the people. The mischief lies not so much in the workshop, as in the workman's home; and I would rather raise the vitality of the people to a standard of health that will enable them to resist the offensive influences of trade, than I would lower the energies of commerce to meet the requirements of a low vitality. Where would have been the now flourishing trades of Birmingham and Manchester and Sheffield, and the hundred other busy centres of industry, whose commerce is the glory of England, if those trades had been harassed by a mischievous sentimentalism, and fettered by the fantastic rules of a visionary system of hygiene. In fact, the history of manufactures in this country is not merely a history of the successful application of science to art, and of the profitable employment of waste products; nor is it a history of the development of industry through the fostering care of a paternal government, for happily for us they have had no such assistance. It is rather

a history of the progress of unfettered enterprise; of the way in which competitive skill has advanced trade to the highest pitch of excellence. And, after all, where is the proof that this uncontrolled liberty of action has had any injurious influence on the public health. Early records inform us that the life-time of the people has never been so long as it is now. In 1690, according to Mr. Finlaison, the expectancy of a man's life at the age of thirty was only to about fifty-six; at the present time it is to sixty-three. Surely this does not show that the rapid progress of manufactures has done any injury to the public health, it rather shows that with the increase of trade, and the larger employment of industry, there have come better means for the preservation of health and the prolongation of life.

I am far from saying in all this, that there are no occasions for interference with the methods of trade and manufacture. It may be that this very freedom in the exercise of industry, when uncontrolled by science, does sometimes produce, what may be called an exuberance of growth, that requires trimming and keeping in order. Here it is that the powers of local authorities can be usefully employed; for when a manufacturer so conducts his processes as to let loose into the air and soil, a large portion of his property as waste products, he is not merely doing an injury to his neighbours, but he is also acting imprudently to himself; in fact,

to allow property to pass from the domain of art into that of nature, is, for a time, to lose command over it. That which has been done, therefore, in the City has been merely the checking of such waste, and the suggesting of better modes for the management of business.

A word or two more and I shall have done. In the course of the year the medical officers of the City Unions have attended 14,046 cases of disease among the poor. Of these, 1,099 were cases of fever, 1,434 of diarrhœa, and 48 of English cholera. Each of these 2,581 cases has been separately inquired into, and many of the sanitary orders issued during the year have had reference to them.

It might perhaps be thought that at this juncture of an expected visitation of cholera, I ought to report to you of the state of our defences, and of the manner in which an attack is to be met. I do not, however, think that the signs of its approach are so portent as to call for unnecessary excitement or alarm; and even if they were, I do not know that I could put the defences into a better condition, for it has been my aim to keep them always in order. It may be that these defences are not impregnable, but I trust that the sanitary measures which have been enforced for the last nine years, and which are now in active operation, will serve to fortify us as strongly as possible against the approach

of the malady. Where such measures have not been duly employed, it is right that notice should be taken of the slightest sign of the approach of the disease, and the warning turned to account. The Board of Health has therefore done well to urge the importance of this matter on public attention, and to point out the means whereby the force of the coming evil may be abated. To all I would say, that the most powerful means of repelling the disease are prudence and cleanliness. Avoid all those circumstances which lower the vital powers, and remove the putrid filth that gives the malady a footing. If I were to write an essay on the subject I could tell you no more. One thing, however, I would urge upon the attention of the parish authorities: it is that they should be ready for the appointment of a house to house visitation, under the direction of their district medical officers, directly the first signs of the disease are with us, for experience has shown that the diarrhœa which precedes an attack of cholera is mostly susceptible of cure.

I have the honour,
GENTLEMEN,
To remain your obedient Servant,
HENRY LETHEBY, M.B.

GUILDHALL,
October 27th, 1857.

APPENDIX.

No. I.—*Ninth Annual Enumeration of Deaths, relating to the fifty-two weeks dating from September 28th*, 1856, *to September 26th*, 1857.

Deaths in the four quarters terminating as follows:—		East London Union.						West London Union.						City of London Union.											
		Saint Botolph.		Cripplegate.		Workhouses.		North.		South.		Workhouse.		S. W.		N. W.		South.		S. E.		N. E.		Workhouse.	
		M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
I. In the quarter ending Dec. 27th	696	70	46	66	55	19	19	36	28	44	58	10	15	18	13	17	11	25	17	27	20	35	22	9	16
		116		121		38		64		102		25		31		28		42		47		57		25	
II. In the quarter ending March 28th ..	852	73	78	68	63	38	30	30	24	52	46	34	22	26	26	13	22	38	27	33	18	21	28	14	28
		151		131		68		54		98		56		52		35		65		51		49		42	
III. In the quarter ending June 27th	684	65	52	62	55	17	14	30	27	47	40	19	16	15	19	12	11	23	16	19	27	36	23	23	16
		117		117		31		57		87		35		34		23		39		46		59		39	
IV. In the quarter ending Sept. 26th....	672	58	54	49	71	10	18	27	33	51	37	13	14	18	30	11	18	20	19	25	14	32	21	14	15
		112		120		28		60		88		27		48		29		39		39		53		29	
Sum of the four quarters	2904	266	230	245	244	84	81	123	112	194	181	76	67	77	88	53	62	106	79	104	79	124	94	60	75
		496		489		165		235		375		143		165		115		185		183		218		135	
		1150						753						1001											

Total Number of Deaths for the Year 2904

No. II.—*Classification of the 2,904 Deaths, which occurred in the fifty-two weeks dating from September 28th, 1856, to September 26th, 1857.*

	Total Number of Deaths.	AT WHAT AGES?										FROM WHAT CAUSES?									
		0 to 5	5 to 10	10 to 15	15 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 and over.	Violence, Privation, Poison, and Premature Birth.	Fever.	Acute Diarrhœa (not of Infants), Dysentery, and Cholera.	Scarlet Fever and Cynanche Maligna.	Small-Pox.	Phthisis and other Tubercular Diseases.	Erysipelas, Puerperal Fever, and Phlebitis.	Diarrhœa, Bronchitis, and Pneumonia of infants under 5 years of age.	Measles, Hooping-cough, and Croup.	Hydrocephalus, Teething, & Convulsions of Infants.	Other Diseases, chiefly Infantile.
East London Union ..	1150	512	37	15	23	54	86	88	91	115	129	48	43	20	28	8	222	6	149	69	117	440
West London Union..	753	295	24	9	10	47	69	55	88	93	63	49	32	10	15	4	164	9	74	60	52	284
City of London Union	1001	356	33	17	25	50	85	95	105	104	131	78	34	8	22	2	163	5	87	83	85	434
ENTIRE CITY	2904	1163	94	41	58	151	240	238	284	312	323	175	109	38	65	14	549	20	310	212	254	1158
Average of the last Eight Years	3155	1188	130	57	71	199	250	285	293	316	366	140*	142	167	107	37	490*	27	290	190	273	1292

* These are the numbers of last year, as there is no record of the deaths from Violence, &c., and from Tubercular disease, in the preceeding seven years.

No. III.—*Mortality in the City of London during Nine Years, namely from Michaelmas 1848, to Michaelmas 1857.*

		Entire City.	East London Union.			West London Union.			City of London Union.						
			Saint Botolph.	Cripplegate.	Workhouses.	North.	South.	Workhouse.	S. W.	N. W.	South.	S. E.	N. E.	Workhouse.	
Mortality from Michaelmas to Michaelmas.	1848–49.....	3763	519	574	179	372	598	126	293	245	263	214	262	103	
	1849–50.....	2752	396	444	125	324	290	108	176	168	218	183	219	101	
	1850–51.....	2978	493	471	167	317	313	68	191	169	258	217	213	101	
	1851–52.....	3064	534	460	176	266	379	129	196	198	203	171	235	117	
	1852–53.....	3040	516	534	155	289	309	164	170	188	223	164	224	104	
	1853–54.....	3335	577	539	198	284	367	152	210	189	184	215	272	148	
	1854–55.....	3400	595	606	202	273	365	161	167	171	211	232	259	158	
	1855–56.....	2910	443	507	176	247	402	147	147	167	186	135	220	133	
	AVERAGE ..	3155	509	517	172	296	378	132	194	187	218	191	238	121	
			1198			806			1149						
	1856–57.....	2904	496	489	165	235	375	143	165	115	185	183	218	135	
			1150			753			1001						

No. IV.—*Proportion of Deaths per* 1,000 *at each Interval of Age, from* 0 *to* 100, *in the City Districts, in the Metropolis, in England, and in the Country.*

Intervals of Age.	Proportions in a 1,000 Deaths at each Interval of Age.						
	East London Union.	West London Union.	City of London Union.	Entire City.	Metropolis.	England.	Country.
0 to 5	435	363	327	377	317	258	208
5 to 10	41	40	40	41	48	36	59
10 to 20	34	45	47	41	42	45	50
20 to 30	60	70	61	63	55	57	54
30 to 40	71	90	80	80	75	65	64
40 to 50	85	94	94	90	96	72	81
50 to 60	77	98	106	93	129	86	117
60 to 70	93	100	107	100	133	135	167
70 to 80	73	81	92	83	87	152	155
80 to 90	28	17	44	30	17	83	44
90 to 100	3	2	2	2	1	11	1

This Table is deduced from the returns of the last nine years for the City of London, and from the Life Tables in the 5th and 6th Annual Reports of the Registrar General.

The Table may be read thus:—Of 1,000 Persons dying in East London Union 435 died between the Ages of 0 to 5; forty-one from 5 to 10; thirty-four from 10 to 20; and so on.

No. V.—*Annual Mortality per* 1,000 *of Males and Females at Different Ages in the City Districts, compared with that of England and France for* 10 *Years.*

Deaths per 1000 Living at each Period.		All Ages.	0 to 5	5 to 10	10 to 15	15 to 25	25 to 35	35 to 45	45 to 55	55 to 65	65 to 75	75 to 85	85 to 95
Males.	East London Union	1856	27·0	94·7	12·7	2·8	4·7	11·3	14·4	35·8	39·9	115·9	200·0	727·2
		1857	27·6	99·6	8·6	4·6	3·8	9·2	20·1	26·4	58·4	120·4	227·3	181·8
	West London Union	1856	28·3	112·0	10·3	2·4	7·1	14·6	20·3	27·3	53·2	88·6	108·1	..
		1857	26·9	99·0	10·3	3·2	4·3	15·0	17·9	25·9	57·0	105·2	166·7	111·1
	City of London Union	1856	19·2	69·0	8·2	2·7	4·2	6·7	15·5	21·7	49·8	87·6	190·1	200·0
		1857	19·3	69·4	7·3	4·7	3·8	7·8	17·5	21·3	45·2	66·1	239·4	266·7
	Entire City	1856	24·0	88·8	10·4	2·6	5·0	10·2	16·3	27·8	47·4	96·7	153·8	214·3
		1857	23·8	87·9	8·5	4·4	3·9	10·0	18·4	24·1	52·5	93·1	160·0	200·0
	England, 1845–54		23·6	73·6	9·2	5·2	8·3	10·2	13·1	18·9	32·3	67·6	149·9	327·8
	France, 1840–49		23·8	84·5	10·5	5·4	10·3	10·0	11·0	14·8	29·2	60·7	161·7	329·3
Females.	East London Union	1856	23·7	83·9	8·9	2·5	6·0	8·3	15·7	14·6	50·0	54·1	206·2	400·0
		1857	24·3	94·4	7·1	2·5	7·1	6·8	12·3	16·6	38·7	80·5	185·5	371·4
	West London Union	1856	26·9	96·4	13·3	3·2	4·5	10·7	18·1	20·3	51·1	94·0	205·6	461·5
		1857	25·3	97·8	8·6	4·0	5·5	7·3	16·1	23·2	63·6	78·0	120·5	77·0
	City of London Union	1856	16·2	54·4	6·0	3·5	4·2	6·2	9·0	16·7	30·3	68·5	146·4	393·9
		1857	16·6	65·2	7·3	1·3	3·4	4·7	8·7	12·3	35·0	57·2	209·2	272·7
	Entire City	1856	21·1	74·9	8·7	3·1	4·8	7·8	13·3	16·8	41·6	69·2	181·1	407·4
		1857	21·1	83·6	7·5	2·3	5·0	6·0	11·6	16·3	42·4	70·2	179·4	307·4
	England, 1845–54		22·1	63·4	8·9	5·5	8·6	10·8	12·9	16·2	28·6	61·0	136·5	280·8
	France, 1840–49		23·2	75·4	11·0	6·4	8·4	9·7	11·0	14·9	27·3	63·5	144·8	271·9

Note.—The Table may be read thus:—Of 1,000 Males living in the East London Union in 1856, 27·0 died. Of 1,000 Males at from 0 to 5 Years of Age, 94·7 died; and so on.

No. VI.—*The Deaths in the City of London, from Michaelmas* 1855, *to Michaelmas* 1857, *Classified according to the principal Occupations, with the Mean Age at Death from* 20 *and upwards; and the Deaths per* 1,000 *per Annum of Adult Males of each Class.*

CLASSES OR OCCUPATIONS.	Number of Deaths in the Two Years.					Mean Age at Death.						Deaths of Males over 20 per 1000.
	At all Ages.	Under 20.		20 and over.		At 20 and over.		At 45 and over.		At 65 and over.		
		M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
Merchants, Shop-keepers, and Agents	750	191	168	205	186	56·6	55·9	64·0	65·9	71·9	74·1	16·4
Domestic Servants and Nurses	192	24	28	11	129	57·6	51·7	62·9	66·7	72·5	74·5	7·0
Clerks, Accountants, Solicitors, &c.	396	65	56	176	99	53·7	56·9	64·6	65·4	73·3	74·5	34·0
Butchers, Poulterers, Fishmongers, &c.	115	23	23	31	38	53·0	56·4	61·4	63·8	67·8	72·3	14·5
Porters, Messengers, Packers, &c.	546	131	118	186	111	51·3	53·5	62·6	62·1	73·5	74·4	26·0
Bricklayers, Masons, Laborers, &c.	659	171	156	220	112	51·9	56·8	62·7	65·9	73·0	77·0	45·0
Shoe-makers, Saddlers, Harness-makers.	383	113	86	95	89	51·8	56·7	61·0	65·4	72·7	74·2	20·6
Tailors and Weavers	396	119	109	86	82	51·4	56·2	60·2	68·3	71·9	79·3	21·4
Blacksmiths, Gunsmiths, Gas-fitters, &c.	215	48	49	72	46	50·8	52·3	59·7	61·1	72·7	73·5	28·4
Carpenters, Turners, Cork-cutters, &c.	390	102	94	110	84	51·5	55·1	59·4	65·0	72·0	74·7	43·5
Cabmen, Ostlers, Draymen, Carmen, &c.	272	72	75	78	47	50·3	49·1	58·1	59·5	74·0	71·5	31·5
Wine-merchants, Publicans, Waiters	195	44	26	84	41	50·2	49·6	59·9	59·6	71·1	74·0	24·5
Painters, Glaziers, Dyers, &c.	138	44	25	40	29	48·7	61·7	60·8	67·0	70·0	73·1	30·2
Watermen, Bargemen, Sailors, &c.	111	16	15	42	38	48·8	60·6	59·9	65·3	73·9	77·0	29·0
Soldiers, Police, Firemen, Beadles	174	50	45	39	40	48·6	50·7	59·5	62·7	70·4	74·9	35·1
Costermongers and Hawkers	89	15	16	35	23	48·2	60·6	61·0	66·5	72·3	74·1	?
Printers and Compositors	187	48	62	42	34	44·7	52·1	56·7	62·3	68·8	73·0	23·2
Bakers, Confectioners, &c.	80	20	23	22	15	42·3	53·3	56·1	61·3	72·0	74·5	35·1
Needlewomen	179	71	46	..	62	..	40·4	..	62·4	..	71·5	35·2
All Classes in the City	5814	1415	1264	1616	1519	50·6	55·2	61·7	65·4	72·3	74·6	22·5
All Classes in England	..	..	..	..	..	59·9	60·8	68·3	69·4	75·9	76·5	20·0

No. VII.—*Annual Proportion of Deaths in each of the City Districts, and in England, from Zymotic, Tubercular, and other Diseases.*

CAUSES OF DEATH.	DEATHS TO 10,000 PERSONS LIVING.					PROPORTIONS TO 1,000 DEATHS.				
	East Union.	West Union.	City Union.	Entire City.	England.	East Union.	West Union.	City Union.	Entire City.	England.
ALL CAUSES.	255·2	270·8	175·3	223·6	226·6	1000	1000	1000	1000	1000
Zymotic Diseases	57·4	60·3	27·7	45·0	45·7	225·0	222·7	157·8	201·4	201·5
Small-pox	2·6	2·4	0·9	1·8	1·4	10·1	9·0	5·0	8·1	6·0
Measles	5·4	7·0	3·2	4·8	4·0	21·1	25·9	18·1	21·3	17·5
Scarlet-fever	10·4	9·3	4·1	7·5	9·3	40·8	36·3	24·6	33·5	41·2
Hooping-cough and Croup	11·2	12·7	8·0	10·1	7·9	43·9	47·1	45·7	45·4	34·8
Diarrhœa, &c.	12·4	10·8	5·3	9·0	8·1	48·7	40·0	30·2	40·0	35·8
Typhus	14·0	14·5	5·3	10·3	8·6	54·9	53·6	30·2	46·1	38·2
Tubercular Diseases	52·6	66·7	33·3	47·3	36·4	205·8	246·6	191·1	211·5	160·8
Phthisis	26·6	37·9	19·6	26·0	28·2	104·0	140·1	112·1	116·1	124·6
Tabes and Scrofula	17·9	20·0	8·1	14·0	4·2	70·3	71·0	46·2	62·3	18·5
Hydrocephalus	8·0	10·0	5·7	7·3	4·0	31·6	34·2	32·7	32·6	17·8
Convulsions and Teething	16·7	14·5	9·3	12·6	15·6	65·5	47·0	53·5	56·4	69·0
Pneumonia and Bronchitis	44·4	35·4	24·3	33·6	28·7	173·9	131·0	138·7	150·5	126·8

The City Returns are the Average of the Years 1856 and 1857. The Returns of England are for the Year 1855.

No. VIII.—*The proportions of Deaths per* 1,000 *from some of the most important Diseases among the Children and Adults of the different classes.*

CLASSES OR OCCUPATIONS.	CAUSES OF DEATH PER 1,000 OF THE DEATHS.																	
	Among Children under 15.						Among Persons of 15 Years of age and upwards.											
	Fever.	Tabes & Scrofula.	Pneumonia & Bronchitis.	Diarrhœa.	Convulsions & Teething.	Zymotic Diseases.	Fever.		Phthisis.		Pneumonia and Bronchitis.		Diarrhœa.		Brain Disease.		Heart Disease.	
							M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Merchants, Shop-keepers, &c.	28·8	158·5	141·2	46·1	175·8	265·1	54·0	26·2	216·1	136·1	139·7	172·7	4·5	5·2	81·0	89·0	72·0	46·9
Servants and Nurses	58·8	500·0	147·0	117·6	206·0	176·5	..	148·9	..	127·7	..	134·7	..	21·2	..	49·6	..	71·0
Clerks, Accountants, &c.	18.0	171·1	162·1	27·0	306·3	200·9	60·1	0·0	202·2	166·0	131·1	196·0	21·8	9·8	125·6	88·2	76·5	49·0
Butchers, Poulterers, &c.	22·7	113·6	204·5	0·0	227·2	318·4	62·5	51·3	281·5	76·9	156·4	179·4	0·0	25·6	187·7	179·4	0·0	76·9
Porters, Messengers, &c.	24·3	142·2	178·9	53·0	194·3	187·9	26·6	17·8	207·5	142·8	133·0	161·6	21·3	26·8	53·2	116·1	58·5	26·8
Bricklayers, Masons, &c.	18·8	195·0	125·8	78·0	191·5	261·0	57·5	62·1	177·0	19·3	239·0	268·7	22·1	26·1	79·6	69·5	26·5	87·0
Shoemakers, Furriers, &c.	15·6	208·3	145·8	72·9	177·1	250·0	91·8	53·7	214·2	182·8	183·7	118·2	20·4	0·0	40·8	75·2	40·8	64·5
Tailors, Weavers, &c.	35·4	168·1	194·7	57·4	225·6	190·2	80·0	73.1	216·0	219·5	261·3	195·1	45·5	24·4	56·8	48·8	90·9	12·2
Blacksmiths, &c.	10·7	139·8	193·5	75·2	204·3	268·8	40·5	41·7	216·2	146·0	108·1	166·7	13·5	20·8	67·6	62·5	40·5	41·7
Carpenters, Turners, &c.	52·6	163·2	168·4	73·7	205·3	226·0	52·6	46·5	272·0	139·6	201·7	221·0	52·6	11·6	61·4	34·9	35·1	46·5
Cabmen, Ostlers, &c.	85·1	156·9	156·0	50·0	177·3	255·3	49·4	100·0	247·0	300·0	185·2	160·0	0·0	0·0	98·8	40·0	86·4	100·0
Publicans, Wine-merchnts., &c.	0·0	125·0	93·7	93·7	250·0	171·7	22·5	23·8	236·0	238·1	67·2	142·8	11·2	0·0	191·0	95·2	67·2	142·8
Painters, Glaziers, &c.	30·0	179·1	164·1	44·7	224·0	244·0	73·1	33·3	146·3	100·0	244·0	200·0	24·4	66·7	73·1	166·0	24·4	33·3
Watermen, &c.	66·7	233·3	66·7	133·3	200·0	100·0	47·6	77·0	238·0	102·5	142·8	154·0	23·8	0·0	95·2	179·5	47·6	25·6
Soldiers, Police, &c.	40·5	67·7	216·2	135·0	216·2	364·8	17·0	48·8	220·3	268·3	85·0	122·0	17·0	48·8	51·0	48·8	34·0	48·8
Costermongers, Hawkers, &c.	33·3	266·7	100·0	33·3	200·0	266·7	28·6	41·7	342·9	83·4	171·4	271·8	28·6	0·0	28·6	83·4	28·6	0·0
Printers and Compositors	27·8	138·8	185·2	92·6	176·9	240·7	0·0	57·1	377·8	257·1	155·6	100·0	44·4	0·0	66·7	85·5	22·2	143·0
Bakers, Confectioners, &c.	24·4	97·5	122·0	122·0	170·7	317·0	45·4	36·0	227·3	294·1	227·3	294·1	90·9	0·0	0·0	176·4	45·4	0·0
Needlewomen	48·8	244·3	183·0	85·3	231·7	97·5	..	144·6	..	385·6	..	84·3	..	0·0	..	108·4	..	108·4
All Classes	31·2	170·6	158·7	66·4	202·2	233·4	49·5	58·5	219·8	174·3	163·6	169·4	21·7	17·4	81·5	82·8	51·9	60·6

Note.—While 37 is the average number for Liver Diseases among all classes of Males—in the case of Publicans it is 101, and of their Wives it is 71, as against 43, which is the average per 1,000 of Females.

No. IX.—*Summary of the Sanitary Work done in each of the City Districts during the Year.*

Inspectors.	City Districts.	No. of Houses in Districts.	Houses Inspected.	Orders Issued.	Number of Rooms Measured, & Number of Occupants.						
					Rooms.	Men.	Women.	Children.	Total Occupants.	Families.	Rooms overcrowded
William Ternouth	North-west	1472	996	238	738	804	591	844	2239	750	31
John Painter	South-west	1037	871	316	968	627	751	1357	2735	784	14
John Thomas Hopkinson	North-middle	1389	1089	582	639	465	548	930	1943	523	14
George Mortimer	South-middle	262	232	110	660	348	387	729	1464	400	3
James Williams	North-east	1758	1443	494	1111	806	981	1661	3448	932	57
William Santler	South-east	736	663	391	602	363	419	666	1448	396	6
Totals	....	6654	5294	2131	4718	3413	3677	6187	13277	3785	125*

* These 125 Rooms were occupied by 624 persons, viz.:—187 Men, 244 Women, and 193 Children; and the Rental was from 1s. 3d. to 3s. 6d. per Week, per Room.

Total Number of Houses Inspected, 5,294. Total Number of Sanitary Orders, 2,131.

No. X.—*Meteorology of the City of London for each Month in the Year, from Observations made at the Engineer's Office, Guildhall, under the direction of Mr. Haywood.*

MONTHS. 1856—7.	Barometer.			Dry Thermometer.				Wet Thermometer or Hygrometer.						Rain Gauges.					
								Mean Temperature.						Total Fall in Inches.		Greatest Fall in Inches.		Lowest Fall in Inches.	
	Mean Pressure.	Highest ditto.	Lowest ditto.	Mean Temperature.	Highest ditto.	Lowest ditto.	Mean Daily Range.	Wet Bulb.	Dry Bulb.	Dew Point.	Degree of Humidity.	Weight of vapor in cubic foot of air.	Vapor required to saturate do.	On Roof.	On Ground.	On Roof.	On Ground.	On Roof.	On Ground.
				Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Grains.	Grains.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
October ..	30·10	30·58	29·58	55·1	65·0	49·0	9·2	51·0	53·8	49·7	0·81	3·9	0·8	1·55	1·65	0·30	0·30	0·05	0·04
November	30·01	30·66	29·41	42·8	55·0	26·0	9·3	41·4	43·4	39·0	0·84	2·8	0·5	1·27	1·35	0·44	0·45	0·01	0·01
December	29·80	30·63	28·89	43·1	59·0	25·0	10·8	40·8	45·2	35·8	0·70	2·4	0·9	1·61	1·77	0·46	0·53	0·01	0·01
January ..	29·79	30·40	29·13	38·4	51·0	19·0	9·5	37·6	39·2	35·8	0·87	2·4	0·4	2·63	2·72	0·75	0·75	0·02	0·02
February	30·04	30·57	29·66	38·9	52·0	27·0	7·2	39·6	41·2	37·8	0·88	2·6	0·4	0·08	0·08	0·07	0·07	0·01	0·01
March....	29·84	30·55	29·13	42·8	62·0	31·0	11·9	40·3	43·1	37·0	0·79	2·4	0·5	0·83	0·89	0·21	0·23	0·01	0·01
April	29·76	30·33	29·99	46·1	66·5	35·0	12·4	43·4	46·0	40·4	0·82	2·9	0·7	1·28	1·39	0·40	0·46	0·02	0·02
May	29·90	30·29	29·46	53·8	74·0	29·5	15·9	49·1	53·8	44·5	0·75	3·3	0·9	0·52	0·58	0·30	0·33	0·02	0·02
June	29·97	30·45	29·59	61·7	86·0	46·0	18·1	55·5	61·7	50·2	0·72	4·1	2·1	1·73	1·88	0·70	0·74	0·04	0·05
July	29·76	30·41	29·72	64·7	81·0	50·5	15·8	59·0	65·0	54·1	0·68	4·6	2·2	1·62	1·64	0·60	0·61	0·01	0·01
August ..	29·96	30·39	29·71	64·8	84·0	53·0	14·9	60·2	64·6	56·6	0·75	5·0	1·7	3·95	4·05	1·12	1·15	0·01	0·01
September	29·87	30·44	29·48	60·3	75·5	50·0	11·4	57·3	60·3	54·7	0·82	4·8	1·0	3·12	3·21	0·63	0·65	0·01	0·01

Barometer.—The highest readings were on October 25, November 7, December 16, January 8, February 28, March 2, April 21, May 5, 6, June 25, July 13, August 27, September 19. The lowest readings were on October 15, November 11, December 26, January 24, February 9, March 14, April 13, May 25, June 10, July 6, August 7, September 8.

Temperature.—The highest were October 4, November 22, 24, 25, December 7, January 1, February 16, 18, 22, 23, March 18, April 18, 19, May 18, 19, June 28, July 14, 15, 24, 25, August 3, September 17. The lowest were October 28, 29, November 29, December 2, January 31, February 4, March 10, 12, 23, April 24, May 5, June 1, July 8, August 10, September 29.

Rain.—The greatest fall on October 11, November 26, December 13, January 10, February 10, March 16, April 6, May 23, June 20, July 2, August 15, September 9. The least fall on October 7, November 17, December 15, January 19, February 26, March 26, April 1, 2, May 1, 13, June 4, 30, July 23, August 13, 20, September 29.

Electricity.—Positive generally throughout the year. None in the months of January, February, and March.

[For Private Circulation only.]

PROPOSED IMPROVED DRAINAGE OF MARSH LANDS *EASTWARD OF LONDON.*

A.—LETTERS FROM LONDON PHYSICIANS,

VIZ.—

Dr. CORMACK.

Putney, 18 Nov. 1853.

Rev. Sir,

I send you by the same post which conveys this note two papers containing my recent Communication to the Medical Society of London on Cholera, and the discussion which followed the reading of it, in consequence of my having read your letter in the Times. The relationship of Cholera and Ague, and the topography of both, I intend to illustrate very fully, should leisure be afforded me from the pressure of onerous duties both in the practice and literature of my profession. You have opened up a question of a most momentous nature as regards the health of London, and I sincerely trust that you may be enabled to get the necessary measures carried out.

I am, Reverend Sir,
Your obedient servant,
John Rose Cormack.

The Rev. W. Acworth, Plumstead Vicarage.

B

Dr. SIMON.

Upper Grosvenor Street, November 30, 1853.

Sir,

In reply to your letter, asking my opinion on the subject of Plumstead Marshes, I beg to say that I have no such special knowledge of the locality as would justify me in speaking particularly on its sanitary condition.

But, without reference to anything that may be distinctive in the case of Plumstead Marshes, I can venture to say that any large extent of low-lying undrained land is not only in itself unfit for residence, but is likewise likely, in proportion to its size, to become a cause of intermittent diseases to persons residing, even at considerable distance, on the higher grounds which surround it.

I am, Sir,
Your obedient servant,
John Simon.

Rev. W. Acworth.

Dr. GULL.

Dear Sir,

The draining of Plumstead Marshes would destroy a very fertile source of malaria, which is not only highly injurious to those living in the immediate neighbourhood, but which I have reason to believe, from cases under my care, spreads its noxious influence to a wide extent around; much further indeed than is generally supposed.

From a large experience I can state that this locality furnishes an almost constant supply of patients to the Borough Hospitals, labouring under ague, enlarged liver and spleen, and other malarious affections.

Yours faithfully,
William N. Gull, M.D.,
Fellow of the Royal College of Physicians and one of the Physicians to Guy's Hospital.

Dr. PARIS.

Dear Sir,

I have witnessed with great satisfaction your sanitary efforts to redeem Plum*b*stead Marshes from their deleterious character, and I respond to your request, "to add my testimony to the necessity of such efforts," with the utmost satisfaction. It appears to me so self-evident that a Marsh so contiguous to London must, under certain conditions of the atmosphere, spread its malign influence over the eastern part of the Metropolis as to require no evidence for its confirmation. I have, however, no hesitation in stating, that I know from experience that such is the case.

I had written thus far when I discovered that I had spelt *Plumb*stead incorrectly. I must surely have been under the dire influence of the "*Plumbeus Auster*,"* (I speak to a classical scholar). I have, however, sent the *Bee* to milder and more propitious regions.

Yours, very truly,
J. A. Paris.

Dr. BABINGTON.

29, Hertford Street, May Fair, November 14th, 1853.

Sir,

I think you have mistaken me for my cousin, Dr. Babington, of George Street, Hanover Square, who is one of the physicians to Guy's Hospital. The only establishment I am connected with is the Queen Charlotte's Lying-in Hospital.

I however have read your excellent letters published in "The Times" on the subject of the drainage of the Plumstead Marshes, and fully coincide in your views. Some few years since, I was appointed as Medical Commissioner to inquire into the state of the hulks at Woolwich, and then had an opportunity of observing the evil effects produced by the

* Hor. Sat. ii.

malaria arising from these Marshes on the health of the convicts there stationed.

I remain, with much respect,
Your most obedient Servant,
C. W. Babington.

The Rev. W. Acworth.

May I ask if you are related to Dr. Acworth, of Cheltenham, who was a very great friend of mine?

Dr. HUGHES.

14, St. Thomas Street, Nov. 4th, 1853.

Sir,

I unfortunately had not the advantage of seeing your letters in "The Times," and am therefore unacquainted with their import and tendency. I am therefore unable to reply to your note as may be desired; but I can have no hesitation in stating that in my experience at Guy's Hospital a very large proportion indeed of the out-patients affected with ague or intermittent fever have come from Woolwich and Plumstead, though I am not aware of any similar preponderance in regard to the common continued fever of this country.

I am, Sir,
Your obedient servant,
W. M. Hughes.

Rev. W. Acworth.

Dr. LITTLE.

34, Brook Street, Grosvenor Square, 14 Nov. 1853.

Sir,

In reply to your Letter requesting from me information respecting my experience of the influence of the Marshes in the neighbourhood of Woolwich upon the health of the metropolis, I beg to state that I am every year, at the London Hospital, called upon to treat many cases of fever

and ague, induced by exposure to the influence of Marsh emanations, from residence in the most exposed (the eastern) parts of the metropolis.

I can also state that continuously, during the last twenty years, although in some years more numerously than in others, I have witnessed cases of ague, neuralgia and other forms of disease allied to these, in the more favourably situated parts of the metropolis, which, according to the medical experience of ages, can only be referred to the proximity of Marsh Lands.

I consider that an incalculable benefit to the *general health* of all parts of London would accrue from the proper drainage of the Marsh Lands upon the Kentish and Essex banks of the Thames, from the mouth of the river Lea to that of the Blackwater.

Mariners who have been patients at the London Hospital have informed me that the crews of ships, when detained longer than two or three weeks at the usual stopping place of colliers near the Plumstead Marshes, invariably suffer from ague and allied disorders.

I am, Sir,
Your obedient servant,
W. J. Little, M.D.,
Physician to the London Hospital, &c.

To the Rev. W. Acworth, &c. &c.

Dr. ADDISON.

24 Nov., 1853.

Sir,

The great insalubrity arising from want of drainage of Plumstead and surrounding neighbourhood admits of no dispute. The direct evidence of your neighbour, my friend and former pupil, Mr. Bossey, is abundantly confirmed by my own experience and observations at Guy's Hospital. How far the miasmatic effluvia arising in that quarter may influence the health of the metropolis, it is difficult or impossible

to say, although when the wind blows from thence towards London, it can hardly be doubted that the atmosphere of the latter may be in no inconsiderable degree vitiated. There are, however, so many prolific sources of a similar poison in the neighbourhood of the river, and over the whole of the flat, low and badly drained surface to south of the bridges, that it would hardly be fair to ascribe the insalubrity of these parts to a poison transported from so great a distance as Plumstead.

I may also venture to remark, that it would be a great mistake to suppose that the actual occurrence of ague is requisite to prove the existence and evil effects of the miasmatic poison in question. On the contrary, my own experience leads to the conclusion that ague is the exception, and various forms and degrees of impaired health the general rule. I regret that I cannot furnish you with any statistical report.

Yours respectfully,
T. Addison.

Rev. W. Acworth.

Dr. DAVIES.

23, Finsbury Square, Nov. 16, 1853.

Dear Sir,

As one of the medical staff of the London Hospital, I have of course seen a considerable number of cases of fever and ague, and although I have not in all instances observed the locality from which they came, still I am aware that many were sent to us from the marshy lands in your neighbourhood. There cannot be a shadow of a doubt of the advantage, the absolute necessity, of fully and entirely draining such lands.

Yours truly,
Herbert Davies.

Rev. W. Acworth.

Dr. ROUPELL.

15, Welbeck Street, Nov. 15, 1853.

Dear Sir,

In common with the public at large, I feel much indebted to you, for your exertions with the view to the Sanitary Improvement of Plumstead and its vicinity; and I shall be greatly obliged if favoured by the means, through which it is proposed to remedy, practically, the evil. This seems to me to be the great object; no facts being more easily capable of proof, more generally known, or more universally admitted, than the insalubrity of marshy places, and the unwholesomeness of malaria.

I feel an especial interest in this matter, from being a joint owner of some property at Charlton, similarly situated, as I imagine, to that at Plumstead; that is to say, partially covered with houses, and below the level of high water mark. Should this be the case, I should be more thankful to learn how to drain this land without putting in practice what appears to me a most objectionable custom, that, namely, of polluting the water of the Thames, poisoning those who drink from this source, and imperilling the lives of those who are compelled to navigate its stream or to inhabit its banks.

In hopes of a reply, I remain,

Dear Sir,
Your most faithfully,
G. L. Roupell.

Dr. BENNETT.

15, Finsbury Square, Nov. 17, 1853.

Sir,

I am sorry that I have not had the advantage of seeing your Letters in the Times, but am aware that some investigations have taken place in reference to the drainage of the Marsh Lands in your neighbourhood.

I have long been aware of the unhealthy influence excited by the Marshy districts of Woolwich and the surrounding

country. Ever since my connexion with St. Thomas's Hospital I have noticed that a very large proportion of the cases of Intermittent Disease have come from the Woolwich district. And even in seasons when Aguish Diseases have not been prevalent, there have generally been some cases from the vicinity of the river in your locality. I have no hesitation in saying, from my own experience, that there is a constant malarious influence operating on the inhabitants of the district in question, and I could cite instances in which different members of the same family have again and again applied at the Hospital for the relief of various forms of disease, all clearly referable to the continued operations of endemic causes. I am sure that it is of the utmost importance for the welfare of the inhabitants that sufficient measures should be taken to drain the lands in your vicinity, and sincerely trust that your philanthropic exertions may be crowned with success.

I am, Sir,
Your obedient Servant,
JAS. R. BENNETT, M. D.

To the Rev. W. ACWORTH, &c. &c.

DR. RAMSBOTHAM.

Extract from a Letter from Dr. Ramsbotham to the Rev. Henry Brown, on the subject of Marsh Drainage.

7, Portman Square, Nov. 11th, 1853.

"Referring to the question you ask me, I do not think London is influenced in regard to health by the undrained Marshes of Kent and Essex: but there is no doubt in my mind that the more immediate neighbourhoods suffer severely from their present condition. So strong a feeling have I upon the subject, that I never permit a family, patients of mine, if I can prevent it, to go to Gravesend or Erith, or any of the villages on the banks of the Thames, for summer quarters. I know some persons at this time, who never sleep

there three or four nights, without suffering more or less from fever; and the only cases of ague that have ever come under my care, I have traced to the exhalations of these Marshes on one or other side of the river.

"If you can succeed in draining them effectually, you will be conferring a great blessing on the poorer inhabitants *especially* of the districts you take in hand."

B.—LETTERS FROM SURGEONS PRACTISING IN THE NEIGHBOURHOOD OF THE MARSH DISTRICTS, viz.—

WM. LABRUM, Esq., *Surgeon, Upminster.*

Upminster, Nov. 18, 1853.

Sir,

In answer to a Circular requesting information as to "the sanitary effects of the Marshes (at least five miles from my residence) on the health of the inhabitants," I can only say that my experience does not enable me to give you any information likely to be of value in the inquiry. I now and then have a few cases of ague from the Rainham Marshes, and I consider that district the most unhealthy in our neighbourhood.

There can be no question as to the beneficial effects which must result from the Drainage of the Marshes on this side of the metropolis.

I am, Sir,
Yours, &c. &c.
Wm. Labrum.

To Rev. W. Acworth.

JOHN EVANS BEALE, Esq., M.R.C.S., & A.C., *Surgeon, Plaistow.*

Plaistow, Nov. 21, 1853.

Sir,

I have to acknowledge the receipt of your Letter of the 14th instant, calling on me to afford you information as to my experience of the effects on health of the Marsh Land

in my district. Plaistow, where I have resided thirty years, is situated on a gravelly soil on the upland on the immediate border of the Marsh Land. I believe, from its subsoil of gravel, it does not suffer much from ague. I can, however, bear ample testimony to the necessity of an improved system of Drainage for these Marshes for their sanitary improvement. We suffer much from remittent fever, produced more particularly by an east wind blowing over these Marshes, and which, I am persuaded, extends its influence long distances, and that the health of London is thereby affected. In our district, I am happy to say, steps are being taken to carry out this necessary improvement by an application to Parliament for powers to do so; and I hope it may be made to embrace your more extended and far-seeing views.

I have the honour to remain, Sir,
Your obedient Servant,
John Evans Beale, M.R.C.S. & A.C.

To the Rev. W. Acworth.

W. R. WARWICK, Esq., *Southend, Surgeon.*

Southend, Essex, 18 Nov., 1853.

Reverend Sir,

In reply to the Circular Letter signed by Sir C. E. Eardley, Bart., the Rev. H. Brown and yourself, asking for information as to the effect of Marshes on the health of the locality, I beg to state that I am not aware from personal experience of Marsh Land (which in the *immediate* neighbourhood of Southend is of small extent) affecting the health of the inhabitants injuriously, beyond causing some cases of ague and aguish disorder, chiefly among the poor; these cases not being considerable in number, and generally very easily yielding to treatment.

The number of cases of ague is greater in proportion to the proximity of the Marsh, and I have reason to believe that in the eastern and north-eastern part of this hundred, where a much larger tract of Marsh Land exists, cases of ague are

much more frequent than in Southend and the parishes adjoining.

Mr. Miller, a surgeon residing at Great Wakering, informs me, that in the island of Foulness, which is well drained, the water being allowed to wash completely through the ditches from one side of the island to the other at every tide, and the inhabitants of which are supplied with water from Artesian wells, ague is much less prevalent than among the people living on the neighbouring mainland at the borders of the Marshes; many of the ditches in these Marshes having no outlet,—emptying themselves only by evaporation, and in doing so often exhaling an abominable stench.

I am, Reverend Sir,
Yours very obediently,
W. R. Warwick.

The Rev. W. Acworth.

WILLIAM FISHER, Esq., *Surgeon, Dartford.*

Dartford, Nov. 17th, 1853.

Sir,

The few patients I have had an opportunity of attending in the vicinity of Erith and Picardy have been principally cases of intermittent fever, and I feel confident that the draining of the Marshes would be highly beneficial, and tend much to improve the health of the inhabitants in those localities.

I am, Sir,
Your obedient Servant,
William Fisher.

The Rev. W. Ackworth.

J. B. SHEPPARD, Esq., *Surgeon, Erith.*

Erith, 19 Nov. 1853.

ERITH MARSH.

Gentlemen,

My experience of the effects of the Marsh effluvia upon the health of the inhabitants of Erith, extending only over nine months of the present year, cannot carry much weight in the inquiry you have undertaken; as far as it goes the results of my observation are at your service.

Regarding the general health of the village—I believe it to be better than the average of country districts. This result of my own observation is to some extent confirmed by the inclosed extract from the parish registers (made early in this year by the National Schoolmaster).

Again, *scrofula* is unknown here; there is one inhabitant has a scar on the neck resembling the cicatrix left after a strumous abscess; but I have not been able to learn his history. With this exception I do not know of a trace of the disease existing in the village.

Do the Marshes produce any specific diseases?

Ague and its relative remittent fever are very common in autumn and spring; but, as far as I have seen, in a form easily subdued. All febrile diseases, too, have a tendency to become remittent, and are benefited by a liberal supply of tonics.

That the atmosphere of the Marsh produces these effects, I conclude from the facts, that a change of wind is followed by new cases on the windward side of the village, and that the houses nearest the Marsh are most liable to attack. On the western side, near the church, there are four houses—two railway lodges, a cottage, and a gate lodge belonging to Sir Culling Eardley; in three of these, during the past summer, Marsh fever has occurred, and in the fourth a very virulent form of scarlatina carried off two of the children: this fatality may have arisen from other causes, but I believe the debili-

tating effect of the miasm rendered the patients less able to resist the effect of the scarlatina virus.

I have not, in nine months, seen a pure case of continued fever, or of typhus, such as is frequent in inland towns of the same size.

I am sorry that my residence here has not been sufficiently long to allow me to speak more positively on the subject. Any further information which I can collect I shall be happy to communicate.

Gentlemen, your obedient servant,
J. B. Sheppard.

To Sir C. E. Eardley, Bart.
H. Brown, Esq.
Rev. W. Acworth.

Rd. TIPPOTTS, Esq., *Surgeon, Dartford.*

Dartford, Nov. 16th 1853.

Rev. Sir,

In reply to your communication of to-day, I beg to observe that there cannot be, I think, two opinions as to the importance of an efficient Marsh Drainage; not only would an immense population be greatly improved in health by it but the land would be rendered much more productive.

I am, Rev. Sir,
Your obedient servant,
Rd. Tippotts, Surgeon.

The Rev. W. Acworth.

W. J. ALLISON, Esq., *Surgeon, Ilford.*

Ilford, Nov. 17th, 1853.

Sir,

In reply to the circular on the subject of Drainage of the Marshes to the east of London, I have to observe, that, although Ilford is situated at a distance of two miles from the Thames Marsh, and otherwise favourably circumstanced, the inhabitants are unquestionably, to a certain extent, affected

by the miasm emanating therefrom. The village stands on rising ground, with substratum of gravel, through which water percolates quickly, even during heavy rains, soon leaving the surface tolerably dry. Its position, too, being to the north of the Marsh, we are in a great measure, I think, saved from the baneful effects of the poison through its being carried away from us by the east and north-east winds that generally prevail during the spring and autumn—the seasons when ague is usually most rife. Nevertheless, the air here is highly saturated with moisture, producing rheumatism and frequently severe attacks of neuralgia—of so persisting and obstinate a character as often to require a change to a drier atmosphere before a cure can be effected.

Occasionally mild cases of ague occur, but such as originate in this neighbourhood are generally soon and easily cured; not so, however, with those contracted on the right bank of the river,—for, during a residence in this place of thirty-two years, I have occasionally had to treat ague which has commenced in that locality, and have invariably found it to present a more obstinate and unyielding type than any met with here—bearing out my belief that the east and north-east winds carry away the miasm from us in an opposite direction, and cause thereby an excessive quantity to be imbibed by the inhabitants residing on the south side of the river. The eastern districts of the metropolis probably become affected in this manner. There cannot, however, be a question as to the propriety, and indeed urgent necessity, for an Improved System of Drainage being adopted in these Marshes, so as to remove, as far as possible, so fruitful a source of disease, human misery and suffering, as at present exists there.

I am, Sir, your obedient servant,
W. J. Allison.

Rev. W. Acworth, Plumstead Vicarage, Kent.

C. J. PINCHING, Esq., *Surgeon, H.E.I.C.S., Gravesend.*

Gravesend, 2 Dec. 1853.

I hereby certify that I have practised in this town for twelve years, and am acquainted with it for nearly twenty years; and I have no hesitation in declaring, that from the vast extent of Marsh Land on this and the neighbouring coast of Essex, marsh miasma, producing ague and remittent fever, predominate to a great extent; and that it is my decided opinion that if efficient measures were adopted for draining the low lands on both sides of the river Thames, they would add much to the salubrity of the districts along each bank. Even as a commercial transaction my belief is it would amply pay the capitalist; but when it is taken into consideration the amount of human life that is annually sacrificed, and the ill health that is engendered by being obliged to reside in the neighbourhood of ill-drained or undrained Marshes, not to mention our garrisons of Woolwich and Chatham, the forts of Tilbury, New Tavern, Shorm Battery and Cole House, where the brave defenders of our country are obliged to live, I think the time has arrived when every effort should be made to thoroughly drain and carry away the fruitful seeds of ill health and death.

C. J. Pinching, Surgeon, H.E.I.C.S.

EDWIN COTTENHAM, Esq., *Parish Surgeon, Bexley.*

Bexley, November 30, 1853.

Sir,

In reply to your Letter I believe I have little more to do than recapitulate what was contained in a Letter addressed to Lord Shaftesbury three years ago, when the project was contemplated of converting Belvedere and the Abbey Wood into a burial-ground for the use of the Metropolis; and I there stated that the vast tract of Marsh both on the Essex and Kentish sides of the River was a prolific source of

malaria; and that the hewing down of the woods that intercepted this tract from the uplands would suffer fogs or currents of air to convey the pestiferous emanations arising from it to densely inhabited parts: and that even under the existing circumstances of intervening barriers to the transit of malaria, I, as the appointed medical officer to the pauper population of Erith, as far as Plumstead, for the last thirty-three years, have had extensive opportunities of watching its effects upon the health of the numerous inhabitants within the sphere of its action. And I have long entertained the opinion that if the ditches intersecting the Marsh and serving as outlets to its drainage could be abolished by the substitution of subterrane courses, that an incalculable benefit to the salubrity of the neighbourhood would ensue. That to these open ditches, containing stagnant waters abounding with confervæ (that form the mud) and animalculæ as well as insect larvæ, &c., under circumstances of heat, moisture and electricity, more or less favourable to the evolution of deliterious gases arising from animal and vegetable decomposition, is to be attributed the chief danger; that although fogs will still exist or currents of air still operate, yet they will not be imbued with the poisonous miasmata springing from these ditches, which are now its chief source, rather than the surface of the soil itself; and this extensive and valuable property would thus be deprived in great measure of obnoxious conditions that interfere with public health, and which, were it not tedious to relate, could be exemplified by a multitude of cases occurring in my practice.

I am, Sir,

Your obedient servant,

Edwin Cottenham.

To the Rev. W. Acworth.

PETER BOSSEY, Esq., }
Dr. F. BOSSEY . . . } *Woolwich.*

Gentlemen,

In reply to your inquiry respecting the influence of the marsh malaria of this district on the health of the inhabitants and neighbourhood, we beg to state that in the course of thirty years medical practice in Woolwich we have observed that, besides being the immediate cause of numerous instances of disease, this malaria lowers the general standard of health in the community, begets a proneness to many forms of disease not in themselves necessarily connected with the malaria, complicates other diseases and renders them more dangerous than they would otherwise be, and often causes the recovery therefrom to be very protracted and imperfect.

The operation of marsh malaria as a *cause of disease* is best illustrated by the statistics of ague or intermittent fever,—a form of disease which is universally ascribed to its influence. The following tabular statement of the cases of ague which occurred among the convicts at Woolwich Arsenal in the years 1845—7 demonstrates the power of the malaria of Plumstead Marshes to induce this disease among men mostly in the prime of life when brought within the sphere of its influence :—

Years.	Average Number of Men.	Cases of Ague treated.
1845	430	57
1846	412	196
1847	420	405

In some seasons the malaria is so potent that persons become affected with ague after a very short exposure to the air of the Marshes; and a very large proportion of the families, and in some cases nearly all the members of the families, living in or on the borders of the Marsh simultaneously suffer from that disease.

These observations may give some idea of the numerical extent to which the population of this district is affected by ague in epidemic seasons; but rightly to estimate the importance of these attacks we should take into account the numerous important and, to the public, too little known *complications* which often attend cases of ague, and the disastrous *sequelæ* to which that disease gives rise. Among the former the most grave are congestion of the lungs and of the brain (sudden and fatal examples of which we have witnessed), hemorrhages from the lungs, stomach and bowels, convulsions in children and temporary insanity in adults. Besides these graver complications,—bronchial, pulmonic and pleuritic inflammations are not rare in the agues of the spring, while bilious vomiting, diarrhœa and dysentery attend those of the autumn. Among the latter the most common are enlargements of the spleen, disease of the liver, jaundice, dropsy, general debility, anæmia, and a peculiar diseased condition of the blood (leuco-cythemia).

The influence of the marsh malaria in this district is, however, by no means limited to the production of ague, its complications and direct *sequelæ*, but neuralgia, particularly of the eye-brow, hemicrania and rheumatism are its common effects; and in some seasons, gastric, typhoid and typhus fevers occur in connection with or take the place of the ordinary form of intermittent.

As might *à priori* be expected, that which exerts so deleterious an influence in the locality in which it originates, operates also in a very prejudical manner on the surrounding country. We have formerly asserted our opinion that an epidemic of ague in this district is associated with the prevalence of fever in the Metropolis, and this opinion is confirmed by a comparison of the mortality from fever in London with the cases of ague that occurred in the Justitia at Woolwich.

Years.	Deaths from Typhus in London.	Cases of Ague on board the Justitia.
1845	1301	57
1846	1796	196
1847	3184	405

The following extracts tend to show that in former times, when the Marsh district extended nearer to London, it

exerted a greater influence on the health of the Metropolis than it does at present, although we believe that even now, if the subject were properly inquired into, its influence would be found to be much greater and far more extensive than is generally supposed.

In support of our opinion that the inhabitants of this district possess but a low standard of health through the malaria, we may adduce the large proportion of sickness prevalent among the artizans in the Arsenal;* the amount of poor rate merely expended on the sick poor and in lodging houses; the failure of sick clubs from the multitude of claimants; the high rate of mortality in the Woolwich Arsenal district, which we find in the years 1841-50 to be 2·8 per cent.; and the successful custom of most families residing here of seeking improved health in summer by change of air. That this impaired tone of health must increase the liability to disease, complicate and modify its symptoms, influence the results of treatment and retard recovery, is too obvious to require any further proof.

In accordance with the terms of your inquiry our remarks are restricted to the influence of the poisonous malaria of this district on the health of the neigbourhood, but we would beg permission to observe that the effects of excess of moisture induced by the *undrained state* of the Marsh Land are scarcely less important, and more especially deserve consideration now that it is contemplated to add 400 or 500 acres of water surface to the district by the construction of the Victoria and East Greenwich Docks.

We are, Gentlemen,
Your obedient servants,
PETER BOSSEY,
FRANCIS BOSSEY.

Woolwich, 21 Nov. 1853.

* In the Royal Carriage Department only the number of sick from October, 1847, to 30th September, 1853, is 1,749, and ague was a prominent illness.

PETER BOSSEY, Esq., *Woolwich, Surgeon.*

Woolwich, 4th Dec. 1853.

SIR,

In compliance with the request contained in your note of the 25th ult., I beg to transmit to you the following observations and statistical statements, in the hope that they may aid the Committee to form an estimate of the deleterious influence of the Marsh miasmata of the district on the health of its inhabitants.

That ditches and marshes frequently produce a miasm which is capable of exciting disease, is a well-known and admitted fact; but as the poisonous effect of the marsh miasm varies much in *different* seasons and in *different* localities, it is necessary to select some one of its most constant and least ambiguous results when we wish to determine its presence or estimate its force in any given situation. Intermittent fever or ague is the best test of this kind with which I am acquainted, and it is to that I shall chiefly refer.

This test may be used in two ways; we may select a number of individuals resident in the district, and ascertain how many of them suffer from ague, or we may bring separate individuals into the miasm, and observe in what space of time they will become affected by it. Of the former mode I venture to adduce two instances, both of which amply demonstrate its existence and power.

Two vessels are used as the abode of the prisoners at Woolwich; one of them is placed at the east end of the town, exposed to the malaria, while the other is distant from the Marsh a mile to the westward. The circumstances of the men, as to age, food, clothing, hours of labour and other hygienic conditions, were nearly alike, but they differed in their relation to the malaria. Those in the Warrior were employed in the paved, dry Dockyard; while the others, in the Justitia, laboured, when on shore, either in the Arsenal

or in the Marshes. In an epidemic intermittent fever I compared the result. It is as follows:

Ships.	Years.	The Mean Number of Men daily on board each Ship.	The total Number of Cases of Ague and Relapses.*	Rate of Attacks per Cent. per Annum.
Warrior	From 1844—7 inclusive	388	87	5·670
Justitia	1844—7	413	712	43·09

The Carriage Department in the Royal Arsenal is a square of enclosed workshops, situated about a third of a mile west from the Marsh. The artizans therein employed are healthy men in the prime of life, and most of them reside in that part of Plumstead near to Woolwich. The exposure of these persons to the malaria is less direct than that of the prisoners, and yet from April, 1848, to April, 1849, 112 cases of ague and relapse are registered among 402 men, approaching nearly to the proportion of 28 per cent.

Taking the *time of exposure* as a test of the intensity of the poison of malaria, I may state that instances of ague, contracted by a short exposure, are not uncommon at Plumstead. I have known it immediately to follow the very brief exposure incurred by a walk or a drive through the Plumstead Marshes.

To the above illustrations of intensity I may add, that the inhabitants familiarly remark, that the Marshes render the place unhealthy; that families which had before been healthy have become the reverse on changing houses or situations, and, in the opposite cases, that they have recovered health by change of residence.

If we desire to trace the mortality from ague, it must be observed, that ague is ordinarily fatal only by its complications, under which heading the cause of death may be returned. The columns Fever, Congestion, Convulsion, Hemorrhage,

* Relapse means a second or third attack in the same year in the same individual, for agues often return on renewed exposure.

Dropsy, Diseases of the Liver, Spleen or Bowels would all receive in malarious districts a proportion of examples of aggravated or neglected ague; and it is for this reason possible that a very general and protracted epidemic of intermittent fever may destroy health and cause distress among the people, without appearing as the cause of death.

The power of the malarious poison to induce disease is not limited by the occurrence of simple remittent or intermittent fever. Dysentery and other bowel complaints are produced by the same cause.

The following Return, extracted from the entries of patients treated in the Prison Hospital Ship at Woolwich for twenty years, will serve to indicate an occasional simultaneous increase and decline of these diseases in this locality. It is needful to remark, that the Hospital being small, the graver cases of each class were alone admitted.

A Return showing the relative prevalence of Ague, Diarrhœa and Dysentery in the Prison Hospital at Woolwich from 1824 *to* 1843.

Years.	1824.	1825.	1826.	1827.	1828.	1829.	1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.	1839.	1840.	1841.	1842.	1843.
No of Men	893	999	833	1066	...	1050	875	913	959	868	913	833	778	666	739	861	1043	1153	1068	...
Cases of Ague	3	12	59	45	23	8	7	1	11	...	2	15	21	26	12	9	13	4	1	16
Diarrhœa	7	12	15	35	23	12	5	11	45	13	7	6	5	2	7	14	36	12	21	7
Dysentery	...	...	26	55	81	10	1	...	...	1	2	6	...	...	...	1	1	...	16	1

If the results of private medical practice in this neighbourhood could be examined, it is probable that similar relations would appear, because it is familiar to professional men that the vernal agues are attended with disorders of the chest, and the autumnal intermittents with those of the bowels. In the above table it may be noticed, that in the years 1838 to 1842 the cases of ague are very low, and I find from the registrar, that in Woolwich the mortality from diarrhœa, dysentery and cholera for that period was correspondingly small; being, for five years, diarrhœa, 15; dysentery, 8; cholera, 1, in a population of 26,300 persons.

In concluding, permit me to express my regret that the pressure of professional duties on Monday would not permit me to attend the meeting of the Committee until a later period of the day.

I am, Sir,
Your most obedient Servant,
PETER BOSSEY, Surgeon.

W. H. CLIFTON, ESQ., Hon. Sec., &c.

JAMES STEWART, ESQ., *Inspector General, Ordnance Medical Department.*

Royal Ordnance Hospital, Woolwich, 28th Nov., 1853.

MY DEAR SIR,

I regret that the pressure of official business has hitherto prevented me from replying to your inquiries respecting the influence of the Plumstead Marshes on the health of this garrison. It is now about forty-six years since I first became acquainted with this locality, and during that time a gradual improvement has taken place in the state of these Marsh Lands. From having been grass pastures, they have been subjected to tillage, and have now become exceedingly productive, corn lands affording year after year abundant crops of wheat, without the necessity of manuring the soil. I have no doubt that a considerable amount of Drainage must have been carried on to lead to these desirable results; still, with all these ameliorations, the health of this garrison suffers materially from the proximity of these low lands on both sides of the River, particularly during east winds. Intermittent and remittent fever—the former at all times, and the latter during summer and autumn—have always during my recollection been common in this garrison. During the autumnal months of 1825 and 1826, and the whole of 1827, these fevers were uncommonly frequent, and constituted the greater part of the Sick List. In the preceding winter the Essex and Plumstead Marshes were much flooded, and being followed by the east winds and the hot and dry summers of

1825 and 1826, a great evaporation from the wet lands was the consequence; and under no circumstances is malaria produced in greater intensity than during the drying up of a marsh. The malarious exhalations being wafted by the north-east winds over the town and garrison of Woolwich, the effect of this subtile agent was seen in the numerous attacks of fever, which were not confined to the lower parts of the town, but extended to the Barracks and Woolwich Common. Many of these attacks proved fatal. These were uncommon years; but at all times this garrison is liable to fevers, and it is seldom that a day passes without an admission from that disease,—often two or three.

The East Wharf Guard Room, being situated so close to the Marshes, has always been found a fertile source of fever. Whilst doing duty as a surgeon in this hospital, I could often trace an attack of fever to the night exposure of a sentry in this unhealthy locality. But that the influence of the malaria extends to the Artillery Barracks is, I think, proved by men of the Royal Horse Artillery being sometimes attacked with ague. These men are not exposed to the night air in the Arsenal, like the men of the battalions. Their agues seem to be produced by their getting over-heated in grooming their horses, and then exposing themselves to the cold air at the doors of the stables. Another proof that the effects of the malaria is not confined to the margins of the Marsh Land is, that attacks of ague often originate at Sandy Hill and other parts of Plumstead Common, which is high ground, and of a dry gravelly soil.

The following facts, I think, bear on the subject of your inquiries. A serjeant of artillery, with his wife and a family of children, who lived at the lodge near the Marsh gate, found that he and his family suffered so constantly from ague and its concomitant affections, that their life was completely miserable. Rightly divining the cause, he instituted inquiries, by which he found that the owners of property in the Marshes were bound by law to open their flood gates a certain number of times weekly, but that this wholesome

regulation was sadly neglected; he stirred himself in the matter so much, that the law was put in force, and he was rewarded by finding a great amelioration in his own health and that of his family.

That a great deal can still be done in the way of improvement, I have no doubt. Draining in all its varieties is now better understood and better performed, and it is consoling to reflect that any improvement which can be effected for agricultural purposes must have a corresponding good effect on the health of the rapidly-increasing population of this vicinity.

Believe me, my dear Sir,
Yours faithfully,
JAMES STEWART,
Inspector General, Ordnance Medical Department.

Rev. HENRY BROWN, M.A.,
Rectory Place, Woolwich.

C.—EVIDENCE SORTED AND PRINTED BY COMMITTEE.

DR. BARKER, *Physician to St. Thomas's Hospital, London.*

71, Grosvenor Street, Nov. 19, 1853.

SIR,

I beg to apologize for not having answered your note of the 12th inst., but having unfortunately mislaid it, and forgotten the address, I was unable to do so until I saw your letter in the Times last night.

I can have no hesitation in stating that, during the thirteen years that I have been physician to St. Thomas's Hospital, I have had very ample proof of the unwholesomeness of the district around Woolwich, not only in the severe cases of fever which so frequently occur amongst its inhabitants and those who have been at work there even for a short time, but also in the enfeebled constitutions of many, which renders them unable to recover readily from other diseases, or to bear the remedies which in ordinary cases are required for their treatment.

With respect to the extent of the injurious effects of the Marsh Lands on the health of the inhabitants of London, I believe there may be a difference of opinion amongst the members of my profession. My own opinion is, that the inhabitants of the eastern district suffer much from undrained marshes; and I think it probable, too, some injury may be inflicted on those living at a greater distance.

I am, Sir,
Your obedient servant,
T. A. BARKER.

Dr. J. T. WALLANCE.

Stratford House, Essex, 15th Nov. 1853.

Reverend Sir,

I beg to acknowledge the receipt of your Circulars, and to say that I am *very* glad to find that *at last* the Marsh swamps and ditches, most fruitful sources of pestilence, disease and death, are likely to be dealt with by a public bill; anything less will, I fear, be powerless to grapple with so gigantic an evil. Not being a member of your committee, I do not know whether my personal attendance is desired, but so anxious am I to add my mite of aid, that I will if possible attend; and am,

Reverend Sir,
Your obedient servant,
James Tho. Wallance,
Medical Officer of Health, &c. &c.

Rev. W. Acworth, &c. &c.

Dr. CORBET.

Orsett, Essex, 17th Nov. 1853.

Gentlemen,

In reply to your communication relative to the Drainage of the Marshes east of London, I have no hesitation in stating that some plan for this object is highly necessary. For many years the sanitary state of the parishes bordering on the Thames from Grays to Vange has been under my close observation, and unquestionably ague, bilious and remittent diseases, especially a type of remittent fever terminating in about eight days in congestion of the brain and death, are greatly increased, if not wholly originated, by defective drainage; nor is it on the flats or marshes where these diseases alone prevail, but all along the higher grounds bordering on these Marshes, although the soil is dry or

gravelly, these diseases prevail: the malaria taints the air to a considerable distance.

I remain, yours, &c.,
Dav. Corbet, M.D.

To Sir C. E. Eardley, Bart.
Rev. H. Brown.
Rev. W. Acworth.

JOHN C. SECCOMBE, Esq., *Surgeon, Greenhithe.*

Greenhithe, Kent, 18th November, 1853.

Sir,

I beg to acknowledge the receipt of your note requesting information with reference to the sanitary effect which the Drainage of the Marshes on the borders of the Thames to the east of London would have on the public health, bearing especial reference, however, to the district within my immediate neighbourhood.

I may be permitted to say, that I am of opinion that the general Drainage of the Marshes to the east of London is a subject which merits all the attention which your Committee are disposed to bestow upon it, and one which, if effectually carried out, cannot but be productive of immense benefit, in a sanitarial point of view, to the inhabitants living within range of the malaria arising from the marshes on the banks of the Thames.

During a residence of more than seventeen years at Greenhithe, I have very frequently noticed the heavy mists which from time to time hang about the Marshes on the Thames, which mists must be more or less charged with the poisonous exhalation which the state of these Marshes must give forth, inducing thereby a tendency to lessen nervous power generally, and, as a sequitur, ushering in cholera, ague, in fact all diseases having a low typhoid character.

I beg to remain, Sir,
Your obedient servant,
John C. Seccombe, Surgeon.

The Rev. Wm. Acworth,
Vicarage, Plumstead, Kent.

Woolwich, Nov. 19th.

Sir,

In answer to your letter of the 14th inst., I beg to say, my removal from the *immediate* neighbourhood of Plumstead has prevented me of late seeing much of the illness (particularly amongst the poor) of that parish. From the year 1818 to 1830, I had constant opportunities of observing the character of the illness prevalent; it was generally of an intermittent form, sometimes low fever—*both*, I believe, much depending on situation, the village being near a large Marsh district: those illnesses appeared after north-easterly winds or much rain followed by *hot sun*. In 1826 I visited almost every day, during the months of September and October, from eighty to ninety patients suffering as just mentioned. There can be no doubt, effectual drainage on *both* sides of the river would tend greatly to improve the health of the neighbourhood.

I am, sir,
Your obedient servant,
John Butler,
Rectory Place, Woolwich.

Rev. W. Acworth.

JOHN F. SOUTH.

Blackheath Park, Dec. 20, 1853.

My Dear Sir,

As I know you are interested on the subject of the Marsh Drainage in the neighbourhood of the River Thames, I do not hesitate to make you acquainted with the state of the Charlton Marshes, which, as one of the Local Health Committee for that parish, I have of late visited several times. They form a portion of the district between Greenwich Reach and Woolwich, north of the Lower Woolwich road, and are of the most unwholesome and filthy character, specially towards the north-east end of Charlton. Not only are these

Marsh Lands constantly wet, owing to the drainage through them of the higher parts of Charlton and Blackheath, and their level being much below high-water mark, in consequence of which they are continually covered with fog—but this foggy atmosphere is still further unhealthy on account of the stagnant condition of the few private ditches by which the lands are separated, and which are full of decayed vegetable matter and the drainage of night-soil, which is frequently deposited in their immediate neighbourhood; and because the Spring ditches belonging to the Dartford Commissioners, which ought to carry off only clean water, are poisoned and filthy, with the unauthorized turning into them of the drain pipes from the Roupell estate. The occupiers of the land think proper to dam up as suits them, and for so long as they think proper, the ditches flowing by their ground, from which the effluvia is always very offensive, and still more so when the water is let off and the filthy banks are exposed.

A large portion of the north-eastern part of Charlton is being rapidly covered with four-roomed houses, scarcely one of which has a cellar beneath the ground-floor. The drain-pipes which have been put down, it would seem as a pretence for drainage, are not eighteen inches below the surface, and even into these very commonly no house sewerage runs, but is allowed to empty itself into long open cuts, about eighteen inches wide, and as many deep, whence it spreads about and forms a most filthy and dangerous swamp. The consequence is, that many of these houses are unoccupied; that the tenants who come rarely stay above two or three months, by which time they have full experience of the filthy nature of the locality.

There can be no difficulty in thoroughly draining the whole of this neighbourhood, as there is at least six or eight feet fall to low water beyond the level of the sluice in Charlton pier.

That ague and fever are of common occurrence in this nighbourhood is well known to medical men, and to all connected with the large hospitals of London, to which cases are continually sent; and though the persons who live in the

neighbourhood are the first to suffer from the baneful effects of the Marsh poison continually generated here; yet still, though more distant, the inhabitants of the metropolis come in for their full share of the insidious enemy, which is caught up and carried on by breezes which we too often think are balmy and health-inspiring, when in reality they are the bearers of disease and death.

Believe me, my dear Sir,
Yours faithfully,
JOHN F. SOUTH.

TO JAMES MACGREGOR, ESQ.

Number of Out Patients attended at St. Thomas's Hospital for Ague during the Years 1851, 1852 *and* 1853.

1853.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Male..	3	3	15	16	23	21	12	14	6	8	3	0
Female	1	4	5	9	13	17	4	4	2	4	1	0
Total	4	7	20	25	36	38	16	18	8	12	4	0

1852.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Male..	0	4	7	11	24	14	9	7	10	6	5	4
Female	0	3	3	6	16	9	4	3	6	4	5	3
Total	0	7	10	17	40	23	13	10	16	10	10	7

1851.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Male..	3	2	4	6	12	18	7	5	4	4	3	2
Female	2	2	3	6	9	16	3	2	2	3	2	1
Total	5	4	7	12	21	34	10	7	6	7	5	3

Most of these patients came from Deptford, Woolwich, Plumstead, Chatham and Sheerness; but a large number, especially of low Irish labourers, have for some time before the attack been living in various dirty and densely populated courts about Bishopsgate Street, the Commercial Road, or the Borough and Bermondsey, especially in a wretched

place called Vine Yard. Nearly all these patients have, however, been residing at or working in the districts in Kent where ague abounds within a few months of the attack, or at all events have had this complaint at some former time.

About four or five years ago there was a fearful outbreak of ague at Sheerness and the surrounding country, which originated in the malaria created by turning up the earth for the purpose of making fortifications.

Nearly all diseases other than ague in persons living in the above aguish districts, are of an intermitting character, at least have a tendency to this, and more or less require quinine for their treatment.

EDWARD CLAPTON.
Assistant Apothecary, St. Thomas's Hospital.

R. D. GRAINGER.

St. Thomas's Hospital, December 20, 1853.

IN the discharge of my duty as a Medical Inspector of the General Board of Health, my attention has been directed to the great evils inflicted on the public health in the metropolis by the vicinity of the large area of undrained Marsh land of Essex and Kent; and I feel assured, that, until this land is effectually drained, much mischief will continue to be inflicted on the inhabitants not only of Woolwich and other localities along the Thames, but likewise on those of London. The vast importance of thorough Drainage in regard to health, and for the purpose not only of removing the refuse matter of towns, but also of excessive moisture, is beginning to be generally recognized; and the local authorities of some districts, who are now engaged in laying down drainage pipes, have, for the purpose of removing the subsoil water, provided a special set of tubes, independently of the ordinary sewers.

R. D. GRAINGER.

HENRY GREENWOOD, Esq., M. D.

Talbot Place, Blackheath.

After a careful consideration of the facts observed during the epidemic period, from the beginning of 1847 to the end of 1851, I have been led to form the following conclusions:—

1st. That there is one epidemic poison only, which, according to its power and as modified by circumstances, is capable of generating every variety of epidemic disease.

2nd. That what has long been known under the name of Marsh Miasmata, is the essential epidemic poison, and its power in direct ratio to the impurity of its source, and the temperature under which it is generated.

3rd. That the usual sources of epidemic poison are, Marshes, Estuaries, Tidal Rivers, large collections of water, especially if stagnant, and low and damp situations. In certain places, therefore, it is always present in a greater or less degree, and influencing injuriously the health of individuals living in those localities; but when its power is increased in consequence of the contamination of its source by impurities of any kind, whether animal or vegetable, and the temperature under which it is generated, it becomes capable of originating the most formidable epidemic diseases.

4th. That the remarkable circumstance of three attacks of epidemic cholera having occurred in this country in the short space of twenty-one years, after an exemption of nearly 200 years from any pestilential disease, can only be accounted for on the ground of the above conclusions.

5th. That the rapid increase of population in London and other large towns, during the last forty years, has from time to time called attention to the necessity of Drainage; and in the Metropolis extensive and costly works have been executed on both sides of the River, having the object of a thorough Drainage in view. But as all the Drains were allowed to discharge their contents into the Thames, within the limits of the Metropolis, no suspicion of the danger of their

so doing being entertained, the result is such an increase of the power of the epidemic poison, by the immense amount of impurities of every kind poured into the river, as to subject London to visitations of pestilential disease, from which it had been free for ages.

6th. That as no limits can be assigned to the power of the epidemic poison, and the causes of the increase of that power are continually in operation, there is reason to fear, that, having already brought ourselves under the influence of so formidable a disease as Epidemic Cholera, we shall, at no distant period, be subjected to the more dreadful forms of epidemic disease, Plague and Yellow Fever.

7th. That the diversion of the Drainage of the metropolis from the Thames is imperative, as, under existing circumstances, the population along its banks is at any time liable to be subjected to the destructive effects of the highest order of pestilential disease.

8th. That the specific epidemic diseases, as Small Pox, Measles, &c., are generated, de novo, under certain conditions of the epidemic poison, and although capable of propagation by contagion when once originated, are only diffused extensively in an epidemic atmosphere.

HENRY GREENWOOD.

Blackheath, Jan. 6th, 1854.

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PAMPHLETS

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