tion of these also would cause cough. It is impossible to form any conclusion as to the result of irritation of the alveoli.

In another series of experiments the result of irritation of the pleura was tested. A dog was experimented upon, a puncture being made through the muscles of an intercostal space. A sound was then introduced so as to cause a pneumothorax, and the sound was moved about in the pleural cavity. No cough was produced. The opening was then enlarged, and further irritation was set up, but no cough occurred. However, it might be said that, although the healthy pleura did not give rise to cough when irritated, an inflamed pleura might produce cough by its irritation. Accordingly a dog was thrown into narcosis with morphia, and in this condition a solution of croton oil in olive oil was injected into the pleura. The skin was closed. When the animal came to itself it winced and cried, but did not cough. The same evening the pleura was irritated, as in the above experiments, in every direction, and there was evidence of pain, but not the least tendency to cough. In order to correct the experiment, the trachea was opened. Irritation of the larynx and the trachea at its bifurcation produced violent cough. Dissection showed intense pleurisy, with considerable exudation and effusion of blood in both pleuræ.

The results thus obtained undoubtedly seem in curious contradiction with the commonly observed fact that cough sometimes attends pleurisy; but the fact is, in all probability, that exact observation would show that in simple pleurisy there really seldom is cough. The probability is, in fact, that in those cases where cough is present there is simultaneous affection of the lung or of the bronchi.

Some observers, for instance, Krimer and Romberg, state that irritation of the vagus trunk causes cough. Most experimenters contradict this, and also deny that irritation of the trunk of the superior laryngeal nerve causes cough. A series of experiments have convinced Nothnagel that the latter opinion is correct. In no single case have we got evidence that irritation either of the uninjured trunk or of the central end of the vagus or of the superior laryngeal causes cough. It is impossible to say what the sources of mistake may have been. The result to which Nothnagel's experiments led entirely corresponded with the physiological law, that irritation of branches of a nerve much more easily produces reflex phenomena than irritation of the trunk. It shows also a remarkable difference between reflex coughing and reflex vomiting. The latter symptom is easily induced, not merely by irritation of the stomach, but of many other places, and of the nervous centres. People have indeed spoken of a centrally produced cough, but their observations are very doubtful and inconclusive.

In conclusion, the author remarks that there are some other important points yet to be observed as to the origin of cough; for instance, many people talk of a stomach cough, and of the cough in pericarditis. So far he has made no experiments upon these points, but on the whole he is inclined to disbelieve these statements, especially in view of the results obtained by experimenting on the pleura. However, the fact is established that in many individuals cough may be produced by irritation of many particular places. A small branch of the vagus is here probably the medium of irritation.—*Syd. Soc. Bienn. Retrosp.* 1869, from *Virchow's Archiv*, iv. 1, 1868.

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20. *Inflammation and Suppuration.*—The most important researches on this subject which have been made for many years are those of Cohnheim. In an elaborate paper (*Virchow's Archiv*, Sept. 1867) he brings out the following facts. Referring to the researches of His and Strave, he illustrates the results of artificially produced inflammation of the cornea. It is generally believed that under these circumstances the stellate corneal corpuscles increase in size and develop either by splitting of the nuclei and cell-substance, or by the production of young elements from within, which are pus-cells.

More careful examination shows that the new cellular elements are not only pus; on the contrary, it can be seen that the ordinary corpuscles of the cornea are present in exactly their ordinary distribution. The pus-cells exhibit a great variety of shapes, corresponding with their natural contractility. At a

later stage the stellate corpuscles are also seen arranged in successive parallel layers, with the pus-cells irregularly dispersed among them. The curious fact, however, is observed, that the pus-corpuscles change their places; by reason of their contractility they *migrate*. The question now arises, whence are the pus-cells derived? They may either have come from the migrating lymphoid elements pre-existing in the cornea, or may have migrated from without. Putting aside for the moment the case of simple artificial traumatic keratitis, as to which Cohnheim arrives at results not materially different from those of earlier observers, we may refer to his special experiments upon irritation applied at the *centre* of the cornea. If this be touched with solid nitrate of silver so deeply as to destroy the epithelium, and the surplus nitrate washed away with a solution of common salt, the dead part, under the influence of light, will become brown, the rest of the cornea remaining transparent. After twenty or twenty-four hours, however, there is a narrow pale ring round the slough, and at a distance from it, separated by a broad piece of transparent tissue, we observe a cloudy, pale gray streak, while the centre remains unchanged. The external streak increases in size, both as to width parallel to the margin of the cornea, and especially towards the centre. On the third day the cloudiness has usually reached the slough from the upper margin in a wedge-shaped form, and somewhat later a similar wedge joins the centre from the lower border, while the inner and outer portions of the cornea may remain slightly or not at all affected. Later on, whilst the opacity around the slough becomes deeper, the periphery becomes constantly more clear; and on the fifth or sixth day there is only a milky or yellowish-white ring around the cauterized part, while the whole periphery is quite clear.

Microscopically examined, the tissues show the following appearances: At first the only important changes are in the gray marginal streak; there are numerous pus-corpuscles here, the greatest number being at the outer edge. Later, when the opacity concentrates round the centre, the pus-cells here also become extremely dense, while their number as much diminish at the margin of the cornea. The slough never contains pus-cells.

If the experiments be varied by setting up continuous irritation, as that of a thread drawn through the cornea and left, the opacity is continuous and the cornea swells, and even forms abscesses which may rupture. Cohnheim explains the fact that purulent infiltration always begins either at the upper or the lower border of the cornea by the fact that here the largest and most numerous bloodvessels approach the cornea. The above experiments were made on frogs, but very similar results were obtained in observations on rabbits, although the greater tendency to slough often interfered with the accuracy of observation.

These experiments made it very probable that the pus migrated into the cornea from without; and Cohnheim, in subsequent experiments, accordingly fed the animals with particles of insoluble coloring matter, hoping that these would render the pus-cells, which easily absorb such matters, very easily traceable in their course. In order to avoid fallacies, Cohnheim first experimentally proved that aniline blue introduced into the conjunctival sac, or injected into the anterior chamber, had no effect on the pus-cells of the inflamed cornea.

It now remained to be seen whether the lymphatics could be the channel of introduction. Aniline blue having been injected into a lymph-sac of the frog, the tissues show nowhere any pigment; but if we cause a keratitis, some of the pus-cells will contain blue granules. The number of cells thus stained depends pretty much on the quantity of colouring matter successfully introduced. These experiments still left it doubtful whether the pus-cells migrate directly from the lymphatic system, or by a more indirect road to the cornea, namely, by the bloodvessels.

It was already known, from the researches of Recklinghausen, that solid particles introduced into the lymph-sacs easily enter the bloodvessels; for the most part they were found in the interior of the white corpuscles. Cohnheim now experimented on direct injection of colouring matter into the blood with precisely the same results as those obtained by injection of the lymph-sac. No coloured granules are seen in the normal tissues, but if the cornea be ex-

cited its pus-cells will be seeu to obtain colouring matter. These experimcnts, so succcssful on the frog, fail in the rabbit, probably from deposition of the pigment in the liver.

The researches were now extended to a highly vascular tissue, the peritoneum of frogs which had been previously poisoned with curara so as to render them motionless, the effect being kept up by successive small injections. The inflammation was excited by exposure of the mcsentery to the air. Congestion is rapidly developed till a dense uniform redness is produced; in a few hours the whole looks cloudy, and the individual vessels become indistinct. In from fifteen to thirty-six hours the mesentery and intestine are covered with a soft layer of false membrane, which under the microscope is seen to consist entirely of densely crowded contractile pus-cells, with a very few red bubbles, all imbedded in a slightly granular material. The first step in the inflammation is a dilatation of the arteries, which seems to begin immediately on the applicatiou of atmospheric irritation, and in ten or fiftcen minutes may be very pronounced. It is uniform throughout; only here and there we may find a small spot where an artery is suddenly contracted, with an equally limited picce on the cardiac aspect of the samc which is unusually dilated. The next stagc, which follows more slowly, is that of venous dilatation. The final result, however, is that the veins and arteries regain their original proportion. At the same time the rapidity of the current begins to vacillate, and after about two hours a diminution of its speed is dcveloped. We can now easily recognize the outlines of individual corpusclcs. It can now be seen plainly enough that the white corpuscles tend towards the walls of the vessels; at the height of retardation they seem to stick there till the next wave carries them on. In the veins the outside zone of the current, the *original plasma-layer*, contains countless white blood-cells. Slowly, and sometimcs jerkingly, several of these enter the field, and soon come to rest at some point of the wall of the vessel, either permanently or only for a time. By degrees the whole peripheral zone of the vessel is filled with white corpuscles. Within this wall the central red column of blood flows on with uniform rapidity.

Very soon the eye is attracted by a remarkable occurrence. On the external outline of the vein there arise several small colourless button-shaped elevations. These excrescences slowly enlarge till a half globe, about as big as half a white blood-cell, seems to lie outside the vessel. Later this becomes pear-shaped, with a pedicle attached to the vessel. Fine processes and points now begin to radiate from the margin of this pear-shaped corpuscle, which frequently changes its shape; the corpuscles move gradually more away from the vessel till their connection is severed.

There is now a colourless, shining, contractile corpuscle, with one long and a few short processes, otherwise just like a white corpuscle, altogether outside the vessel. The whole process of extrusion may occupy more than two hours.

In three or four hours from the commencement of this process the vein is surrounded by a single but dense ring of the corpuscles; and a few hours later swarms of them extend on all sides, the inner row still adhering to the vessel by their pedicles, while the outermost shorten their pedicles, and get to look just like contractile blood- or pus-cells. The interior of the vessels remains unchanged.

While the arterics and veins dilate, the capillaries become more distinct, probably not from dilatation, but from greater repletion with blood-corpuscles. The current in them is uuchanged from the state of health, as to its direction, rapidity, and uniformity. As in the veins, there is often a stagnating layer: but this layer contains red corpuscles as well as white.

In these capillaries, in which the blood-current continues uniform, no change ensues; but whenever there is partial or complete stagnation we observe, in the first place, amœboid changes of form in the colourless cells, and, soon after, the same protrusion through the wall of the vessel as has been described in the case of the veins. But in the capillaries not only white, but also red cells escape through the walls. A singular element in the migration of the latter is the length of time during which they sometimes remain sticking *in transitu*. In

this position it sometimes happens that their inner half is torn off and carried away by the blood-current.

Nothing is more interesting than the demonstration which Cohnheim's experiments afford, that the whole business of cell-formation in inflammation of a serous membrane is performed by the migrating corpuscles, and that the epithelium-cells have nothing to do with it. If the latter perish at all it is only by being cast off.

Cohnheim followed the process of inflammation up to the point where the mesentery is filled with crowds of contractile cells, and also covered on both sides by a fibrinous layer filled with such cells.

Attempts were made to exhibit the same phenomena in mammalian animals; and although the experiment is less satisfactory, substantially the same facts were observed, as to the migration of cells, as in the researches on frogs. Cohnheim has no doubt that the experiments thus performed on the mesentery fairly represent the pathological processes in inflammations of other parts. He leaves it doubtful whether emigration of white cells be the only source of pus, but is disposed to deny that the corpuscles of a connective tissue ever produce pus-cells by division.—*Sydenham Soc. Biennial Retrospect*, 1869.

21. *Occurrence of two Specific Fevers at once.*—Some interesting cases are reported by MONTI (*Jahr. f. Kinderk.*, 1868), and by STEINER, of this kind of complication. Monti reports a case in which measles and scarlatina were combined. The family in which this occurred was composed of five children—three boys of the respective ages of ten years, eighteen months, and two months; and two girls of fourteen and six years. The two youngest boys and the younger girl had no connection with other children; the eldest boy and girl went to separate schools. In the boys' school there was a severe epidemic of measles. The boy appears to have caught the measles there. In the girls' school there was an epidemic of scarlet fever, and the eldest girl became affected with it in the middle of January. The child of eighteen months caught the measles from the elder brother, and just as this was vanishing she showed symptoms of scarlet fever. The girl of six years was exposed to both contagions, and on the 21st January she exhibited feverish symptoms, apparently combining both affections. The eyes and nose and the throat exhibited the characteristic symptoms of the two diseases. On the third day a scarlatina rash was well developed: on the following day this somewhat faded, but some crescentic spots of measles were visible. The two eruptions vanished about the fifth or sixth day, and the throat and nose symptoms then also disappeared. On the seventh day the first symptoms of desquamation appeared, and this was fully developed by the twelfth day. On the twentieth day the child was bathed, and pronounced well. Steiner reports a case of smallpox and measles. A girl of six years was taken ill with rigors, feverishness, and vomiting, which increased during three days; on the fourth day the characteristic smallpox eruption appeared. Two days later, the fever still continuing, it was noted that the eyes were congested, and there was dry cough, &c. Next day there was profuse catarrh; the cough was worse. The breathing was quick, the pulse and temperature higher, and certain dark red spots like measles appeared. The following day the latter were more clear. On the next day to this the smallpox eruption had much subsided—that of measles was highly developed. The temperature went on diminishing on the night of the tenth day. There was a gentle sweat. The pulse had fallen next day to 96. The patient was dismissed, fully cured, on the twenty-second day.

Steiner also reports a case of measles and scarlatina. A child of five years old, scrofulous, was attacked with catarrh, and fever and cough. Four days later the eruption of measles appeared. Inspection of the mouth and pharynx showed small, scattered, round, and very red spots on the palate. On the fifth and sixth days, the eruption still increasing, the child vomited repeatedly, and the temperature and pulse rose. The fauces were now much swollen and dark red, with a yellowish-gray secretion covering them. Besides the original eruption, the neck and back, and certain parts of the extremities, showed a uniform diffuse scarlatina rash. On the eighth day, the measles eruption being some-