

# **Absorption, Ulceration, and Cellular Processes in Organic Systems**

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The phenomena of absorption and ulceration in organic systems involve intricate cellular processes that are fundamental to growth, maintenance, and pathology. John Goodsir's work on these topics provides a detailed examination of the cellular mechanisms underlying these processes. Goodsir highlighted the role of cells in selecting and processing nutrients, their variable lifespans, and their involvement in pathological states like ulceration. This compilation aims to explore Goodsir's insights into cellular absorption, the dynamics of ulceration, and the structural components involved in these processes.

## **Cellular Absorption**

Goodsir asserted that every organic cell, whether part of a simple or complex organism, engages in the absorption of materials necessary for its growth. This process is fundamental and precedes all other cellular activities. Different cell types possess unique abilities to select and transform nutrients from their environment, akin to how different species of organisms select and process food. This selective absorption enables cells to grow and function according to their specific roles within the organism.

Goodsir drew an analogy between cells and organisms, suggesting that just as different species have distinct diets and nutritional requirements, so too do different cell types within an organism. This comparison underscores the specificity and complexity of cellular nutrition, highlighting the cells' ability to not only select but also chemically modify the absorbed materials to suit their needs.

## **Lifespan and Variability of Cells**

A critical aspect of cellular biology discussed by Goodsir is the variable lifespan of cells. Each cell type has an average term of existence, influenced by factors such as nervous activity, constitutional peculiarities, irritability, and pathological conditions. This variability in lifespan affects how cells function and respond to their environment, impacting overall tissue health and disease progression.

Goodsir pointed out that understanding the duration of cellular life and the factors that influence it can provide insights into numerous organic phenomena. Just as different species of animals and plants have varying lifespans, so do different cell types, and this variability must be accounted for in studies of cellular function and pathology.

### **Role of Vessels in Absorption and Ulceration**

Traditionally, vessels such as capillaries and lymphatics have been viewed as active agents in absorption, nutrition, and secretion. Goodsir challenged this view by suggesting that non-vascular cellular components play a more active role in these processes. He proposed that while vessels are essential for transporting nutrients and waste products, the actual selection and processing of these materials occur at the cellular level.

Goodsir's observations indicated that cells, rather than vessels, are primarily responsible for the active processes of absorption and ulceration. This shift in perspective emphasises the importance of cellular activity over vascular function in maintaining tissue health and responding to injury or disease.

### **Cellular Mechanisms in Ulceration**

Ulceration, a pathological process characterised by the breakdown of tissues, involves complex cellular interactions. Goodsir described how a thin film of cellular material, analogous to the epidermis or epithelium, progressively replaces and dissolves the underlying textures. This cellular layer, endowed with unique properties, induces the dissolution of the subjacent tissues through new forces and cellular activity.

In rapidly extending ulcerations, the destruction of tissues appears mechanical, as if "scooped out by a sharp instrument." However, Goodsir explained that this is due to the dynamic activity of the cellular layer, which absorbs and replaces the tissues, rather than an active aggressive action by the vessels. This perspective highlights the regenerative and destructive capabilities of cells in response to various internal and external stimuli.

### **Ulceration in Bone and Soft Tissues**

The process of separating dead or dying bone from living tissue mirrors the ulcerative processes in soft tissues. Goodsir described how the Haversian canals in bones enlarge and fill with new cellular growth, leading to the separation of necrotic bone. This cellular

activity, similar to that observed in soft tissue ulceration, underscores the role of cells in both growth and decay.

In both bone and soft tissue ulceration, the formation of new cellular layers and the subsequent disappearance of old tissues illustrate the dynamic nature of cellular processes. Goodsir's observations suggest that the apparent aggressive power of absorption attributed to vessels is actually a manifestation of cellular growth and activity.

The following is Goodsir's work viz.

#### “Absorption, Ulceration, And The Structure Engaged In These Processes

Every organic cell, the most simple as well as the most complicated, when a separate organism, or when a part of a more highly organised being, existing as a mere magazine of matter, or performing some of the more striking of the vital functions, invariably exhibits a phenomenon which is antecedent to all others absorption from without of materials for its own growth.

The various kinds of cells in any organism differ from one another in this respect, that they have the power, each after its kind, of selecting and procuring from the circulating medium, or from other sources, the sort of matter necessary for their own growth: or they have the power of elaborating, or of conducting to the chemical change of the matter which is absorbed by them. In this respect, the component cells of animals and vegetables resemble the various species of beings of which they form parts: they have not only the power of selecting food, but the various species out of the same kind of food are formed of matter and of parts which are specifically different.

A most important circumstance in the history of cellular phenomena is the duration of existence of a cell. Like the various species of animals and vegetables, each species of cell has its own average term of existence, each after its kind. This average term is nevertheless contingent on the amount of action which each species may, by peculiar circumstances in the organism to which it belongs, be called on to perform. This variableness in the average age of each species of cell, is dependent on those circumstances which have been named 'nervous agency,' 'peculiarity of constitution,' 'irritability of the parts,' 'morbid action,' but may be studied independently of these agencies. The variableness in the term of existence of cells can no more be explained at present, than the variety in the duration of the lives of species of

animals and vegetables: but the fact being known, its laws ascertained will afford a clue to the explanation of many organic phenomena and processes.

In the study of absorption, nutrition, and secretion, attention has been directed to the vessels, as the active agents in the performance of these processes. It is only a short time since we have been willing to admit that the new matter which is constantly replacing the old materials of the frame, is selected and laid down, not by the ultimate vessels, but by the non-vascular portions of the textures. It is only now that we are beginning to know that secretion differs from nutrition in its anatomical relations, and not in its intimate nature. We still, however, retain in full force the old belief in the active absorbent powers of the vessels, and in the agency of the capillary and lymphatic vessels in removing parts and modelling the forms.

It is not my intention to question entirely the active agency of the veins and lymphatics in absorption and ulceration, but merely to direct attention to the subject; and to point out, in some of the following chapters, a few organic processes in which these actions appear to be functions independent of the vessels, the latter to be passive agents, mere ducts for conveying away the products of action.

A rapidly-extending ulcerated surface appears as if the textures were scooped out by a sharp instrument. The textures are separated from the external medium by a thin film. This film is cellular in its constitution, and so far it is analogous to the epidermis or epithelium. It is a peculiarly endowed cellular layer, which takes up progressively the place of the subjacent textures these being prepared for dissolution, either by the state of the system, the condition of the part, or by some influence induced by the contiguity of the new formation. Carrying out, therefore, the principles at present regarded as regulating the reciprocal functions of textures and vessels, the subjacent textures disappear in consequence of a disturbance of their own forces, consequent upon the appearance of new forces residing in the cellular layer. The disturbance and gradual annihilation of the natural forces residing in the subjacent textures, is indicated by the gradual disappearance of these. That new forces, not formerly existing in the part, are developed, appears from the formation of the cells of the cellular layer. As these appear in rapid succession, and disappear as rapidly, the subjacent textures also disappear, either by previous solution and subsequent absorption by the properties and powers of the former; or under the peculiar circumstances of inflammatory action by the more vigorous growth of the former, monopolising the resources of the part, the latter dissolving and

disappearing by the usual channels of the returning circulation, more rapidly, but according to ordinary laws.

From this view of the process, it appears that, so far from consisting in a diminution of the formative powers of the part, such a progressive ulceration is actually an increase of it. The apparent diminution is a consequence of the extremely limited duration of existence of the cells of the absorbent layer, which die as rapidly as they are formed, disappearing after dissolution, partly as a discharge from the surface, but principally through the natural channels by which the debris of parts, which have already performed their allotted functions are taken up into the organism.

When a portion of dead or dying bone is about to be separated from the living, the process which occurs is essentially the same as that which has now been described. The Haversian canals, which immediately bound the dead or dying bone, are enlarged contemporaneously with the filling of their cavities with a cellular growth. As this proceeds, contiguous canals are thrown into one another. At last, the dead or dying bone is connected to the living by the cellular mass alone. It is now loose, and has become so in consequence of the cellular layer which surrounds it presenting a free surface and throwing off pus.

In this process the veins and absorbents act on the osseous texture of the walls of the Haversian canals in no otherwise than in the natural state of the part. They are mediate, not immediate, instruments of absorption. It is the cells of the newly-formed cellular mass, contained in the Haversian canals, which are the immediate cause of the removal of the bone, either by taking it up as nourishment, and substituting themselves in its stead the bone being prepared for this absorption in a manner analogous to that which occurs in the digestion of food previously to absorption of it by the cells of the gut;<sup>1</sup> or by the active formation of the cells of the new substance monopolising the resources of the part, and so inducing the disappearance of the osseous texture by the natural channels of the returning circulation.

The process by which a slough in the soft parts is separated from the living textures is similar to that which occurs in bone.

In this view of ulceration, there is substituted for the hypothetical active or aggressive power of absorption ascribed to the veins and the lymphatics, a power which is known to exist in the organic cell during the progress of its growth; and the ultimate removal of the matter from the scene of action is ascribed, partly to the formation of discharge, partly to the yet unexplained,

but at the same time undoubted, and in all probability passive, agency of the returning circulation.”<sup>2</sup>

### **Conclusion**

John Goodsir’s exploration of absorption, ulceration, and the cellular structures involved in these processes offered profound insights into the fundamental mechanisms of organic life. By emphasising the active role of cells in nutrient selection, growth, and tissue breakdown, Goodsir challenged traditional views that prioritise vascular activity. His work underscored the importance of understanding cellular dynamics in both health and disease, paving the way for future research in cellular biology and pathology. The intricate processes described by Goodsir highlight the remarkable capabilities of cells to adapt, regenerate, and respond to their environment, providing a deeper understanding of the vital functions that sustain life.

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<sup>1</sup> “Hence, the digestive process, instead of being confined to the stomach and duodenum, is actually carried on without intermission, in all parts of a living animal body.” Prout’s *Bridgewater Treatise*, page 534.

<sup>2</sup> Turner, William (ed.) and Lonsdale, Henry (contrib.). *The Anatomical Memoirs Of John Goodsir F.R.S. Late Professor Of Anatomy In The University Of Edinburgh, Volume II* (Edinburgh: Adam and Charles Black, 1868): 403-407.