LETTERS TO THE EDITOR

Comments on
“Calcium Depletion in Rabbit Myocardium. Ultrastructure of the Sarcolemma and Correlation with the Calcium Paradox” which appeared in Circ. Res. 51: 117-130, 1982

I am referring to the recent article by Frank et al. (1982), cited above, and should like to comment on the terms “glycocalyx” and “sarcolemma” as they are used in that article and in other communications of the group of Frank, Langer, and collaborators.

Glycocalyx

In the paper by Frank et al. (1982), “glycocalyx” is applied rather inconsistently. In some instances, the authors use the term according to the definition given by Langer (1978), i.e., glycocalyx = complex of the lamina externa + the coat of cell surface glycoconjugates. In other instances, the application of the term differs from Langer’s definition: in several figures (Figs. 1; 3, a and b; 5a), a structure clearly being only the lamina externa is labeled “glycocalyx.” This may mislead a reader who does not make the effort to go back to the origin of this term, and it erroneously suggests that glycocalyx and external lamina are two names for the same structural entity.

Quite apart from the inconsistent application of the term in the paper of Frank et al. (1982), I believe that the definition of “glycocalyx” as suggested and propagated by Langer (1978) and his collaborators is very unfortunate and may create terminological confusion. Langer (1978), in giving his definition, refers to a lecture of Bennett (1963) who originally coined the purely descriptive term “glycocalyx” which, by that time, comprised all sorts of carbohydrate-containing materials seen on the outer aspect of animal cells, including the basal lamina and external lamina. In subsequent years, this covering material was characterized in detail, and it is now clear that the basal (or external) lamina (Kefalides et al., 1979) and the coat of cell surface glycoconjugates (Glick and Flowers, 1978; Olden et al., 1982) are entirely different, structurally, biochemically, and functionally. The term “glycocalyx” gradually became confined to the plasmalemma-integrated coat of glycoconjugates (Bloom and Fawcett, 1975; Pigman, 1977), and all morphologists, biochemists, and cell biologists would use and understand this term in its confined sense. The misleading and nonjustified character of the term “glycocalyx” in its original sense (Bennett 1963) has been explained very clearly by Martinez-Palomo (1970) and by Cook and Stoddart (1973). All the more so, it is not plausible why the term in its old-fashioned sense was brought up again in 1978.

Sarcolemma

From the summary of the paper of Frank et al. (1982), one can deduce that “sarcolemma” is understood here as the complex of plasma membrane, glycoprotein surface coat of plasma membrane, and the external lamina. This application of the term is at variance (1) with the more modern definition of sarcolemma = plasmalemma (Bloom and Fawcett, 1975); and (2) with the very old light microscopic definition of “sarcolemma” of the skeletal muscle as understood by myopathologists, i.e., complex of plasmalemma + external lamina + outer network of thin collagen fibrils (Mauro and Adams, 1961; Sanes et al., 1978).

My comments may appear as a fight about terms, rather than about facts. As long as everybody has the same understanding of the term, nomenclature is secondary. As soon as morphologists and cell biologists (thinking of the more modern sense of “glycocalyx”) and cardiologists (using the term in Langer’s sense) meet without realizing that they use the same term for two different entities, confusion will arise. As to “sarcolemma,” terminological confusion is already there and should not be increased further by again another definition.

In conclusion, I would suggest (1) that the term “glycocalyx” be used exclusively according to the definition of Bloom and Fawcett (1975) and Pigman (1977), since, in this sense, it is understood by all morphologists, biochemists, and cell biologists; (2) to re-name Langer’s glycocalyx to “surface coat-external lamina complex,” as it was originally called by Langer and coworkers (Frank et al. 1977); (3) to reserve “sarcolemma” for the use in light microscopic myopathology, although one has to be aware that “sarcolemma” as synonym for “plasmalemma” will be impossible to eliminate from the literature.

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Reply to the Preceding Letter

In response to your concern over nomenclature, I
think we will all agree that terminology should not
perpetuate confusion.

1. The term “glycocalyx,” as we use it, was first
defined in 1976 in a chapter entitled, “The Myocar-
In International Reviews of Physiology, Vol. 9. Here
we state, “glycocalyx will include (1) glycoprotein,
glycolipid cell coat and (2) the external lamina or
carbohydrate coating just superficial to cell coat.”
Your suggestion to call these layers only surface coat-
external lamina complex—the second and most recent
addition lies on the internal aspect of the plasma
membrane, the specialized layer of fibrillar material
that influences the overall properties of the boundary
between the cytoplasm and the exterior.

I feel it is really a minor semantic point whether
these specialized layers internal or external to the unit
membrane are included in the definition of sarco-
lemma. But what is important is the growing aware-
ness by those concerned with structure-function re-
lationships that these layers must be considered as part
of the “greater” membrane in terms of their influence
on the function of the unit bilayer.

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