NEWS AND VIEWS

CONDENSATION OF THE FIRST TWO REPORTS OF THE COMMITTEE
FOR CLARIFICATION OF THE NOMENCLATURE OF CELLS AND
DISEASES OF THE BLOOD AND BLOOD-FORMING ORGANS*

THE TERMS AND DEFINITIONS FOR THE CELLS OF THE LEUKOCYTIC, THROMBOCYTIC
AND ERYTHROCYTIC SERIES

Clarification and definition of terms is urgently needed for the sake of a common
understanding in clinical usage and in teaching of medical students and technicians.
The choice of a preferred term, it was agreed, should not be based merely on
historical priority or common usage but, in general, should represent the simplest,
clearest and most descriptive term. Eponyms and new terms should be avoided,
wherever possible, without sacrifice of clarity. An effort should be made to attain
consistency between related terms.

The various series of cells were considered. It was recommended that in table 1
the term listed at the left replace all terms listed at the right in referring to cells of a
particular series or to a disease affecting any cell of that series.

No changes were suggested in the criteria in current use for determining the
series to which a cell belongs. It is hoped, however, that the advances now being
made in histochemistry will contribute more clearcut criteria than are available at
present.

It is recommended that the term leukocyte be considered synonymous with white blood corpuscle and
include all white cells of the blood and their precursors in the blood-forming organs. Its use should not be
limited to cells of the granulocytic series, excluding cells of the lymphocytic, monocytic or plasmacytic
series. This and other words derived from the same root should be spelled with a k and not a c, e.g.,
leukocyte, leukemia, not leucocyte or leucmia.

It is recommended that the descriptive terms for granules, neutrophil, eosinophil, basophil, and azurophil
be spelled as indicated without a final e.

It is suggested that the name of the most undifferentiated of the cells of each series carry the suffix
-blast, the second stage the prefix pro- and, except in the granulocytic series, all cells that are more mature
than the -blast stage have names with the suffix -cyte. The name for the fourth stage in the granulocytic
and erythrocytic series is to have the prefix meta-. The terms blast cells and pro cells may be used to replace
other terms for these stages of development when speaking of the stage of development as a whole or
when the series to which the cells belong has not been identified.

It is recognized that the blast cells of each series are morphologically very similar, all having fine
nuclear chromatin structure, usually demonstrable nucleoli, and basophilic cytoplasm, with or without
azurophilic granules, so the prefix to be used will, in many instances, depend on the identification of the
pro-stage associated with them.

Fine chromatin structure is defined as having the nuclear appearance of a background of homogeneous
lighter-staining parachromatin, overlaid by a darker-staining lace-net meshwork or finely stippled pat-

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Company.

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Portland, Oregon.
tern of basichromatin, with no aggregation of the basichromatin into even a single clump of appreciable size staining darker than any other areas in the nucleus.

A nucleus is defined as a homogeneous blue-staining area within the nucleus of a cell, which stains more like the cytoplasm than does any other part of the nucleus.

The term azurophil should be applied to the granules seen typically in the cytoplasm of cells of the lymphocytic and monocytic series and the progranulocyte stage of the granulocytic series. The term azurophil is recommended, and not azure, in describing these granules, since the term refers to an affinity for a particular dye and not to the color of the granules. These granules may be present or absent in any cell of the lymphocytic series and when present are usually coarse and in clumps. They are usually present in all cells of the monocytic series, including the monoblast. In the monocytic series they are usually fine, diffusely and uniformly scattered through the cytoplasm. If not seen in the monocyte or promonocyte, it usually indicates a faulty stain or poor visual definition in the microscope. These granules may be present or absent in any cell of the granulocytic series. They are rarely seen beyond the myelocyte stage except in disease. They are occasionally present in the cytoplasm of cells of the plasmacytic and erythrocytic series, and constantly present in the cells beyond the blast stage in the thrombocytic series where they tend to be fine and few in the early stages and numerous and often clumped in the more mature stages.

<table>
<thead>
<tr>
<th>Term to be used</th>
<th>Terms to be avoided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lymphocytic</td>
<td>Lymphoid, lymphatic, lymphogenous, lymphocyte, mononuclear</td>
</tr>
<tr>
<td>Granulocytic</td>
<td>Myeloid, myelogenous, myelocyte, myelocytic, granulocyte, leucoyte, leukocytic, leucocyte, leucocytic</td>
</tr>
<tr>
<td>Monocytic</td>
<td>Monocytoid, monocytogenous, mononuclear, monocyte</td>
</tr>
<tr>
<td>Plasmacytic</td>
<td>Plasma cellular, plasmacytogenous, myeloma cell, plasmacyte</td>
</tr>
<tr>
<td>Thrombocytic</td>
<td>Megakaryocytic, platelet, thrombocyte</td>
</tr>
<tr>
<td>Erythrocytic</td>
<td>Erythroid, erythrocytoid, erythrocyte, erythrocytogenous, erythrocyte</td>
</tr>
</tbody>
</table>

It is recognized that in each cell series there is a continuous development from the most undifferentiated to the most differentiated stage, that an infinite number of subdivisions are possible, and that any subdivision is arbitrary. The committee recommended the use of the minimum number of subdivisions which will provide essential information for diagnostic and prognostic purposes and defined the lines of division between these stages as clearly as possible, basing these divisions on a single easily identifiable feature. As far as possible, the feature selected to differentiate the different stages of development is one which could be recognized in either stained or supravital preparations, but it is realized that at present the majority of such decisions will be based on smears stained with Wright's stain or with one of the other Romanowsky stains. Even with these definitions, cells will be encountered where decision is difficult, in which case it is suggested that the cell be arbitrarily placed in the more differentiated category.

Names were selected for each of the cells, which were acceptable to all members present and which, in the opinion of the committee, were least likely to be confusing.

The recommended terms and the terms to be avoided are listed in table 2.

It is not the intention of the committee to imply from its recommendation of terms to be used that the origin of all these cells has been settled.

It is recognized that to ensure flexibility and for certain specialized purposes finer
<table>
<thead>
<tr>
<th>Name of series</th>
<th>Term to be used</th>
<th>Terms to be avoided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lymphocytic</td>
<td>Lymphoblast</td>
<td>Myeloblast, hemocytoblast, lymphoidocyte, stem cell, lymphocyte</td>
</tr>
<tr>
<td></td>
<td>Prolymphocyte</td>
<td>Large lymphocyte, pathologic large lymphocyte, atypical leukocytoic lymphocyte, monocyte, immature lymphocyte</td>
</tr>
<tr>
<td></td>
<td>Lymphocyte</td>
<td>Small, medium or large lymphocyte, normal lymphocyte, small, medium or large mononuclear</td>
</tr>
<tr>
<td>Monocytic</td>
<td>Monoblast</td>
<td>Myeloblast, hemocytoblast, lymphoidocyte, lymphocyte, stem cell, immature monocyte</td>
</tr>
<tr>
<td></td>
<td>Promonocyte</td>
<td>Premonocyte, hemohistioblast, immature monocyte, Ferrata cell</td>
</tr>
<tr>
<td></td>
<td>Monocyte</td>
<td>Large mononuclear, transitional, plasmacytoid, endothelial leukocyte, histiocyte, resting wandering cell</td>
</tr>
<tr>
<td>Granulocytic</td>
<td>Myeloblast</td>
<td>Granuloblast, hemocytoblast, lymphoidocyte, lymphocyte, stem cell</td>
</tr>
<tr>
<td></td>
<td>Progranulocyte</td>
<td>Promyelocyte II, leukoblast, myeloblast, premyelocyte, promyelocyte, progranulocyte A</td>
</tr>
<tr>
<td></td>
<td>Myelocyte</td>
<td>Granulocyte, myelocyte B, non-filament, class I</td>
</tr>
<tr>
<td></td>
<td>Metamyelocyte</td>
<td>Metagranulocyte, juvenile, myelocyte C, non-filament, class I</td>
</tr>
<tr>
<td></td>
<td>Band Cell</td>
<td>Staff cell, stab cell, non-filament, class I, rod nucleus, polymorphonuclear, stabkernige, rhabdocyte, non-segmented</td>
</tr>
<tr>
<td></td>
<td>Segmented</td>
<td>Polymorphonuclear, filamented, class II, III, IV, or V, lobocyte</td>
</tr>
<tr>
<td>Plasmacytic</td>
<td>Plasmablast</td>
<td>Myeloblast, hemocytoblast, lymphoidocyte, lymphocyte, stem cell, lymphoblastic plasma cell, myeloma cell</td>
</tr>
<tr>
<td></td>
<td>Proplasmocyte</td>
<td>Türk cell, Türk irritation form, lymphoblastic or myeloblastic plasma cell, myeloma cell</td>
</tr>
<tr>
<td></td>
<td>Plasmacyte</td>
<td>Plasma cell, Unna's plasma cell, Marschak's plasma cell, plasmacytoid lymphocyte, myeloma cell</td>
</tr>
<tr>
<td>Thrombocytic</td>
<td>Megakaryoblast</td>
<td>Megalokaryoblast</td>
</tr>
<tr>
<td></td>
<td>Promegakaryocyte</td>
<td>Premegalokaryocyte</td>
</tr>
<tr>
<td></td>
<td>Megakaryocyte</td>
<td>Megalokaryocyte</td>
</tr>
<tr>
<td></td>
<td>Thrombocyte</td>
<td>Platelet, thromboplastic</td>
</tr>
<tr>
<td></td>
<td>Disintegrated cell</td>
<td>Senile cell, smudge, basket cell, smear cell, degenerated cell</td>
</tr>
</tbody>
</table>
subdivisions may be necessary than those herein recommended. It is suggested that in such case no change be made in the term or definition of the recommended major subdivisions but that *clearly defined* qualifying adjectives be used for these further subdivisions. Should new knowledge indicate that another major cell division is needed the evidence for this need, together with the suggested term, should be submitted for consideration by a permanent body which it is hoped will develop out of this committee.

The definitions decided on are as follows:

**Lymphoblast:** Any cell of the lymphocytic series having fine chromatin structure in the nucleus. Cells of blast morphology associated with prolymphocytes should be tentatively classified as lymphoblasts.

**Prolymphocyte:** Any cell of the lymphocytic series intermediate in morphology between the lymphoblast and the lymphocyte. It will always have too coarse a chromatin structure to fit the criteria for a blast and too fine a chromatin structure or too large a cell diameter to be classed as a lymphocyte. Usually, but not always, prolymphocytes are larger than 15 microns in diameter, which is the upper limit for the lymphocyte.

**Lymphocyte:** Any cell of the lymphocytic series having the morphology of those commonly found in the blood of healthy adults.

**Monoblast:** Any cell of the monocytic series having fine chromatin structure. Usually nucleoli are visible. Cells of blast morphology found in association with promonocytes should be tentatively classed as monoblasts.

**Promonocyte:** Any cell intermediate in morphology between the monoblast and the monocyte. It is differentiated from the monoblast by having an irregularly shaped nucleus and somewhat coarser chromatin structure, and from the monocyte by the presence of one or more nucleoli.

**Monocyte:** Any cell of the monocytic series having the morphology of those commonly found in the blood of healthy adults. It is differentiated from the promonocyte by the absence of nucleoli.

**Myeloblast:** Any cell of the granulocytic series having fine chromatin structure and containing no specific granules. Usually nucleoli are visible. Cells of blast morphology found in association with progranulocytes should tentatively be classed as myeloblasts.

**Progranulocyte:** Any cell of the granulocytic series which has a nuclear structure too coarse for that of a blast cell and which has not yet developed discernible, specific granules. This term was selected rather than “promyelocyte” because of its clear relationship to the definition of granulocyte, given below, and because the term “promyelocyte” has been in wide use for cells which do contain specific granules. The reason that the terms “granuloblast,” “granulocyte,” and “metagranulocyte” were not chosen was that the terms “myeloblast” and “myelocyte” were already in general use with essentially the definitions here given. This is true also for the term “granulocyte,” which would otherwise have to be synonymous with the term “myelocyte.”

**Specific granules:** Neutrophilic, eosinophilic or basophilic granules. This term does not include azurophilic granules.

**Granulocyte:** An inclusive term to apply to any cell containing specific granules. The plural form *granulocytes* would therefore include all myelocytes, metamyelocytes, band cells and segmented cells whether neutrophils, eosinophils, or basophils.

**Myelocyte:** Any cell containing specific granules, with a round or oval nucleus. It is distinguished from the progranulocyte by the presence of specific granules and from the metamyelocyte by the absence of indentation in the nucleus. It may be further subdivided, at the option of the user into early and late stages, but the definition of early or late should be clearly stated in any publication.

This and all subsequent cells of the granulocytic series should be additionally characterized as neutrophil, eosinophil or basophil.

**Metamyelocyte:** Any cell of the granulocytic series having specific granules in the cytoplasm and a nucleus intermediate in shape between that of the myelocyte and the band cell. The nucleus usually has an indented oval shape, resembling a bean or kidney.
Band cell: Any cell of the granulocytic series which has a nucleus that could be described as a curved or coiled band, no matter how marked the indentation, if it does not completely segment the nucleus into lobes connected by a filament. It is differentiated from the metamyelocyte by an appreciable length of the nucleus having parallel sides, and from the segmented neutrophil by having no indentation which could be described as a filament.

Segmented cell: Any cell containing specific granules in which the lobes of the nucleus are connected by a filament. A filament is defined as a threadlike structure. Since at times, in viewing a three-dimensional object from one direction, it is impossible to be certain whether two parts of the nucleus are connected by a filament or band, it is suggested that such cells always be placed in the segmented category, since this is the more differentiated and more common cell.

The term toxic neutrophils, followed by 1 to 4+ designation, is recommended for the grading of toxic granules, basophilia of the cytoplasm, vacuoles and condensation of nuclear chromatin in the neutrophils, since its meaning is clear, although it is recognized that it is not an adequately descriptive term. The grading should depend more on the degree of change than on the percentage of the cells involved and should be recorded in the report whenever the degree of change exceeds 2+.

Plasmablast: Any cell of the plasmacytic series having fine chromatin structure in the nucleus. Cells of blast morphology found in association with proplasmacytes are usually seen only in plasmacytic leukemia or plasmacytic sarcoma. The cytoplasm tends to be more opaque in staining than in the other leukocytic blast cells.

Proplasmacyte: Any cell of the plasmacytic series with a nuclear structure too coarse for that of a blast cell but with one or more nucleoli present.

Plasmacyte: A cell characterized by extremely coarse chromatin structure, with the deeply staining chromatin of the nucleus aggregated into large, sharply demarcated clumps. It is differentiated from the proplasmacyte by the absence of nucleoli. The cytoplasm of all cells of the plasmacytic series tends to be deeply basophilic and opaque in appearance. Azurophilic granules may be present or absent, but are more commonly absent.

Megakaryoblast: Any cell of the thrombocytic series having a nucleus with fine chromatin structure. Usually these are larger than the other blast cells.

Promegakaryocyte: Any cell of the thrombocytic series with a nucleus containing nucleoli but having a chromatin structure too coarse for a blast cell. The nucleus is usually similar in shape to that of the megakaryocyte. Fine azurophilic granules are usually diffusely scattered through the cytoplasm.

Megakaryocyte: Any nucleated cell of the thrombocytic series in which nucleoli are not discernible. The azurophilic granules are often aggregated into clumps. Megakaryocytes and promegakaryocytes are typically much larger than other cells found in the marrow.

Thrombocyte: Any cell of the thrombocytic series containing no nucleus; in other words, any non-nucleated fragment of megakaryocytic cytoplasm containing azurophilic granules similar to those of the mature megakaryocyte.

The term thromboplastid was recognized as being anatomically correct, but it was felt that to be consistent with the use of the term erythrocyte and to permit the use of "thrombocytic" and "erythrocytic" in describing these cell series, the suffix "cyte" was preferable for these non-nucleated forms.

Disintegrated cell: Any cell of any series in which the cytoplasmic outline has been disrupted or the nuclear chromatin is no longer surrounded by a membrane, excluding the changes in the nucleus that occur in mitotic division. Disintegrated cells should be recorded as such in the differential report, even though they could be identified by dispersed granules. They should be counted even if only shreds of nuclear material are discernible, since they are undoubtedly included in the total leukocyte count.

It was the decision of the committee that none of the terms in current use for the nucleated cells of the erythrocytic series could be recommended because mutually exclusive definitions for the same term have been used in different schools of hematology; because these are all inconsistent with the terms already recommended by the committee for the other series of cells; and because the use of the suffix -blast for the most differentiated nucleated cell of the erythrocytic series has been a constant source of confusion to medical students and medical technologists, for in
all other series -blast has been used exclusively for the least differentiated cell. The logical terms erythroblast, proerythrocyte, erythrocyte and metaerythrocyte were impossible to use because of the wide employment of the terms erythroblast and erythrocyte with other meanings than would be intended for them in the present recommendations. After considering many suggestions and consulting Latin and Greek authorities, the Latin syllables rubri, meaning red, were selected as least likely to be misinterpreted because this stem is familiar in medical terminology, having been used in "polycythemia rubra vera" and in the derivation of many other words in which the root rub denotes red, such as "rubicund" and "rubefacient." Other stems considered were the Greek terms rodo, rose, rodino, rosy, eryth, red, porphyro, deep-red, pyrro, flame-colored, and cirrho, tawny-yellow, but these were discarded as likely to be more difficult to pronounce and learn.

Table 3. Recommended Terms and Terms to be Avoided when Referring to Specific Cells of the Erythrocytic Series

<table>
<thead>
<tr>
<th>Name of series</th>
<th>Term to be used</th>
<th>Terms to be avoided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erythrocytic</td>
<td>Rubriblast</td>
<td>Erythroblast, megaloblast, pronormoblast, promegaloblast, normoblast, hemocytoblast, stem cell, myeloblast, lymphoidocyte, karyoblast.</td>
</tr>
<tr>
<td>Prorubricyte</td>
<td>Erythroblast, megaloblast, pronormoblast, normoblast, macronormoblast macroblast, prokaryocyte</td>
<td></td>
</tr>
<tr>
<td>Rubricyte</td>
<td>Normoblast, pronormoblast, macronormoblast, erythroblast, polychromatophilic normoblast, karyocyte</td>
<td></td>
</tr>
<tr>
<td>Metarubricyte</td>
<td>Normoblast, erythroblast, metakaryocyte</td>
<td></td>
</tr>
<tr>
<td>Reticulocyte*</td>
<td>Erythrocyte</td>
<td>Red blood cell, erythroblastic, normocyte, akaryocyte</td>
</tr>
</tbody>
</table>

* It is recommended that the reticulocyte stage be considered a subdivision of the erythrocyte stage.

The best solution that could be found for the problem of clearly indicating the changes in nuclear morphology commonly seen in cells of the erythrocytic and granulocytic series in pernicious anemia and other macrocytic anemias which respond to liver extract and folic acid was to coin a new adjective phrase which could be used to qualify the recommended terms for any of the cells of these two series, or to describe the marrow and blood pictures as a whole. The terms macrocytoid, macroid, megalo-, and megaloid were considered, but none was acceptable to the authorities consulted or to the majority of the members of the committee. The adjective phrase pernicious anemia type was recommended by the committee after extensive deliberation, to be used in full in any publication, although in the laboratory and clinic it can conveniently be abbreviated to P. A. The use of such an adjective phrase should be perfectly clear and it has the great advantage over megaloblastic that it can be applied to cells of the granulocytic as well as of the
erythrocytic series and also to the marrow and blood pictures. Eventually, if the anti-pernicious anemia principle is identified and given a short, simple name, a term analogous to afolic may be substituted by committee action for the presently recommended adjective phrase.

The names selected by the committee for the stages of differentiation are given in Table 3, and their definitions follow. It should be re-emphasized, as was pointed out in the first report,¹ that no changes are suggested or implied by these definitions for the criteria in current use for determining the series to which a cell belongs. The recommended definitions are meant to point out only the one essential differential characteristic for determining the stage of differentiation, and they are not intended to be complete descriptions of all cell stages, or of normal and pathologic variants. For these finer details of identification readers are referred to standard textbooks of hematology.

Rubriblast: Any cell of the erythrocytic series having fine chromatin structure in the nucleus. Nucleoli are usually discernible. A stippled chromatin pattern is more common than the lace-net pattern usually seen in other blast cells.

Prorubricyte: Any cell of the erythrocytic series in which one or more nucleoli are discernible in the nucleus and which has a chromatin structure too coarse to be classified as a rubriblast.

Rubricyte: Any cell of the erythrocytic series having definite structure of the nuclear chromatin, but containing no discernible nucleoli. This stage is differentiated from the prorubricyte by the absence of nucleoli in the nucleus and from the metarubricyte by not having a pyknotic, fragmented or partially extruded nucleus. Some may wish to subdivide and qualify this stage—or other stages—further into basophilic, polychromatic or normochromatic rubricytes, according to the amount of hemoglobin present in the cytoplasm.

Metarubricyte: Any nucleated cell of the erythrocytic series having a pyknotic, fragmented, partially extruded or partially autolyzed nucleus. Pyknotic describes a dense, solid, structureless nuclear mass. The phenomenon of karyorrhexis or fragmentation of nuclei should be clearly distinguished from the occurrence of double, well-formed nuclei which are occasionally seen in prorubricytes and rubricytes, as well as in other cells which may divide amitotically.

Reticulocyte: Any non-nucleated cell of the erythrocytic series in which, when supravitally stained—usually with brilliant cresyl blue—one or more granules or a diffuse network of fibrils are discernible. All reticulocytes are included under the term erythrocytes since, without a special stain, reticulocytes are indistinguishable from erythrocytes.

Erythrocyte: Any non-nucleated cell of the erythrocytic series.

Pernicious anemia type: The qualifying adjective phrase to be applied to any cell of the erythrocytic or granulocytic series, and to the marrow and blood pictures as a whole, to indicate the presence of the morphologic changes characteristically seen in pernicious anemia and other macrocytic anemias which respond to liver extract or folic acid therapy. In the nucleated cells of the erythrocytic series the major feature of this change is a relative increase in the pale-staining parachromatin with a corresponding decrease in the deep-staining basichromatin. In the cells of the granulocytic series the characteristic change is the presence of giant forms having very bizarre nuclei, and in the segmented neutrophils the occurrence of many cells with more than five lobes.

Each name recommended for the cells of the erythrocytic series clearly indicates the stage of differentiation. The use of the qualifying adjective phrase, pernicious anemia type, with the name of the cell stage will equally clearly indicate that a cell shows the alterations in morphology typically seen in the marrow or blood of untreated pernicious anemia, as contrasted with the corresponding cell which is unqualified as to terminology. Pre-existing confusion in the usage of terms for

¹ For personal use only.
nucleated erythrocytes is thought to be clarified by the recommended terminology as illustrated by the following example: *Megaloblast* as in current use by some hematologists is synonymous with *rubriblast*, as herein recommended and defined, but as used by other hematologists it is synonymous with the presently recommended term *pernicious anemia type prorubricyte*.

It is, of course, understood that modifying adjectives may be applied to any of the recommended terms in describing results of investigation, but if these terms are to gain general acceptance they should not be given any new definitions except by general action of the committee.

REFERENCES


INTERNATIONAL SOCIETY OF HEMATOLOGY

Through an unfortunate error in publication, the names of the two Secretaries-General were omitted from the list of officers elected at the Buffalo Congress of last August (*Blood* 3: 1313, 1948). The complete list of new officers is as follows:

**President:** Professor Sir Lionel Whitby, Cambridge, England

**Vice-Presidents:** For North America: William Dameshek, Boston, Mass.
For South America: Luis Sandoval S., Santiago, Chile
For Europe: G. DiGuglielmo, Naples, Italy

**Secretaries General:** Western Hemisphere: Sol Haberman, Dallas, Texas
Europe: Marcel Bessis, Paris, France

**Counsellors for the United States:** Charles A. Doan, Columbus, Ohio
Edwin E. Osgood, Portland, Ore.
Ernest Witebsky, Buffalo, N. Y.

A more complete report of the Congress, of which the November 1948 note was intended as preliminary, will be published in a future issue of *Blood* as soon as the large amount of wire-recorded material can be transcribed and edited. The publication of a volume of the Proceedings is presently being discussed.

Acting on suggestions made to the Editorial Board, the Journal is pleased to announce the following revision in subscription policy. Holders of Internships, Residentships and Fellowships within the United States may now obtain one or two year subscriptions to *Blood* at the reduced rate of $9 per year. Those wishing to take advantage of this offer should provide the publisher with their hospital addresses and positions.
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