The following study of calcite was occasioned by a prize-theme, "a critical investigation of the skalenohedrons occurring on calcite", which was set two years ago by the University of Bonn. Hessenberg had proposed the same problem to himself, and had collected notices of almost all known skalenhedrons. He had a series of cards printed, one for each form, arranged with appropriate spaces for the several angles and symbols. The filling out of these cards had been only partially completed when he was suddenly snatched away. His remarks on the occurrence of the forms did not go back beyond Zippe. There was nothing to indicate that he had especially studied either Levy on Hauy. The number of skalenohedrons of which he had notices was 129. There were five angles indicated for each of them, those of the three edges, and the inclinations of the apical edges to the vertical. It was proposed to calculate the angles to seconds. About one fourth of them had been calculated. There was no indication of any system of classification which had occurred to him.

At Hessenberg's death his family committed these cards into the hands of his friend Prof. G. vom Rath, as the person most fitted to carry out his work.

Prof. vom Rath was however prevented by other occupations from immediately doing so; and, on my announcing my intention of working on the prize-theme, he did me the honor of handing these cards over to me.
At first I had no thought of studying any forms except the skalenohedros. The tables and accompanying remarks relating to them were a year ago so far advanced that they could be submitted for the prize, which I was so fortunate as to obtain; and I now determined to extend the investigation so as to include the remaining forms of calcite.

The whole of the work was performed while I was in Bonn, a student of Prof. vom Rath's. As teacher and friend I have everything to thank him for, but it is justice to him, as well as to myself, to say, that I have worked quite independently of him. Those acquainted with his writings will at once perceive this.

The starting point of my investigation is the hypothesis of Hauy, modified by assuming as the molecule integrante the rhombohedron of $105^\circ 5'$ instead of that whose faces are equally inclined to base and prism. In adopting this hypothesis however I am perfectly in the dark as to what measure of defence or justification, is necessary, if any. I can call to my mind only two Germans works in which I find mention of Hauy. In the historical introduction to Quenstedts Mineralogy of course it could not have been omitted. Zippe in the introduction to his monograph on calcite (p. i) says "the German crystallograpers very soon forsook the method of Hauy. Indeed one might say it has never become properly habilitated in Germany". I should not omit to name Scharff who in pursuit of analogies between crystals and plants has come to regard Hauy somewhat as the demon of crystallography — not a demon of that scientific and useful kind which figures in the mechanical theory of heat.

The impression produced is that Hauy, like an inconvenient topic, is ignored. And yet it seems to me that all who fairly face the problem of the constitution of crystals must incline to the opinion, that he was in the main right. The theories of Bravais and Frankenheim are in no essential particular different from that of Hauy. If in their assemblages we consider the shape of that portion properly be-
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longing to each point we arrive at once at the *molecules integrantes*.

The constitution of the crystals being that described Millers system of axes is the only natural one. In selecting these for calcite, however, I do not mean to advocate the entire replacement of the hexagonal axes by them. As Bravais has shown, there is a rhombohedral and also a hexagonal system.

The method I have employed in investigating the development of the crystal is, so far as I know, new, though it may be that Sadebeck in his "Krystalltektonik" has treated crystals in an analogous manner.

In the tables I hope few errors will be found. I have taken great care both in calculating and in correcting the printer. The angles have been calculated to seconds but this is rather an over refinement; for we are not sure of the fundamental angle within a minute\. Many other details which might have been added to the tables have been omitted for fear of incumbering them. It might perhaps have been well to have added a separate table with the symbols of the forms according to Weiss and as they are given in the *Zeitschrift für Krystallographie*. But whoever regards the intercepts on Millers axes as expressing the constitution of the faces will have but little sympathy with these nomenclatures and would only add them in order to make the work more accessible to others. This I considered practically to have been attained by the use of Naumann's symbols. Weiss' intercepts may at a glance be changed to $m \, R \, n$, and there is no paper on calcite or book on mineralogy, in which the indices of the *Zeitschrift* have been used unaccompanied by other symbols. The symbols of Levy may at once be written from Miller's indices, $d^{1/4} \, d^{1/4} k^{1/4} =$

1) Where no previous calculation of an angle was at hand for comparison, it has been calculated twice. If my recalculation of Zippe's angles agreed with his to the minute (they are only carried so far), I have not repeated them.
(h k 1). $b^h_k = (h k o)$. $d^h_k = (h o ar{k})$. $a^h_k = (h k k)$. $e^h_k = (h k k)$.

The critical portions of the work have not always been pleasant especially where determinations of vom Rath and Hessenberg had to be called in question. The uniform and genial kindness which I have experienced from the former during my term of study in Bonn has bound me to him by the firmest ties. With Hessenberg I had not the honor of an acquaintance. He died before I came to Europe. But his signal achievements without teacher or early training, and his near relations to Prof. vom Rath, and also to myself, as the continuer of his work might well inspire me with the highest reverence for him. I am sure that Prof. vom Rath is, and that Hessenberg would have been, convinced that my one object has been to arrive at the truth.

My thanks for many kindnesses are due to Prof. C. Klein, now at Göttingen, formerly of Heidelberg, my first teacher in crystallography.

J. R. Mcd. IRBY.