In memory of Victor Klee

by Branko Grünbaum
University of Washington, Box 354350, Seattle, WA 98195
e-mail: grunbaum@math.washington.edu

My colleague Vic Klee passed away last summer. For several years he was in poor health, but nevertheless his death came as a shock to all that knew him.

Born in San Francisco in 1925, Victor L. Klee graduated (with high honors) from Pomona College in 1945. In 1949 he obtained his PhD from the University of Virginia, under the guidance of Edward McShane. He came to the University of Washington in 1953, and rose to full professorship in 1957. Except for several visiting appointments and fellowships in the US, Europe and Australia, he remained at the University of Washington till his 1998 retirement; since then he was Professor Emeritus.

Vic was a very prominent and productive mathematician, who contributed in very fundamental ways to a large number of mathematical fields — combinatorics, computational convexity, classically oriented convexity are just a few of them. It is beyond my capabilities to adequately honor his varied achievements; in fact, the two editors of a memorial article for Klee that is to appear in the Notices of the American Mathematical Society enlisted the help of eleven other mathematicians in presenting Vic's seminal contributions to about a dozen different topics, in mathematics and in its applications. For many of these, Klee's insights and results started rapid developments that continue to this day.

In my opinion, Klee's most important work deals with convex polytopes. He can with full justification be considered the originator of the modern combinatorial theory of convex polytopes. His contributions contrast to earlier directions (by

Minkowski, Weyl, and others) which dealt with the elementary set-theoretic aspects of convex polytopes, and to Coxeter's work predominantly concerned with regular polytopes. The vitality of the combinatorial theory of polytopes and related structures continues to this day, and does not seem to be nearing any stagnation.

Vic was known for the excellence of the courses he gave, and for his untiring dedication to his students – especially those in his advanced courses and his thesis students. Thirty four people received their PhD under his guidance, and a large number attained a master's degree. He worked tirelessly with his students. To the best of my recollection, every single one that started with him ended up earning his degree

For several decades Klee was the organizer of a geometry and combinatorics seminar, in which essentially anybody who is somebody in convexity or combinatorics was a speaker at some time. This included — during a memorable summer in 1970 — David Barnette who presenting his newly-found proof of the "lower-bound conjecture" for convex polytopes (which was open since the start of the twentieth century) and Peter McMullen presenting his equally new proof of the "upper-bound conjecture". Both results are still landmarks in the development of the combinatorial theory of polytopes.

On a more personal note, my first contact with Vic was in the mid-fifties. At that time we had independently published papers with similar results. This led to correspondence, and after the first exchange of letters the already famous professor suggested to me, still a student, to drop the "Professor". After the next exchange, he proposed replacing "Klee" by "Vic". This kind of friendliness was experienced by many, many people worldwide.

During the 1960/61 year, Vic arranged for a visiting appointment at the math department for me and for a young German mathematician, Ludwig Danzer. The same year Vic organized a symposium, the first ever devoted to the topic of

convexity; he also edited the publication of a volume entitled "Convexity" reporting the presentations on the symposium. As it happened, each of us three – Vic, Danzer, and I – wanted to write on the same topic, Helly's theorem. As editor of the volume, and being far senior to both Danzer and myself, Vic could have decided that his paper is the one that will appear. Instead, he proposed that we have a joint paper, and the situation was resolved in the most friendly manner possible. Danzer and I both contributed, but the major part of the work was done by Vic in such a thorough and engaging form that to this day – almost fifty years later – the paper is one of the most cited of our publications.

A similar situation developed in 1963, when H. G. Eggleston and I were visiting at the same time. Common interests and discussions led to another paper with three coauthors (a rarity at that time), again written largely by Vic.

Vic was very successful in presenting his ideas to large audiences. Besides the innumerable talks and lectures in the most varied forums, this led to another notable activity of Vic's: The *Unsolved Problems* column in the American Mathematical Monthly, which Vic started in 1969 and to which he contributed many items. This was an outgrowth of an earlier endeavor: Vic compiled in the early 1960's a collection of unsolved problems, meant to be part of a joint effort with Paul Erdös, Laszlo Fejes Toth and Hugo Hadwiger; however, this collaboration never materialized.

A few more personal memories. In summer of 1963 I had just arrived from Jerusalem to spend three months working with Vic. Vic picked me up at the airport and asked whether I would be willing to go for a few days with him and his family to the lodge at Paradise on Mt. Rainier. Naturally, I was more than ready. We spent many hours discussing mathematics while hiking and admiring the scenery, and in the evenings observing bears that came to the parking lot probably looking for food. On one such occasion Vic posed a question about realization of polytopes n the n-dimensional *rational* space; al-

though some results are known, many aspect of that question remain open even to this day.

Throughout the years, Vic was a most helpful colleague, always willing to substitute if the need arose, and to help in other ways. He also took good care of the many visitors who came to Seattle in order to work with him.

Vic has been more than a friend to me, helping me in many more ways than I can describe here. His ideas influenced much of my work, and his advice saved me from some unwise steps.

In 2003, the Mathematics Department celebrated the fifty-years long association of Vic Klee and of Ernie Michael with the department. It was a rather joyous occasion, and I was very happy to be able to tell about a recent discovery I had made: *Vic and I are relatives* — in the mathematical heritage – – in fact we are seventh cousins. We both had the "princeps mathematicorum" Carl Friedrich Gauss as our academic great-great-great-great-great-great-grandfather! Only later it occurred to me that this is not something very unique, since — according to the Mathematics Genealogy Project through which I gained this insight — Gauss had at that time 16,478 descendants. (By the way, these seem to be multiplying very rapidly, since now (November 2007) there are 38,735 of us, out of a total number 113676 of mathematicians listed in the Project.)

Vic passing left a great gap in the mathematics department, and in the wider mathematical community. But he will live in pleasant memory of all who were privileged to know him.