resources location needs indirect tools involving latest neo and nano technologies regime. This aspect warrants genesis of a new curriculum.

Those who had specialized in the sub-disciplines and traditional geologists have been at loggerheads. This is a setback to the professional earth exploration activity and academic R&D of inter- (sub) disciplinary approach, involving multi-dimensional parameters and poly-componential indicators. This situation had prompted me to suggest remedial measures for circumventing these lacunae, so that generalists and specialists of earth sciences could think collectively and work for the general good.

The medical education system is worth emulating for the betterment of the earth education system, in an endeavour to accomplish the envisaged cardinal objective of a much needed and value-added education. As such, parallelism is drawn.

The present optional subject of geology among three subjects in B Sc and M Sc degree programmes without professional orientation is to be replaced with a 4-year B Tech degree in earth sciences technology. In addition to the various sub-disciplines of geology (pure geology, geophysics, geochemistry, etc.), the course must include the essentials of technology courses like mathematics, physics, chemistry, engineering design and drawing, etc. This B.Tech degree would be the graduation course for earth science technology (just like a graduate medical degree in medical sciences), for further specializations at PG (M Tech) and Doctoral (Ph D) levels. Integrated graduate (and postgraduate) education leading to Ph D and admission into Ph D programmes directly after graduation should also be possible. The graduation programme should be enough for general practice of geology, like graduate medical doctors. Specializations and super-specializations will strengthen the system.

As of now, admission of geology graduates into M Sc (Tech) or M Tech in applied geology, mineral exploration or geophysics is in vogue in many Indian universities, ISM and IITs. This indicates that application of geological knowledge has inbuilt engineering and technological components. At M Tech level, specialized engineering skills consisting of integration of specific branches of engineering, for earth exploration and exploitation also need to be introduced. Academic, research and professional institutions should evolve as schools of research excellence of reputation in each super-specialization. Deemed university status should be accorded, wherever necessary.

In conclusion, while designing the curriculum, one has to take care of the industry need. Examinations should be oriented to solve a given field problem with the blend of academics and professionalism. The teaching should include interaction with experienced professionals from the industry, an important issue which is neglected. The contribution of the Indian mining and mineral-based industries is 'nil' for earth sciences education. This needs to be changed. Creation of interest in earth sciences technology education and field work with a good blend of professionalism and academics is the need of the hour, as almost all the surface manifestations for prospecting have been exhausted, thus warranting a new curriculum with modern technology regime to address this issue. There is acute shortage of good professionals and academicians in earth sciences. This situation needs immediate redressal to cope up with the ever-increasing natural resources demand. It is needless to state that suitable reorientation of the curriculum is an absolute, immediate necessity, followed by other rectification methods like suitable remuneration, attractive perks and family separation allowances for teachers and professionals, and attractive stipend for students and research scholars.

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Amazing events in SKR's life and the men behind them

I have read the obituary of S. K. Rangarajan (henceforth referred to as SKR, the name he was popularly known by), published in *Current Science*[1] with great interest. As stated there, SKR started his career as a film critic, changed a number of jobs, and finally evolved as a Distinguished Professor at the Indian Institute of Science (IISc), Bangalore and later at the Institute of Mathematical Sciences (Matscience), Chennai. There are many amazing facts in his life and works. With only a B A (Hons) degree in mathematics, he became an Assistant Professor in mathematics in an engineering college two years after his graduation. This is quite unusual and has few parallels, as all colleges prescribe a Master's degree as the minimum qualification for a teaching position. The principal of the college must have been more than a routine administrator in recognizing the potentials of SKR.

With only a Bachelor's degree, for SKR to actively pursue research in special functions and publish 17 papers is also unusual. This amply illustrates the kind of genius that he was. From special functions to developing a theory of faradic rectification in the domain of electrochemistry, and that too in a couple of days, is another amazing achievement. K. S. G. Doss, the then Director of the Central Electrochemical Research Institute (CECRI), Karaikudi, at whose request SKR solved this problem, was quick to recognize the talents of this man and was bold enough to offer him a scientist's position at his institute. Doss must have broken all rules of CSIR to offer a scientist's position in electrochemistry to a Bachelor's degree holder in mathematics, for which, again, a Master's degree in the relevant field must have been the minimum qualification. But SKR proved his worth by doing

excellent work in electrochemistry at CECRI, so much so that he was invited by the then USSR Academy of Sciences by none else than A. N. Franklin, a giant in the field of electrochemistry.

SKR's next job was at the National Aeronautical Laboratory (NAL), Bangalore, first as a Homi Bhabha Fellow and later as a scientist, apparently at a junior level. After spending five years at NAL, SKR got the biggest jump in his career, due to the talent-spotting capability of another giant – Satish Dhawan – the then Director of IISc, who personalized an outstanding mix of academics and administration. Dhawan wanted to appoint SKR as an 'Institute Professor', the highest level at the IISc, the only other person holding such a position being G. N. Ramachandran. However, the Council did not approve of this in view of his previous position as a junior scientist in a CSIR laboratory and his highest degree. However, Dhawan succeeded in offering SKR the position of 'Senior Professor' in the Department of Inorganic and Physical Chemistry. Did anyone else, with an Indian B A degree ever occupy the position of a Professor at IISc? Many other talents were spotted and inducted into the IISc by Dhawan, but SKR's case must have remained unique in its history. (Here I am reminded of Ashutosh Mukherjee who had spotted C. V. Raman, an MA degree holder, and invited him to the prestigious Palit Professorship in physics at the Calcutta University.)

For four years, SKR went on deputation to CECRI as Director. Is there any other example of a B A degree holder occupying the position of the Director of a CSIR laboratory? Yet another amazing event in SKR's life is the invitation by Matscience to join the same as a Senior Professor. Again, in the history of Matscience, is there another such instance? A versatile talent like that of SKR is indeed rare to find. Mathematics, electrochemistry, theoretical physics, mathematical modelling of engineering problems and English poetry were all close to his heart, and he made original contributions to each field.

It is gratifying to note that unlike many unsung heros, SKR got many recognitions and appreciation, including the Fellowship of all the national science academies during his lifetime.

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In memory of K. R. Rao, BARC and Editor, *Physics News*

I am deeply pained to learn about the sad demise of K. R. Rao (*Current Science*, 2008, **95**, 1507–1508). An outstanding scientist, Rao's scientific achievements were in the area of condensed matter physics. He carried out phase transition simulation studies as well as neutron scattering studies in metal oxides and other minerals at Bhabha Atomic Research Centre, Mumbai. He was also serving for Indian Physics Association as Editor, *Physics News*. I hardly knew him personally, but as a new entrant to DST system in 1980s, I have cherished his memories through a communication inviting me to contribute to *Physics News* about DST's programme on Thrust Areas in Physical Science. P. J. Lavakare, heading the SERC Division in DST, encouraged me to write as it was recognition to DST's contribution and a new direction in support for physics research based on DST policies.

Thereafter I worked in DST in different divisions. When in the Earth System Science, I was asked to coordinate country wide MONTBLEX-90 and other national programmes in atmospheric science during early 1990s. In the subsequent years, technology assessment and technology development projects became priorities for me. In the last few years I was constantly reminded of my first few days in DST, when we were told to learn about national science. Coming from a premier technology institute in the country and having adequate research publications in journals of international repute, I knew science is international and wondered how national science could be different from that. Evidently basic research is open ended and is international. Therefore, it is only the strategic, applied or industrially directed research, which is national. By the time I retired from DST, I became fully familiar with national science priorities. Often, these days I am reminded of the following quote from the late S. Ramaseshan:

'*Neither age, nor field of study,*
nor scientific position plays any role;
common interest brings people together.'

I do not know how good my first article in *Physics News* was in dissemination of information, but it marked a beginning for me to write on science–technology–policy interface, especially on topics related to environment and energy. I owe it to visionaries and committed scientists like Rao.

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