has for indefinitely increasing values of n, as limit ρ, tends multiplied by $(1 - x)^\lambda$, towards the limit $\rho\,\Gamma(\lambda + 1)$. This proposition, which follows immediately from the type theorem, gives for $\lambda = 0$ Abel's theorem; for $\lambda = 1$, the theorem of Frobenius ('Crelle,' 1878); and leads to consequences in regard to the integrals of linear differential equations with rational coefficients. The principal result of this chapter, is that the singularities of a function, defined by a power series $\Sigma c_n x^n$, can be found and their nature analysed by the examination only, for values of n tending towards ∞, of the sequence c_n and of other sequences derived from this one.

A new conception is introduced in the third chapter, that of an "asymptotical region." An asymptotical region encloses always a point $x = a$, of essential singularity, of a function $F(x)$ and consists of an ordinary region enclosing a with an infinity of co-holes in it, not enclosing a, but approaching it indefinitely. The object of the author is to throw some light on the manner in which a function behaves in the vicinity of a point of essential singularity. It is shown that if

$$F(x) = \Sigma \frac{b_n}{(x - c_n)} m_n,$$

a being ∞, and the m_n denoting finite integers, an asymptotical region can generally be constructed in which lim. $F(x) = 0$ if lim. $x = \infty$; and that this proposition is convertible. The new conception is applied to the theory of transcendental integral functions as founded by Weierstrass, Laguerre, Poincaré, &c. If $G(x)$ denotes a function of class zero, a certain asymptotical region will belong to G'/G in the above sense. If $H(x) = G(x) + c_1\, G'(x) + c_2\, G''(x) + \ldots\ldots$ where the c_i are any constants, such that the power series $\underset{(i\,=\,1,\,\ldots\ldots\,\infty)}{\Sigma\, c_i t^i}$ has a non-vanishing radius of convergence, $H(x)$ will again be a transcendental integral function of class zero; and the asymptotical region belonging to $H(x)$ will be the same as that belonging to $G(x)$.

"Further Note on the Influence of the Temperature of Liquid Air on Bacteria." By Allan Macfadyen, M.D., and S. Rowland, M.A. Communicated by Lord Lister, P.R.S. Received April 3,—Read April 5, 1900.

In a previous communication* it was shown that no appreciable influence was exerted upon the vital properties of bacteria when exposed for 20 hours to the temperature of liquid air ($-183°$ C. to

* 'Roy. Soc. Proc.,' February 1, 1900.

The Royal Society is collaborating with JSTOR to digitize, preserve, and extend access to
Proceedings of the Royal Society of London.
www.jstor.org

-192° C.). Further experiments have since been made in which the organisms were again exposed to the temperature of liquid air for a much longer period, viz., seven days.

The organisms employed were *B. typhosus*, *B. coli communis*, *B. diphtheriæ*, *B. proteus vulgaris*, *B. acidi lactici*, *B. anthracis* (sporing culture), *Spirillum choleræ asiaticæ*, *Staphylococcus pyogenes aureus*, *B. phosphorescens*, a Sarcina, a Saccharomyces, and unsterilised milk.

Instead of being exposed as formerly on the actual media in which they were growing, the organisms were submitted to the cooling process in the form of a broth emulsion in hermetically sealed fine quill tubing. This allows of complete immersion, and effects a considerable economy in the amount of liquid air used, besides greatly facilitating manipulation. The liquid air was kindly furnished by Professor Dewar, and the experiment was conducted in his laboratory.

In the course of the experiment, the loss by evaporation of the liquid air was made up by adding fresh portions from time to time. In this way the temperature of about -190° C. was maintained uninterruptedly through the whole period of the experiment. At the same time considerable care had to be taken in conducting the first cooling, in order to avoid fracture of the quill tubes. A preliminary cooling was therefore effected by means of solid CO_2. After the expiration of a week, the tubes were removed with cork-tipped forceps, and placed in a strong glass vessel till thawing was complete. The tubes were then opened, and the contents transferred to suitable culture media. In each case, a direct microscopical examination was made to detect any possible structural changes.

It is a remarkable fact that, notwithstanding the enormous mechanical strain to which the organisms must have been exposed, a strain far exceeding in amount any capable of being produced hitherto by direct mechanical means, not the slightest structural alteration could be detected.

The sub-cultures made at the conclusion of the experiment grew well, and in no instance could any impairment in the vitality of the organisms be detected. In one or two instances only, growth was slightly delayed, an effect which might have been due to other causes. The photogenic bacteria grew and emitted light, and the samples of milk became curdled.

The above experiments show that bacteria can be cooled down to -190° C. for a period of seven days without any appreciable impairment of their vitality.

It has not yet been possible to undertake the experiments with liquid hydrogen.