Dr. G. F. RUEDIGER, Chicago, said that about a year ago he was approached on this subject of untoward symptoms following the use of antitoxin by the representative of a manufacturer of antitoxin, who showed letters indicating that the writers got their most serious results after several injections had been given. From the reports in the literature he came to the same conclusion mentioned by Dr. Rosenau: that is, that many of the most alarming symptoms are observed after the first injection. The letters showed, however, that these doctors got very alarming symptoms, with collapse in some instances, after several injections had been given and not after the first injection. These reports are not published, as a rule.

Dr. THEOBALD SMITH, Boston, said the subject had interested him since 1902, although no special effort has been made to analyze the phenomenon. He remarked that guinea-pigs which have received no preliminary doses of serum may die and that of those which have received a fairly large dose of serum at the outset nearly all are thereafter immune. The problem, therefore, is very complicated. He presented his results in the following table:

GUINEA PIGS

Preliminary treatment	Final treatment	Number treated	RESULTS			% of illness or death
			Died	Re-covered	No effect	
3cc-5cc diph. antitoxin	3-5cc diph. antitoxin	31	2	—	29	6.45
nothing	3-5cc diph. antitoxin	58	9	—	49	15.5
diphtheria toxin only	3-5cc diph. antitoxin	10	—	—	10	0
diph. toxin + antitoxin (serum 1/200-1/400cc)	3-5cc diph. ant toxin	18	10	3	5	72.3

Dr. Smith said that an interval of two or three minutes elapsed between the first and second injections. None died after the first treatment. He did not know whether or not the animals were the young of guinea-pigs that had been treated.

Dr. ROSENAU said that he wished that he could believe that Dr. Vaughan's explanation is the correct one, being so plain and succinct. It is very easy to expand Ehrlich's side-chain theory to fit these facts by adding, subtracting or modifying a receptor. Dr. Anderson and he had felt that they could safely let Ehrlich modify his own theory to include the new facts. With Dr. Vaughan he realized that chemistry may some day explain the complex and multiple processes constantly going on in living protoplasm. It seemed to him that science has not yet reached that stage where it can assign a definite chemical molecular structure to such a complex, highly-organized and changing substance as protoplasm. Those who constantly deal with the material sciences would like a physical or chemical explanation of life. A correct explanation of the phenomenon studied in the guinea-pig would bring nearer the solution of many problems connected with metabolism and the fundamental processes on which existence depends.

DETERMINATION OF THE NORMAL TEMPERATURE OF THE CLOSED INGUINAL FOLD OF A CHILD, AND ITS CLINICAL SIGNIFICANCE.*

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HISTORY.

The practitioner of medicine is constantly looking to science and research for methods he may use in his routine work. Most practitioners seek methods which combine two characteristics, accuracy and practicability,

but these are often diametrically opposed. I have attempted to solve a problem in a manner that shall yield results at the same time accurate and easy of application to the clinical case.

Normal and pathologic conditions in the animal body are very intimately connected with, and in fact dependent on, the production, the distribution and the variation of that phenomenon called animal heat.

Medical and scientific literature is replete with all phases of this subject, and I intend to touch on only those points of measurement which may be included in the term thermometry.

The practitioner usually adopts the practice of taking the patient's temperature as one of the first steps in his routine examination. Two methods of estimation as pertains to clinical thermometry are in vogue, namely, the internal and the external. Both have their adherents and applications. Some writers contend that the only true measurement of the temperature of the body can be obtained from the internal cavities, while others state that external methods are sufficiently correct for purposes of clinical study.

The following table shows the results of observations by several authors who have made extended studies along these lines:

TABLE 1.

Maximum.		Minimum.		Mean.		Author and Place.
F.	C.	F.	C.	F.	C.	
99.05	37.2	97.7	36.5	98.42	36.9	Davy ¹ : Mouth.
99.5	37.5	98.24	36.8	99.05	37.2	Gierse ² : Mouth.
98.6	37.0	97.34	36.3	98.06	36.7	Hooper ³ : Mouth.
99.14	37.3	97.88	36.6	98.6	36.7	Hallmann ⁴ : Mouth.
98.6	37.0	97.88	36.3	98.24	36.8	Clifford Allbutt ⁵ : Mouth.
100.4	38.	97.16	36.2	98.6	37.0	Wunderlich ⁶ : Axilla.
99.32	37.4	96.98	36.1	98.24	36.8	Leibermeister ⁷ : Axilla.
98.78	37.1	98.06	36.7	98.42	36.9	Damrosch ⁸ : Axilla.
99.32	37.4	96.98	36.1	98.06	36.7	Billet ⁹ : Axilla.
100.2	37.9	97.34	36.3	98.78	37.1	Billroth ¹⁰ : Axilla.
100.4	37.8	97.7	36.5	99.05	37.2	Turgenson ¹¹ : Rectum.
98.78	37.1	97.88	36.6	98.24	36.8	Neubaus ¹² : Rectum.
99.14	37.3	98.42	36.9	98.78	37.1	Jaeger ¹³ : Rectum.
99.32	37.4	96.98	36.1	98.24	36.8	Nicol ¹⁴ : Rectum.
99.5	37.5	99.32	37.4	99.14	37.3	Hall ¹⁵ : Rectum.

The average of the mean observations in Table 1 for the mouth temperature is 98.47 F. (36.93 C.), for the axilla 98.43 F. (36.91 C.), for the temperature of the rectum 98.81 F. (37.12 C.). This shows that the difference between the mouth temperature and the axillary temperature is very small, approximately .04 F. (.02 C.). The variation between the axillary and rectal temperature is somewhat larger, being .38 F. (.21 C.). The maximum average for the temperature of the mouth is 99.42 F. (36.91 C.), the minimum being 98.47 F. (36.93 C.); for the axilla, maximum 99.60 F. (37.56 C.), minimum 98.42 F. (36.91 C.), and for the rectum,

1. Davy: Phil. Trans., London, 1845, part 2, p. 319.
2. Gierse: "Quænam sit ratio caloris organici, etc." Halae, 1842, p. 40.
3. Hooper: Med. Times and Gaz., London, 1866, vol. ii, p. 483.
4. Hallmann: Quoted from Landolt's Lehrbuch d. Physiol. Aufg. 3, S. 406.
5. Clifford Allbutt: Jour. Anat. and Physiol., London, 1872, vol. iii, p. 106.
6. Wunderlich: Medical Thermometry, p. 95.
7. Leibermeister: "Handbuch d. Path. u. Therap. d. Fleberd," 1875, p. 78.
8. Damrosch: Deuts. Klinik, Berlin, 1862, vol. ii, p. 331.
9. Billet: These, Strasburg, 1869.
10. Billroth: Arch. f. Klin. Chir., Berlin, 1862, vol. ii, p. 331.
11. Turgenson: "Die Körper warme des gesunden Menschen," Leipzig, 1873.
12. Neubaus: Virchow's Arch., 1893, vol. cxxiv, p. 365.
13. Jaeger: Deuts. arch. f. klin. Med., Leipzig, 1881.
14. Nicol: Quoted.
15. Hall: "Text-Book of Physiology."

* Read in the Section on Pathology and Physiology of the American Medical Association, at the Fifty-seventh Annual Session, June, 1906.

* From the Department of Physiology, Northwestern University Medical School.

maximum 99.33 F. (37.41 C.), minimum 98.69 F. (37.05 C.).

Many authors quote higher readings, especially for the rectal temperature, and also declare that the difference between the rectal and axillary temperature is greater, while a few are under the above figures. My observations regarding rectal temperature closely correspond with the results of the above table, with the exception that the range of variation was greater, due to the fact that the temperature range of children is more variable than that of adults.

It can not be denied that for purposes of accuracy the natural closed cavities of the body give more constant and reliable results than surface temperatures, or the artificially closed cavities as the axilla, or the groin.

The surface of the body naturally responds more quickly to the variations in temperature of the surrounding medium, and in some instances the variation is considerable. For instance, in the case of rigor the surface temperature falls several degrees, while the internal temperature is steadily rising. This is further shown by the tests made during the defervescence of fevers, in which case the temperature of the blood falls, while the surface remains at fever heat. A very rapid fall of temperature in an external part likewise corresponds to a very rapid rise in the internal parts. In the vast majority of cases the external cavities of the body, as the axilla and the groin, if properly closed for a few minutes, soon approximate the internal temperature of the body.

In taking the temperature of infants, to which class of patients I now confine my attention, we are confronted by an inability to use the ordinary oral method employed so extensively in adults, and so we are forced to rely on some other means for estimating the body temperature.

METHODS.

The following methods are being used or have been suggested by various authors:

1. Internal surfaces.....rectum, vagina
2. External surfaces.....axilla, groin
3. Freshly voided urine.

The first or rectal temperature has been the accepted method and probably gives the most constant and reliable results. It has always enjoyed the greatest popularity in the practice in hospitals and institutions, while the practitioner in the private home has often made objections to it, as it is sometimes repulsive to his other patients or friends in the home. An oral temperature for the mother, following a rectal temperature for the child is likely to raise a suspicion in the mind of the former that her esthetic interests are not properly guarded by the physician. It is sometimes no justification to say that separate thermometers are kept for each purpose or that the instrument has been properly cleansed, for, in fact, that necessary procedure is sometimes neglected.

Objections are also raised to this method, as it can seldom be repeated often enough for the exigencies of many cases unless the physician is in constant attendance or is assisted by a professional nurse. It is not safe to intrust an unskilled hand with the introduction of the thermometer into the rectal cavity of an infant, for injury to the rectum has been reported in several cases from careless manipulation of the instrument

both by means of force and by breakage. A rectal fistula with the introduction of septic material would present a serious condition in an infant. The rectal temperature necessitates an unnecessary exposure to cold and drafts, and is often entirely unreliable, due to contact with or the introduction of the bulb of the thermometer into a mass of feces.

Still less suitable is the method of taking the temperature in the vagina. The taking of the temperature of the freshly voided urine is only mentioned to be condemned.

We are left now to the consideration of the last two methods, external temperatures, taken in the temporarily closed cavities, namely, the axilla and groin. The temperature of the well-closed axilla has probably been the most used and convenient method employed by the practitioner for many years in those cases in which he did not wish, for any reason, to take a rectal temperature. The use of the thermometer in this location is not attended with many difficulties and it overcomes many of the objections to the former procedures. It is also shown by Table 1 to be approximately correct, varying from .38 F. to .21 C. from the rectal temperature.

The temperature of the groin, which has been suggested at various times by numerous authors and employed in practice by a few, possesses many advantages and gives results somewhat similar to those of the axilla. The literature to date does not give any complete records of clinical observations of temperatures taken in the groin nor does one find any description of the technic which would seem to possess many points of interest or value.

I present the following observations made on 175 individual cases: a. The age of the patients varied from 4 months to 5 years. b. Normal cases were used so far as possible. c. Mean readings were taken in all cases used as a basis for the determination of the normal temperature of the groin. d. For comparative results in the groin and rectum, individual readings were largely used without reference to number or time. e. In all observations identical conditions were obtained in each case, and these same conditions were produced so far as possible in all cases as a whole. f. The thermometers used in this work were the ordinary one-half minute self-registering clinical thermometers corrected to the same standard instrument.

TECHNIC.

The following technic was used in these cases:

I. Rectal method.

1. The ordinary technic was used. The bulb of the thermometer was introduced well into the rectum and the readings recorded when the mercury became stationary.
2. The child was exposed as little as possible.

II. Inguinal method.

1. The clothing was loosened, but not removed, so as to be free from the groin.
2. The groin was wiped dry with a towel to remove all secretions from the skin.
3. The thermometer was placed deep in the inguinal fold and the leg allowed to return to its natural position of adduction.
4. Readings were taken *in situ* until the maximum reading was reached.

TABLE 2.

Case.	Morning 8-10 a. m.		Night 3-5 p. m.		Mean.		Place.
	F.	C.	F.	C.	F.	C.	
1. Age 2 years	98.72	37.1	99.1	37.3	98.91	37.1	Rectum.
	98.5	36.9	98.62	37.0	98.56	36.9	Groin.
2. Age 9 mos.	98.9	37.15	99.0	37.2	98.95	37.1	R.
	98.64	37.0	98.5	36.9	98.57	36.9	G.
3. Age 4 years	99.0	37.2	98.7	37.1	98.8	37.1	R.
	98.8	37.1	98.6	37.0	98.7	37.1	G.
4. Age 18 mo.	98.2	36.8	98.5	37.0	98.35	37.1	R.
	97.7	36.5	97.9	36.6	98.0	36.6	G.
5. Age 3 years	100.1	37.8	100.4	38.0	100.15	37.9	R.
	99.8	37.7	99.8	37.7	99.8	37.7	G.
6. Age 1 year.	97.9	36.6	98.0	37.2	97.95	36.6	R.
	97.7	36.5	97.9	36.6	98.0	36.6	G.
7. Age 4 mos.	99.4	37.4	99.1	37.3	99.25	37.3	R.
	99.4	37.4	99.0	37.2	99.2	37.3	G.
8. Age 6 mos.	98.6	37.0	98.65	37.0	98.62	37.6	R.
	98.	36.7	98.2	36.8	98.1	36.7	G.
9. Age 2 years	99.1	37.3	99.3	37.4	99.2	37.3	R.
	98.6	37.0	98.7	37.1	98.65	37.0	G.
10. Age 1 year.	98.8	37.1	98.7	37.1	98.71	37.1	R.
	98.6	37.0	98.6	37.0	98.6	37.0	G.

TABLE 3.

Age.	Rectum.		Time.	Groin.		Time.
	F.	C.		F.	C.	
18 months	98.8	31.1	4 min.	98.6	37.	6½ min.
1 year	99.32	37.4	3 min.	99.0	37.2	7 min.
4 years	98.06	36.7	3½ min.	97.8	36.6	5½ min.
6 months	99.1	37.3	5 min.	99.0	37.2	5½ min.
9 months	97.8	36.6	4½ min.	97.49	36.4	6 min.
4½ years	98.0	36.7	4 min.	97.6	36.5	6½ min.
2 years	98.78	37.1	6 min.	98.65	37.0	7 min.
1 year	100.04	37.8	3 min.	99.5	37.5	5½ min.
8 months	99.0	37.25	3¼ min.	98.7	37.1	8 min.
18 months	98.8	36.7	4½ min.	98.5	37.0	4¾ min.
3 years	97.9	36.6	5½ min.	97.4	36.3	6½ min.
10 months	98.05	36.7	5 min.	98.0	36.7	6 min.
4 years	99.0	37.2	3½ min.	98.4	36.9	8 min.
5 years	99.14	37.3	4 min.	99.0	37.2	5 min.
4 months	100.2	37.9	3 min.	100.0	37.8	4½ min.
18 months	98.2	36.8	3¼ min.	97.4	36.3	3½ min.
2½ years	98.42	36.9	4½ min.	98.1	36.7	5½ min.
1 year	98.6	37.0	3 min.	98.1	37.7	7 min.
10 months	99.1	37.3	3½ min.	98.9	37.1	6½ min.
3 months	97.8	36.6	4½ min.	97.6	36.4	5 min.

RESULTS.

The few cases given above in Tables 2 and 3, selected at random from the entire number, will show that the difference between internal temperature (rectum) and external temperature (groin) is comparatively small.

The results of the entire number of mean cases under observation show that the average difference between the temperature of the rectum and the closed groin is .34 F. (.18 C.) while the normal temperature of the closed inguinal fold of a child is 98.52 F. (37.5 C.). The greatest difference found in any one case was 1.5 F., while the majority of the cases ranged close to average found. In a number of readings the results of the groin and rectal readings were the same, while in a few cases the inguinal temperature was higher by a fraction of a degree. In most of these cases the lower rectal temperature was found to be due to the contact of the thermometer bulb with fecal masses. In such cases the readings were discarded as not representing the true rectal temperature.

The time element, which is an important one, was carefully worked out and recorded. It was found that with the above technic the rectal method required three and one-half minutes for a complete register of the thermometer, while the inguinal method required six and three-quarters minutes. We did not find that so long a time was necessary for correct results as some authors quote for external reading.

The clinical ease of application of the two methods offers interesting results. The great majority of cases under observation were obtained from hospitals and public institutions, and so we were not forced to face the objections which many practitioners meet with in the

employment of rectal temperature. We were impressed with the great facility and ease of the inguinal method. The natural attitude of the child while retaining the thermometer in the closed groin made the usual struggling and crying unnecessary, and with but few exceptions the temperature of the groin was taken without any resistance or disturbance from the child.

It was not found necessary to hold the thermometer in the hand during the process, for the natural close apposition of the thigh to the body retained the instrument in place without any trouble, with the exception of a few cases which showed extreme emaciation. In such a condition more satisfactory results may be obtained from the internal than from the external method. If it is necessary to use the external method the groin possesses obvious advantages over the axilla.

It was not feasible to consider the influence of cold or of extreme heat on the body surface as in sudden chilling or in a rapid rise in the atmospheric temperature, as the patient was protected in all cases, but a rise of .2 F. was observed in the inguinal temperature of one child directly after a warm bath.

With the thermometer in the groin and the leg retained in apposition to the body either by the hand of the nurse or the doctor, the time required for the register of the thermometer can be employed with advantage to a further study of the case.

The inguinal method is absolutely safe for the employment of the mother or the non-professional nurse, the only requisites being an acquaintance with a few simple rules of technic and an ability to read correctly a thermometer scale.

SUMMARY.

a. The normal temperature of the closed inguinal fold of a child is 98.52 F. (37.5 C.).

b. The variation of the inguinal temperature from the rectal temperature approximates one-third of a degree F. or two-fifths of a degree C., the average variation being .34 F. (.18 C.). That is, the inguinal temperature is approximately one-third of a degree F. (two-fifths C.) below rectal temperature.

c. The usual variation between the temperature of the rectum and groin is so small as to be practically disregarded for clinical purposes.

d. The absence of many objectionable features of the rectal method and the ease and reliability of the groin method gives the latter several points of advantage over the rectal method. These advantages of the groin method would recommend it not only as applicable in hospital practice in pediatrics, but more especially in home practice among children.¹⁶

16. For further literature on the subject the reader may consult Schofer: "Text-book of Physiology"; Cohen: "System of Physiologic Therapeutics"; Vierordt's "Physical Diagnosis"; Rotch: "Pediatrics"; Holt: "Diseases of Children"; Boileau: *Lancet*, Lond., 1888, vol. II, p. 204; Starr: "Diseases of Children"; Ashby and White: "Diseases of Children"; Landols and Sterling: "Physiology"; Ringer and Stewart: "Proceedings Royal Society," London, 1877; vol. xxvi, p. 186; Crombie: *Indian Am. Med. Sc.*, Calcutta, 1873, vol. xvi; Oertmann: *Arch. f. d. ges. Physiol.*, Bonn, 1878, vol. xvi; Loralin: "De la temperature du corps humaine," Paris, 1877, vol. I, p. 434; Redord: "Etudes de thermometrie clinique," 1874, p. 20; Davy: "Researches," London, 1839, vol. I, p. 199.

Skill Acquired by Long and Diligent Application.—In this day of "workless" methods of doing things, remarks the *Western Medical Review*, it will be wise to realize that there are certain ends which can only be obtained by conscientious as well as conscious efforts. There is no method of attaining skill and accuracy of diagnosis except that method which involves long and painstaking mental and manual education.