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Contributors

Coulter Electronics.

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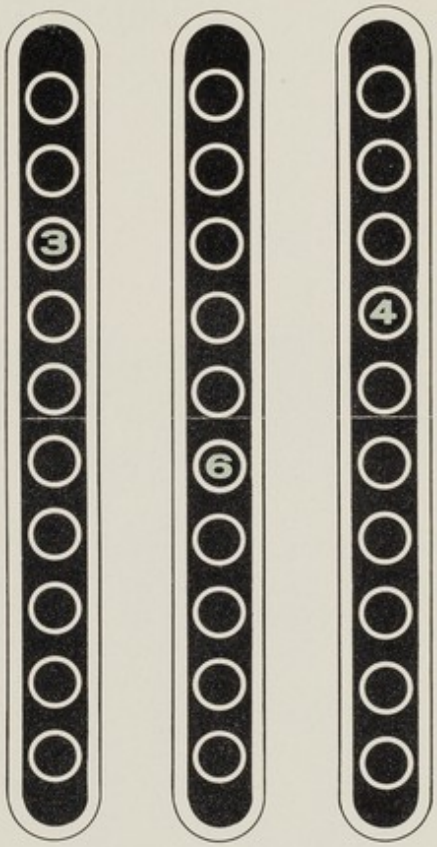
THE COULTER AUTOMATIC BLOOD CELL COUNTER and CELL SIZE ANALYZER



PATENT No's
U.K. 722418.
W. GERMANY [illegible]4310.
FRANCE 1030716.

COULTER ELECTRONICS LTD.,
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another giant step forward in the field of hematology

Coulter Electronics, Chicago 40, Ill.

PROVED

PREVIOUSLY UNATTAINABLE BLOOD CELL COUNT ACCURACY IS NOW ROUTINE*

1 COULTER COUNTER ELIMINATES THE TEDIOUS MICROSCOPIC WORK OF SEVERAL TECHNICIANS*

valuable technician time can now be diverted to other laboratory assignments

to illustrate:

technicians' visual blood cell counts.	Coulter Electronic blood cell counts.
Average between 20 to 30 blood cell counts per day.	In practice, restricted only by number of blood samples supplied to instrument . . . as many as 800 plus per day on a production basis.
Average cell count includes only 500 cells because of tedium and eye strain.	Average cell count includes 50,000 cells, each electronic count equivalent to the average of 100 chamber counts.
Length of time required per count . . . from 3 to 8 minutes. Disagreeability of task tends to slow related activities.	Length of time per electronic count . . . 25 seconds or less plus sample dilution time.
Inaccuracies from small samplings and human errors. Tedium often affects laboratory morale.	Statistical error of visual counting reduced by factor of 10; opportunities for human error reduced . Tedium and eye strain also eliminated.
Inherent: errors in counting chamber such as unequal distribution of blood cells in chamber.	Unit automatically takes precisely metered sample from sample beaker.
High cost per count due to time and work required of technicians. Skilled technicians difficult to obtain.	Direct savings . . . the Coulter Counter can pay for itself in less than a year in technician man-hours saved.

Both from the medical and economic points of view, the development and proved success of the Coulter Counter is of particular significance to every hospital, clinic, research institution, wherever blood cell counts are performed. The limited accuracy, tiring strain and inherent errors of microscopic counts are eliminated. Instead precision accuracy, previously considered unattainable and requiring only a fraction of the time presently spent, becomes routine. Operation is simple and economies great. Higher accuracy permits earlier detection of small changes in blood indices and increases the value of services rendered to patients.

here's how the COULTER COUNTER is operated . . . it's basically a matter of feeding diluted samples to the unit

1. A small blood sample is taken with a self-filling pipette. Two cubic millimeters in a typical case.
2. Sample is mixed in a beaker with diluent. (Diluent is delivered by automatic buretta).
3. The beaker is positioned on a spring platform so that orifice tube is immersed in the sample.
4. Count is automatically made by actuating a stopcock and resetting a count switch.
5. Instrument count is noted, beaker is removed and next sample positioned on stand. No rinsing or cleaning of orifice tube is required between samples except when extreme accuracy is needed.

Theory and principle

Operation is based on electrical conductivity differences between all blood cells and common diluents. Blood cells are insulators, diluents good conductors.

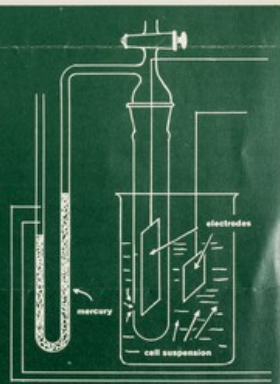
a. When the stopcock is opened, an external vacuum initiates sample flow from beaker through a 1/10 millimeter orifice and "unbalances" mercury in the manometer.

b. An electrode in the sample beaker and one in the orifice tube cause an electric current to flow through the orifice.

c. An individual cell as it is carried through the orifice displaces some of the conductive fluid to raise the electrical resistance of the orifice contents. Resistance increase produces a voltage pulse of short duration which has an amplitude proportional to cell size.

d. Pulses are amplified and displayed on the oscilliscope screen as distinct vertical "spikes". Relative cell size is indicated by relative height of the spikes. Pulses are also fed to a threshold circuit allowing selection of a level which if reached by a pulse causes the pulse to be counted. Threshold level is indicated by a brightening of pulse segments above the threshold level.

e. Closing the stopcock isolates the system from the external vacuum. Syphoning action of the manometer continues sample flow. Rising mercury column contacts start and stop electrodes to activate the digital counter as 1/2 milliliter is drawn through the orifice.



*References: C. F. T. Mattern, F. S. Brackett and B. J. Olson, "The Determination of Number and Size of Particles by Electronic Gating", *Journal of Applied Physiology*, January, 1957.

G. Brecher, M. Schneiderman and G. Z. Williams, "Evaluation of an Electronic Blood Cell Counter", *American Journal of Clinical Pathology*, December, 1956.

the COULTER COUNTER's oscilloscope screen .... a versatile, important tool for the hematologist

The pattern displayed on the screen immediately provides the following information:

- relative cell size
- relative cell size distribution
- setting of the threshold level control
- a virtually continuous check of instrument performance for reliability of counts

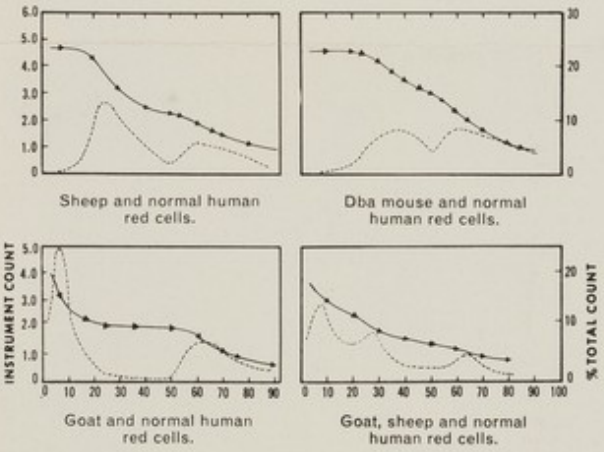
Actual display of individual blood cells indicating relative cell size

The "threshold"—controlled by threshold dial permitting operator to select minimum size cells to be counted. Cells above the threshold level will be counted while smaller cells and debris below the threshold size will not be counted. Note: for routine counting, the threshold is left at a sufficiently low setting to count the smallest cells likely to be encountered.

the only economic method of determining cell size distribution

In less than 4 or 5 minutes, accurate cell size data indicating relatively small changes in population size distribution are readily obtained. The technique: take 6 to 8 readings at successively higher threshold settings. Plotting the threshold curves against relative cell size distribution provides useful information.

Threshold curves (solid lines) and relative size distribution curves (broken lines) of mixtures of different cell size population.



Sheep and normal human red cells.

Dba mouse and normal human red cells.

Goat and normal human red cells.

Goat, sheep and normal human red cells.

United States Patent 2,656,508
Canadian 530,670
Great Britain 722,418
Patents issued in France, Japan, Argentina, Mexico and Brazil. Other U.S. and Foreign Patents Pending.

special adaptations to count particles in 1 micron range

Particles in the 2 micron range are readily counted by the unit. Special designs of the Coulter Counter can be provided to count microscopically minute particles in the 1 micron or smaller range.

distributed by

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