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Acknowledgements

The author wishes to thank Davide Colombo, who contributed with his beautiful sketches to illustrate this history. The author wishes also to mention the following, who did not take part directly in the project, but contributed to disseminate it worldwide:
(in alphabetic order) R. Benet (USA), V. Bernardelli (Italy), A. Berti (Italy), L. Bevilacqua (Italy), R. Bottenus (USA), T. Casas (Spain), V. Casadevall (Spain), D. Colombo (Italy), F. Duran (Spain), E Ferretti (Italy), R. Galli (Italy), M Graça (Mexico), S. Gonzalez (Uruguay), E. Lattuada (Italy), J. Manent (Spain), C. Pascual (Spain), M. Piai (Italy), R. Playdon (UK), F. Raimondo (Italy), A. Rigual (Uruguay), L. Rodighiero (Italy), J.M. Rubiralta (Spain), G. Russi (USA), D. Santo (Italy), V. Sarquella (Spain), G. Semprini (Italy), J. Serra (Spain), M. Spagnotto (Italy), A. Strada (Italy), R. Tazzi (USA), G. Tong (China), A. Tonsi (Italy), M. Triscott (USA), J. Llorens (Spain), P. Zamora (Spain).

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pm 0005HACL PG rev.0 - 10/24

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Hemostasis Innovation is Here.

The Successful History of the Automated Coagulation Laboratory (ACL)

"The fascinating history of hemostasis testing started more than one century ago and has been the focus of one of my previous publications.

In this manuscript, I examine the interesting history of how the revolutionary concept of the Automated Coagulation Laboratory (ACL) instrument came about."

A. Tripodi

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Evolution
of Testing Methods

Manual Tilt Tube (hook) Technique

Up to the late 1970s, coagulation tests were manually conducted using the tilt tube method, requiring skilled operators and multiple stopwatches.



Early Coagulometers

Introduced in the late 1970s, these used an electro-mechanical system of clot detection based on two platinum electrodes that moved within the mixture of plasma and reagents. to detect clot formation, marking a shift from manual to semi-automated processes. Cuvettes used for the reaction were disposable, but the electrodes could not be changed at each test occasion. To avoid thrombin carry over and contamination from one sample to the next, the electrodes had to be flamed from one sample to the next in the series of measurement.

Photo Optical Coagulometers

These instruments replaced electromechanical models by offering improved pipetting and detection capabilities, though their effectiveness compared to manual methods was initially debated.

Centrifugal Analyzers

Developed to handle samples even in zero gravity conditions, these analyzers utilized a rotor system for mixing and reacting components, paving the way for modern coagulation testing.

Key Studies
and Findings

The Study

A notable study by the Italian Committee for Standardization in Laboratory Hematology compared manual techniques against various coagulometers. When results were analyzed, it was evident that coagulometers won the game in many instances, but not in all of them (Table 1).
Some manual operators performed better than the coagulometers, thus leaving room for further improvement. Nonetheless, the above exercise gave support to the use of coagulometers, and many labs started to switch from the manual (tilt tube) technique to the more sophisticated clot detection systems.

Table 1

"t" values for the comparison of manual vs coagulometers. The higher the "t" value the better the capacity of the clot detection system to discriminate between two plasma samples with similar but not identical PT value. Adapted from Italian Cismel Study Group, Clin Lab Haematol 1983; 5: 177 with the permission of the authors.

Coagulometer Type	Method of Detection	
	Manual	Coagulometer
1	0.45	4.79
2	8.60	4.97
3	0.45	4.79
4	8.60	4.97
5	0.45	4.79
6	8.60	4.97
7	0.45	4.79
8	8.60	4.97
9	0.45	4.79

Coagulometers

1. Coagu-A-Pet (General Diagnostics)
2. Schnitger-Gross (Amelung)
3. Multiclot 919 (Elvi)
4. Multiscan 818 (Elvi)
5. Coagulazyer Lancer II (Sherwood Medical)
6. Fibrintimer II (Labor)
7. Electra 600 (Medical Laboratory Automation)
8. Sistema Coagg Salus (Daltec Instrument)
9. Coagulation Profiler CP-8 (Biodata Corporation)

Technological
Innovations

The challenge

The coagulometer could handle clot-based parameters such as Prothrombin Time (PT) and activated partial thromboplastin time (APTT) and congener tests such as thrombin clotting time and individual coagulation factor measurement. However, what about the antithrombin activity? Our main concern was that with this scenario, the coagulation laboratory would have had to use two types of instruments (one clot-based and one optical density-based) to perform the required assays.



The solution

An engineer who was part of the Research and Development Team, saw an opportunity to combine the techniques into a develop a Chimera instrument able to perform both techniques and the ACL was born. The introduction of ACL combined both clot-based and chromogenic detection systems within a single unit, was a groundbreaking development that significantly enhanced the accuracy and reliability of coagulation tests. Few years later, all the other commercial companies developed their own units bearing on board both clotting and chromogenic systems.

