Evolution OF THE Pipette

by: John Buie

The pipette, along with the analytical balance, microscope and centrifuge, is a laboratory staple whose history dates back to the turn of the century. But when examining the early iterations of this important tool, you do not find much in common with what comes out of the box in today's lab equipment deliveries.

Has the evolution of these essential lab tools over the past 60 years shaped modern-day research, or have the increasing demands scientists place on their instruments been the primary catalyst of these innovations?

This article looks at the pipette and how increasing demands in microanalysis, lab safety and automation have shaped its evolution. We also look at particular innovators in the manufacturing of scientific instruments who, with their thumbs on the pulse of research, have responded with groundbreaking innovations in pipette development.

SCIENTIFIC DEMANDS CONTINUE TO DRIVE THE DEVELOPMENT OF THIS ONCE SIMPLE, NOW HIGHLY SOPHISTICATED, TECHNOLOGY

With ergonomics, precision and safety becoming the buzzwords in the pipettor market, electronic pipettors are poised to overshadow gains in the mechanical pipettor market.

The worldwide pipette market is expected to grow by 48.27 thousand units between 2008 and 2012. This growth is driven by novel designs, a rise in PCR diagnostic tests and the involvement of ultra-micro volumes in laboratories. Innovation will continue from companies such as Thermo Fisher Matrix Technologies, which has recently introduced novel ways of adjusting dispensed volume in the pipette, including scrolling presets and voice recognition technology.

Despite being an everyday laboratory commodity, pipettes have a history and anticipated future of responding to the demands of the scientific marketplace with groundbreaking innovations.

Lab researchers, although happy with the functionality of the pipette, were still concerned about cross-contamination between samples and bacteria being passed via the pipette.

The pipette manufacturer Capp Denmark A/S (products available through pipette.com) responded by inventing the first autoclavable multichannel pipette. About 80 percent of the pipettes on the market today are now autoclavable. Other pipette innovations from Capp included the volume control knob, a patented feature that allows the user to turn each pipette from left handed to right handed and adjustable to fixed volume in a matter of seconds. The continuously adjustable, smooth micrometer is in the volume control knob, typically known as the "thumb knob" in other lines, rather than in the body of the pipette. This allows the user to custom design pipettes for his or her specific use at minimal cost.

1950

In the beginning… Larger-than-ideal volumes of liquid were transferred using a modified piece of graduated glass tube, which often went by the name of the Carlsberg pipette. Researchers constructed these in the lab by heating a piece of glass tube over a Bunsen burner while pulling at one end; then, by repeating this operation close to the tip of the tube, a capillary could be pulled. This would allow air flow, but enable users to stop the liquid at the desired volume for which they had constructed the pipette.

Carlsberg pipettes also were being used outside of the lab by milk inspectors, who would mouth-pipette raw milk samples onto a microscope slide for analysis. One of these inspectors was G.S. Riggs, who was not fond of this practice for obvious safety and efficiency reasons. Riggs filed a patent for a mechanical device that would suck the milk up into the tube. Riggs' patent was referenced in the filing of Warren Gilson's patent for the modern-day mechanical pipette 24 years later.

1958

While developing optical enzyme assays, lab researchers faced accuracy challenges while attempting to dispense microliter liquid volumes as well as handle the large volume of pipetting that was required for this task.

One of these researchers was a German medical scientist by the name of Heinrich Schnitger. By adding a spring to the piston of a tuberculin syringe that would stop on cue at a set volume level and replacing the syringe's needle with a plastic tip, Schnitger found he could speed up liquid handling in many of his experiments. This led to the development of the first improvised piston-stroke pipette. This version of the pipette became known as the Marburg pipette and was licensed to the medical supply company Eppendorf in Hamburg, Germany.

1974

With analytical instruments in the fields of microanalysis and biotechnology requiring more accurate measurement of liquid volume and variable sample sizes, pipetting apparatuses of the time did not meet researchers' needs.

Warren Gilson, M.D., founder of Gilson Medical Electronics, who 23 years prior manufactured a modified Warburg respirator that included a circular format and digital readout, invented and successfully patented the first mechanical adjustable pipette, which bears a strong resemblance to the one you use in your lab today. Gilson accomplished this by building upon previous German pipette designs but providing increased accuracy, comfort, digital display and variable volume adjustments; the result was the Gilson Pipetman.

1984

2002

Pipettes already had evolved a very long way in helping protect researchers from coming in direct contact with potentially hazardous liquid samples. However, a new side effect of prolonged pipetting also evolved: Carpal Tunnel Syndrome (CTS). CTS is an inflammation of the tendons in the carpal tunnel, which can be attributed to repetitive use of the hand or wrist in awkward positions.

VistaLab Technologies focused on a new pipetting approach with one goal in mind: to improve upon the pipette and reduce the strain it causes on the end user. They tackled this project using state-of-the-art ergonomics research technology, such as electromyography, which shows the external force a pipette user exerts on his or her muscles while tipping, aspirating, dispensing and de-tipping. By designing a radically different, more natural grip on the pipette and changing the user's arm posture while pipetting, VistaLab introduced the first Ovation BioNatural Pipette, which led the way in pipette ergonomics and reduced the risk of CTS as well as other musculoskeletal disorders.

EMG (electromyogram) testing was used by VistaLab to measure the activity and stresses of pipetting on five muscle groups when using traditionally shaped pipettes, and then compared to the Ovation design. This testing was done during the development process for the Ovation Pipette in 2001.

THE FUTURE