Moving “High Speed” to “High Performance” Centrifugation: Applications History to Avanti™ J Series Performance

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The following applications perspective is offered in order to better understand the impetus for the new Avanti J Series centrifuges. This technical bulletin presents an overview of the applications that were quoted in the literature from 1987 to 1994, and from customer registration cards received from July to December, 1993.

From the literature (Figures 1 and 2) and from the customer registration cards (Figure 3), subcellular organelle separations are a large component of high speed centrifuge use. Nucleic acids and protein separations are also common. Most of these separations are short run-time separations (Figures 4 and 5) and are predominately pelleting runs (Figure 6). There is not a single application that is overwhelmingly performed in any one rotor (Figures 7 and 8). In general, most high speed rotors are purchased for multiple applications (Figure 9).

In considering the design of a new High Performance centrifuge and rotors to cover the applications needs of these customers we would conclude that:

1. High Performance centrifuges would be sold to many different types of laboratories.
2. The features of High Performance centrifuge systems would need to be readily expandable or extended as the laboratory’s focus changes with time.
3. The centrifuge must be tailored to the individual laboratory’s use through the availability of rotors and tubes.
4. Most run times are short. Thus, the new High Performance centrifuge must be able to accommodate these shorter run times.
5. Pelleting separations are most common. Faster acceleration and deceleration times with higher g-forces would allow present applications to be performed more quickly.
6. A significant number of gradient separations are performed. The new centrifuge must have slow, smooth acceleration and deceleration profiles for these types of separations.

The new Avanti J Series was designed to meet the six major points above. Key features of the centrifuge are critical to the High Performance aspects of the system (see other technical bulletins for information on the SR drive: T-1783A, smart FRS system: T-1787A, and the IRIS rotor ID system: T-1776). New rotors, the JA-25.15 and JA-25.50, have been developed to expand the applications possibilities of the higher performance of the Avanti J-25 and Avanti J-25 I centrifuges. The applications history has been used to drive the new Avanti J Series instruments to higher performance for your customers.
**Figure 1.** Applications cited in the literature from 1987 to 1994. Note that the largest group of citations are for subcellular fractionation. The applications area with fastest percentage growth is viral separations.

**Figure 2.** A further look at subcellular fraction citations. Note that the largest group is clearing homogenates, cell lysates, and cell extracts. These separations are all steps prior to other separation steps.
**Figure 3.** Applications given on customer J2-rotor response cards, July to December, 1993. In contrast to literature citations, DNA separations are the largest group, roughly 34% of all responses. Subcellular responses are 14% of the total. Many of the groups overlap, however. Lysate clearing steps in Figure 1 would be listed here as plasmid or mini-prep separations.

**Figure 4.** Run times vs. applications for J2-rotors, from the literature. Note that for almost all of the categories, shorter times predominate.
Figure 5. All applications, from Figure 4, grouped by separation time. Note that about half the runs take less than 15 min, and 83% of all J2 runs took less than 30 min. Short run times are dominant in this class of centrifuge.

Figure 6. Separation protocol by rotor, from customer response cards. Note that pelleting runs are more common in every rotor.
Figure 7. Application listed at time of rotor purchase, from response cards. Note that no rotor has a dominant application. (Roughly half of the respondents for the JA-18 did not give an application. The high lipoprotein value for the JA-18 is probably an artifact of sample size.)

Figure 8. A replot of Figure 7. Note again that, for an application, almost any rotor has been purchased.
Figure 9. The average number of applications cited per rotor purchase. Note that there are multiple applications cited as the reason for rotor purchase.